FREEPORT-MCMORAN

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August 19, 2022

Certified Mail #70201290000110357521

Mr. David Ennis
Mining and Minerals Division
1220 South St. Francis Drive
Santa Fe, New Mexico 87505

Dear Mr. Ennis:

Re: Lampbright Leach System –
Discharge Permit 376 (DP-376) Semi-annual and Annual Monitoring Report

Freeport-McMoRan Chino Mines Company (Chino) submits the enclosed update to the North Lampbright Stockpile Closure-Closeout Plan.

The primary purpose of this update is to demonstrate that the amount of financial assurance currently in place for the permitted North Lampbright Waste Rock Stockpile is sufficient to also satisfy the cost estimates for closure-closeout of the proposed North Lampbright Leach Stockpile, which will have the approximate same geometry of the Waste Rock Stockpile.

There is currently $3,581,931 in financial assurance for the Waste Rock pile, based on an elevation of 6800' amsl, which elevation will not be reached until at least 2038. Chino has updated the cost estimate to reflect 2021 costs and a five-year forecast for construction of the Leach Stockpile, which reaches an elevation of 6650' amsl in the next five years. The revised cost estimate is $1,997,768.

If you have any questions or require additional information, please do not hesitate to contact Roy Paquette at (575) 912-5760 or Christian Krueger at (575) 912-5349.

Sincerely,

Kariann Sokulsky
Environmental Services

cc: Brad Reid, NMED (CD only)
Walt Niccoli, Telesto Solutions (CD only)

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CLOSURE/CLOSEOUT PLAN

NORTH LAMPBRIGHT LEACH STOCKPILE EXTENSION -- CLOSURE / CLOSEOUT PLAN

April 2022

Freeport-McMoRan
Chino Mines Company

Bayard, New Mexico

Prepared for: New Mexico Environment Department
Mining Environmental Compliance Section
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Submitted By: Freeport-McMoRan
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List of Acronyms and Abbreviations

°C	degrees Celsius
°F	degrees Fahrenheit
ac-ft/yr	acre-feet per year
amsl	above mean sea level
Bgs	below ground surface
CCP	Closure/Closeout Plan
CDQAP	Construction Design Quality Assurance Plan
CFR	Code of Federal Regulations
CGCS	Comprehensive Groundwater Characterization Study
Chino	Chino Mines Company
cm	centimeter
CQAP	Construction Quality Assurance Plan
CQAR	Construction Quality Assurance Report
DP	Discharge Permit
EOY	end of year
EPA	U.S Environmental Protection Agency
FS	Feasibility Study
ft	Feet
Golder	Golder Associates Inc.
Guidelines	Closeout Plan Guidelines
HDPE	high density polyethylene
JSAI	John Shomaker and Associates, Inc.
MD	Mining and Minerals Division
msl	Mean Sea Level
NMA	North Mine Area
NMED	New Mexico Environment Department
NMMA	New Mexico Mining Act
NMOSE	New Mexico Office of the State Engineer
NMWQA	New Mexico Water Quality Act
NMWQCC	New Mexico Water Quality Control Commission
O&M	Operation and Maintenance
OPCZ	Open Pit Capture Zone
OPSDA	Open Pit Surface Drainage Area
PCA	Pipeline Corridor Area
PLS	pregnant leach solution (economic copper-bearing leach solution)
PMLU	post-mining land use
SCS	Soil Conservation Service
SSE	Self-sustaining ecosystem
SX/EW	solution extraction-electrowinning

TDS	total dissolved solids
UC	utility corridor
Y^3	cubic yards

1.0 INTRODUCTION

Freeport-McMoRan Chino Mines Company (Chino) operates a concentrator and a solution extraction-electrowinning (SX/EW) plant for the production of copper concentration and copper cathodes. These facilities are associated with the Santa Rita Open Pit and are located approximately 10 miles east of Silver City in Grant County, New Mexico (Figure 1-1). These facilities includes several leach stockpiles. Chino intends to extend the existing Main Lampbright Leach Stockpile to the north as part of the current mine plan (Figure 1-2). The extension of the Main Lampbright is referred herein as the North Lampbright Leach Stockpile (NLLS) extension. The NLLS extension will occur within the footprint of the North Lampbright Waste Rock Stockpile, already permitted by both the New Mexico Environment Department (NMED) and the New Mexico Mining and Minerals Division (MMD).

The proposed project is located on lands owned by Chino and partially occurs within the Santa Rita Open Pit hydrologic sink. The currently permitted footprint for the NLWRS is 187 acres. The proposed NLLS will lie within this 187 acre footprint.

1.1 Regulatory Authority

This Closure-Closeout (CCP) plan was prepared to comply with applicable regulations and requirements of both the NMED and MMD and specifically Title 19, Chapter 10, Part 5, NMAC and Title 20, Chapter 6, and 7 NMAC. The plan is also consistent with previous CCPs approved by both NMED and MMD.

1.2 Purpose of Plan

The general purpose of this CCP is to present a reclamation plan consistent with all applicable federal and state regulatory requirements and permit conditions so that a cost estimate can be calculated to meet the financial assurance requirements of Part 19.10.12 NMAC, in the event of a forfeiture by Chino Mines within the next five years. Further, this plan demonstrates that the disturbed area will be reclaimed to a condition that allows for the re-establishment of self-sustaining ecosystem as well to meet the closure requirements of Section 20.6.7.33 NMAC.

The specific purpose of this CCP is to demonstrate that the amount of financial assurance currently in place for the permitted North Lampbright Waste Rock Stockpile is sufficient to also satisfy the cost estimates for closure-closeout of the proposed NLLS. There is currently $3,581,931 million in financial assurance for the Waste Rock Stockpile, based on an elevation of 6800 msl. This elevation will not be reached until at least 2038. Chino has updated the cost estimate to reflect 2021 costs

and a five-year forecast for construction of the NLLS which reaches an elevation of only 6650 msl. The revised updated cost estimate is $1,997,768.

Plan Organization

This CCP consists of the following sections:

- **Section 1.0** provides an overview of the CCP for NLLS extension;
- **Section 2.0** describes the existing facilities and current environmental setting at the Chino Mine and the NLLS extension area, and permits associated with the mine;
- **Section 3.0** describes the proposed NLLS extension configuration;
- **Section 4.0** describes the proposed reclamation plan and associated design criteria and performance objectives for the NLLS extension;
- **Section 5.0** describes the closure and post-closure monitoring plans for the NLLS extension along with contingency plans and reporting schedules;
- **Section 6.0** provides details of the proposed post-mining land use for the NLLS extension;
- **Section 7.0** presents a summary of the material take-offs and factors that will be applied in the capital and operations and maintenance (O&M) cost estimates associated with the proposed reclamation and post-closure monitoring plans presented in Sections 5.0 and 6.0;
- **Section 8.0** presents the proposed reclamation schedule associated with this CCP;
- **Section 9.0** describes the intended use of this plan; and
- **Section 10.0** lists the references used in preparation of this CC
- **Appendix A** provides the earthwork cost estimate process report and reclamation design drawings that illustrate the CCP for the NLLS extension.

2.0 EXISTING SITE CONDITIONS

The following sections describe the site-specific characteristics of the proposed NLLS extension area.

2.1 Description of North Lampbright Leach Stockpile Extension Area

The proposed NLLS extension area occupies the ridge crest and valley slopes north of the existing Main Lambright Stockpile. This area lies within the North Mine Area (NMA) and is underlain mostly by sedimentary rocks (limestone, shale, and sandstone) associated with the Syrena and Oswaldo Formations and is vegetated with trees, grasses, and shrubs. Approximately 44 acres of the northern portion of the Main Lampbright Stockpile will be covered by the NLLS extension. The remaining footprint acreage will extend to the north onto undisturbed land within the current permitted North Lampbright Waste Rock Stockpile footprint.

The existing PLS collection system along the north side of the Main Lampbright Stockpile in the area of the proposed stockpile consists of three sumps (Lampbright Sumps 1, 2, and 3) (Figure 1-2). Sumps 1 and 2 collect PLS that is pumped to Chino's SX/EW facility to produce copper cathodes. Sump 3, located along the northeast edge of the Main Stockpile, is a buried French-Drain and

vertical sump system designed to intercept seepage from the Main Lampbright Stockpile. Sump 3 discharges into Sump 2. Because Sump 3 is buried by both the Waste Rock Stockpile and the NLLS, Chino has constructed the permitted East Headwall Impoundment to capture any incidental seepage and impacted stormwater from the eastern portions of the stockpile.

Chino will construct the NLLS utilizing the permitted waste rock as the foundation of the NLLS. The expected height of the waste rock foundation will range from approximately 80' in the east to 30' in the west.

Chino has submitted a separate application to NMED to obtain approval for the NLLS.

2.2 Environmental Setting

The following sections present various aspects of the NMA and NLLS extension area, including its topography, geology, climate, hydrology, and material characteristics.

2.2.1 Topography

The general topography of the North Lampbright extension area is depicted on Figure 2-1. The NLLS extension area occupies the ridge crest and valley slopes north of the existing Main Lambright Stockpile. The natural ground surface elevation ranges from approximately 6,500 feet above mean sea level (ft amsl) in the southern part of the area adjacent to the Main Lampbright Stockpile to approximately 6,900 ft amsl immediately north of the stockpile extension area. The proposed NLLS extension area is bounded on the south by access roads and on the north by a ridge with scattered rock outcrops of limestone and shale. The SX/EW facility abuts the northwest corner of the project area. Table 2-1 lists the vegetative units in the NMA.

2.2.2 Geology

The Santa Rita ore deposit that has been mined at Chino lies in the southeastern corner of the Central Mining District (Rose and Baltosser, 1966). Chino lies in the transition zone between the Colorado Plateau and the Basin and Range physiographic provinces. **Figure 2-1** shows a geological map of the NMA and the North Lampbright extension area. The NLLS extension area is underlain mostly by sedimentary rocks, including Paleozoic sandstone, limestone, and shale. In addition, upper Cretaceous rocks occur in the NLLS extension area consisting of sandstone, siltstone, shale, quartzite, and minor amounts of shaley limestone. The main geologic units within the extension area consist of, from youngest to oldest:

- Colorado Formation (Kc), composed primarily of laminated to thinly-bedded dark shale

and sandstone;

- Beartooth Quartzite (Kb) , composed of coarse to fine grained, fractured interbedded orthoquartzite (silica cemented sandstone) and shale;
- Abo Formation (Pa) composed of red shale, mudstone and limy mudstone, limestone and chert conglomerate;
- Syrena Formation (Cs), composed of fossiliferous limestone with some shale interbeds, calcareous shale, and limestone conglomerate; and the
- Oswaldo Formation (Co), composed of thickly-bedded limestone and calcareous sediment.

2.2.3 Climate

The Chino Mine is located in a semiarid region in southwestern New Mexico, with elevations ranging from about 5,200 to 7,700 ft amsl. The climate at Chino is warm and dry, with mean annual precipitation of about 16 inches (400 mm) and a mean annual temperature near 50˚F (10˚C). Precipitation falls mainly as rain, but snow may occur from November to March. Most of the precipitation in the area falls during July through October in the form of rain during short, intense, thunderstorms. About 60 percent of the precipitation falls during the summer months. Monthly precipitation is generally less than an inch per month from November through June, peaks in July, August, and September with between 2 and 3 inches per month, and generally falls to about 1 inch in October. Annual precipitation averages 17.2 inches at the Santa Rita weather station (elevation of 6,312 ft amsl), which is located about 1,000 feet to the west of the Santa Rita Open Pit. Near Hurley,annual precipitation averages approximately 14 inches where the elevation is approximately 5,700 ft amsl.

Evaporative demand in this region is high and annual evaporation far exceeds annual precipitation. Annual potential evaporation is estimated to range from 53 to 70 inches per year (Golder, 2007a).

2.2.4 Surface Water Hydrology

Lampbright Draw is an ephemeral drainage that runs along the eastern portions of the NMA and has been altered in its upper reaches by mining activities. Lampbright Draw commences approximately 6 miles east of Santa Rita Open Pit and east of the NLLS extension area. Two ephemeral drainages, called Tributary 1 and Tributary 2 occur in the vicinity of the Main Lampbright Stockpile and proposed NLLS extension. The headwaters of Tributary 1 begin just north of the proposed NLLS and Main Lampbright Stockpile. Tributary 1 extends to the south directly beneath the Main Lampbright Stockpile (Figure 2-2) where most of the PLS applies to the Main Stockpile is collected. The Tributary 2 drainage occurs east of the extension area and joins Tributary 1 approximately one mile to the south. The drainage continues to the southeast approximately two miles where it joins the main fork of Lampbright Draw.

As shown on Figure 1-2, a stormwater diversion channel diverts clean stormwater from native ground around the proposed NLLS footprint to the east and into the Tributary 2 drainage.

2.2.5 Groundwater Hydrology

Groundwater hydrology at the Chino Mine has been analyzed for several decades and is comprehensively described in the report entitled *Chino Mines Company DP-1340 Condition 83 – Hydrologic Study Final Report* submitted to NMED and MMD in June of 2007. Twice a year, potentiometric maps are submitted to the NMED based on groundwater elevation data collected in a monitoring well network system and the model described in the 2007 study. Data indicate that the ground water system below the Main and proposed Lampbright Stockpiles is an upwelling system which allows for collection of PLS at the southeast toe of the Main Lampbright Stockpile where Tributary 1 daylights, as described above.

Shallow perched groundwater zones of limited nature and saturated thickness have been identified in the vicinity of the NLLS extension area. Shallow ground water in the area generally flows south beneath the Lampbright leach system. No changes to the hydrologic conditions are anticipated by the construction of the NLLS extension.

The existing PLS Sumps, 1, 2 and 3 will be replaced by a new collection Pond at or near the existing Fleming Pond to the west of the proposed NLLS. This new PLS collection system is described in the NMED application.

2.2.6 Cover Material Characteristics

Soils suitable for cover material at reclamation will be salvaged from the footprint of the NLLS extension area prior to the initial build-out of the stockpile. For estimating purposes, it is assumed that the native soils in areas with slopes less than about 15 to 30% will be salvaged. Based on this assumption, approximately 20 to 30 acres have been identified as potential soil salvage areas, with a total estimated volume of suitable soil cover material salvageable from these areas ranging between approximately 97,000 and 145,000 cubic yards (based on an assumed 3-foot salvage thickness).

The remaining cover material required for the NLLS extension will be sourced from the unmineralized volcanic conglomerate deposit that occurs east of the Main Lampbright Stockpile (Figure 2-3). This deposit was identified as the Rubio Peak Formation, which is lithological correlative with the Kneeling Nun and Sugarlump tuffs according to the U. S. Geological Survey.

The Rubio Peak Formation in this area contains poorly sorted coarse gravels from sedimentary and igneous rock in the volcanic ash matrix. The Rubio Peak Formation is the sill rock and the granodiorite of the Hanover-Fierro pluton (Jones et al., 1967). The Rubio Peak Conglomerate at this location ranges from a weakly consolidated volcanic conglomerate to a welded tuff. Ripping tests conducted by Chino indicated that the materials can be worked to produce a viable cover material. Chino currently has a test plot program of the Rubio Peak material and the annual assessment indicate also the viability of this material for reclamation. Chino proposes to use the Rubio material as cover for this CCP.

2.3 Permits and Discharge Plans

Chino currently conducts its mining operations pursuant to several state and federal regulations. Table 2-2 lists the closure/close-out related permits held by Chino pertinent to the NLLS extension. Information regarding these permits is summarized in the following sections.

2.3.1 Mining Act Permit

To meet requirements of the NMMA, Chino obtained approval of its existing mining operation by issuance of an mine permit No. GR009RE from the MMD in December 1997. MMD Permit GR009RE Revision 18-1, issued in 2020, approves Chino's sitewide CCP dat4ed February 14, 2018, and includes the financial assurance estimate for the closure-closeout of the North Lampbright Waste Rock Stockpile in the amount of $3,581,931. The instrument for this amount consists of a surety bond.

2.3.2 Water Rights

Water right permits for the Chino Mine are recorded at the New Mexico Office of the State Engineer (NMOSE) and are administratively associated with the Mimbres Underground Water Basin and surface water diversion permits. Chino's surface and groundwater rights have been adjudicated under Subfile No. 398, Luna Cause No. 6326. Chino's groundwater rights include NMOSE File Nos. M-3527, M-4425, M-5010 through M-5019, and M-6724. Chino's current groundwater right for industrial uses totals approximately 24,000 acre-feet per year (ac-ft/yr). Surface water rights are for capturing and storing stormwater flows in Santa Rita and Whitewater Creek drainages. A total of 11,583 ac-ft/yr of surface water can be diverted, stored, and beneficially used.

The water rights permits are designated for industrial, stock, domestic and municipal use. Industrial use includes manufacturing processes and pollution control related to mine operations.

2.3.3 Air Quality

Chino constitutes a single "*source*" under the federal Clean Air Act, as implemented by the State of New Mexico. Therefore, current, and planned Chino activities are unified in two types of air emissions permits to protect air quality: (1) construction permit (typically known as New Source Review (NSR) permit); and (2) Title V Operating permit. Chino and the Chino owned Cobre Continental Mine operate under Title V air quality Operating Permit Number P066R3. This permit authorizes the operation of the open pit copper mines and associated process activities such as drilling, blasting, loading, hauling, and unloading of ore and overburden.

Chino and the Cobre also operate under NSR air quality permit 0298M10 that regulates its air emissions sources that are spatially separated into three distinct areas: (1) the northernmost Cobre Hanover copper mining and magnetite recovery for off-site delivery operation; (2) the centrally located Santa Rita copper mine, copper and molybdenum concentrator, and SX/EW plant; and (3) the southernmost Hurley operation that produces electricity for internal use with a natural gas power plant, and filter and blending plants that process copper and molybdenum concentrates prior to their off-site shipment. Permit 0298M10 was last issued in April 2020.

2.3.4 Discharge Permit

NMWQCC regulations require a discharge permit (DP) for any discharge of effluent or leachate that has the potential to move directly or indirectly into groundwater or into surface waters that gain flows from groundwater. Chino is separately submitting an application to NMED to modify DP-376 to include the proposed NLLS extension. DP-376 currently covers the Main and South Lampbright Leach Stockpiles; Southwest Lampbright Waste Rock Stockpile; the PLS and stormwater collection systems associated with the existing Lampbright Stockpiles; and all associated tanks and pipelines conveying PLS from the Lampbright area to the SX/EW. Collectively these facilities are referred to as the Lampbright Leach System.

2.3.5 Supplemental Discharge Permit for Closure, DP-1340

Supplemental DP for Closure (DP-1340) was renewed and modified by NMED in May, 2020. This DP contains the closure requirements addressing the various open pits, tailing dams, leach stockpiles, waste rock piles, and associated facilities at the mine. DP-1340 supplements each of the operational DP's for Chino and contains conditions necessary to limit, contain, or prevent the exceedance of standards at Section 20.6.2.3103 NMAC or the presence of a toxic pollutant in groundwater after the cessation of operations and conditions necessary to ensure abatement of groundwater contamination.

3.0 PROPOSED NORTH LAMPBRIGHT LEACH STOCKPILE EXTENSION CONFIGURATION

The proposed NLLS extension will be constructed with waste rock as the foundation (already permitted) and run of mine ore. The proposed NLLS extension at final build-out to an elevation of 6800 ft amsl is presented on Figure 3-1. The stockpile will cover approximately 120 acres and is bounded by the Fleming Pond on the west, the Main Lampbright Stockpile to the south, and the East Headwall Impoundment on the east. In five years, the build-out the top of the stockpile will be at an elevation of 6,650 ft amsl. During operations the stockpile will be constructed to result in an overall slope of approximately 3H:1V to meet the requirements for outslopes requirements at closure.

4.0 NORTH LAMPBRIGHT LEACH STOCKPILE EXTENSION RECLAMATION PLAN

This section presents the reclamation plan and associated design criteria for closure/closeout of the NLLS extension. The reclamation design criteria conform to the closure requirements described in and Section 8 of MMD Permit GR009RE. Conceptual level reclamation design drawings for the NLLS extension are presented in Appendix A. Final designs for reclamation of this facility will be prepared and submitted to the agencies as part of the CDQAP.

Performance objectives and design criteria were developed with the intent of meeting the NMWQA, NMWQCC Regulations and NMMA rules. The reclamation designs were developed to provide enough information to update the financial assurance cost estimate. A summary of the key design criteria for the NLLS extension is presented in Table 4-1. The performance objectives for closure/closeout of the NLLS extension include: establishment of a self-sustaining ecosystem; stabilize the reclaimed area to minimize future impacts to the environment and to protect air and water resources; limit ponding on the final cover surfaces; and reduction of infiltration.

The following information compares the earthwork calculated for financial assurance between the permitted North Lampbright Waste Rock Stockpile and the two planned elevations for the NLLS.

North Lampbright Leach compared to North Lampbright Waste Rock

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North Lampbright Waste Rock Stockpile Elevation 6800	North Lampbright Leach Elevation 6650	North Lampbright Leach Elevation 6800
Total Acreage for Reclaimed Stockpile: 191 acres	Total Acreage for Reclaimed Stockpile: 120 acres	Total Acreage for Reclaimed Stockpile: 168 acres
Total Cover material needed: 924,440 cubic yards	Total Cover material needed: 573,937 cubic yards	Total Cover material needed: 786,551 cubic yards
Total regrading 493,796 cubic yards	Total regrading 394,529 cubic yards	Total regrading 684,510 cubic yards
Bench grading/channels 19,885 linear feet	Bench grading/channels 3,261 linear feet	Bench grading/channels 16,992 linear feet
Down Drains: 31,826 linear feet, six down drains	Down Drains: Not needed	Down Drains: 1,573 linear feet, 2 down drains

Structural Stability

The operational NLLS extension will be constructed to allow for efficient closure of the facility and to ensure that the slope stability requirements listed in the Copper Rules (20.6.7.33.B NMAC) are met. The stockpile is abutted by a natural hillside on the north and the Main Lampbright Stockpile on the south.

Stockpile Erosion and Drainage Control

The proposed reclamation design meets the criteria stipulated in permits GR009RE and DP-1340 and section 20.6.7.33.C NMAC. Erosion and drainage control for the stockpile will be achieved by providing mechanisms for regrading, stormwater conveyance, and revegetation. Upon reclamation, the NLLS extension top surface will be graded and covered to direct non-impacted stormwater to designated discharge areas. The stockpile top surface will be graded to a minimum final grade of 1%. The slopes will be graded to armored storm water conveyance structures. Armored channels, perimeter berms, and hydraulic structures will be designed to control erosion on the top surfaces and outslopes and safely convey storm water for release. At ultimate height, the stockpile inter-bench outslopes will be graded to at least 3H:1V with uninterrupted slope lengths of no greater than 200 feet. Storm water will be controlled using conventional terrace channels integrated to down drains one on the west and the other on the east side of the stockpile (Appendix A). Run-off drainage and

erosion control will be achieved by storm water conveyance channels, stable out slopes, suitable cover material and revegetation.

Run-on from the surrounding terrain and the NLLS will be controlled by perimeter channels located around the NLLS (Appendix A). The channels will be designed to accommodate the peak discharge resulting from the 100-year, 24-hour storm event. The perimeter channel on the west and northwest sides of the extension area will be directed into the mine, and the perimeter channel on the northeast and east sides of the extension area will be directed to the south and released into Tributary 2. Temporary erosion control measures may be provided during the construction and early vegetation establishment periods. These measures may include, but are not limited to, berms, mulch, straw bales, silt fences, and minor corrective regrading. All construction will be in compliance with federal and state regulations for temporary storm water control.

Stockpile Cover and Revegetation Specifications

Finish grading of the stockpile subgrade will be performed based on pre-construction surveys. Earth moving equipment such as bulldozers and motor graders will be used to smooth the surfaces and facilitate access for supplemental cover placement and mulching/seeding. Stockpile covers will be placed according to the following criteria:

North Lampbright Leach Stockpile Extension	
Top Surface Cover Thickness	36 inches
Outslope Cover Thickness	36 inches
Top Surface Grade	1.0 to 5%
Slope (Inter-Bench Slope)	3H:1V max.

The reclamation designs and the associated estimated reclamation quantities presented in Appendix A indicate that the cover requirement for the NLLS extension is approximately 573,937 yd^3 .The currently approved North Lampbright Waste Rock Stockpile was approximately 924,440 yd^3. Revegetation of the covered surfaces will be achieved by seeding with a variety of native and adapted grasses, shrubs, and forbs in accordance with Appendix C of Permit GR009RE and applicable modifications. The planned seed mix is discussed in section 7.0.

Haul roads and access roads not needed for closure and post closure access will be reclaimed. If the roads are located on non-acid generating material, compacted road material will be loosened by ripping to a depth of 18 to 24 inches and revegetated. Haul roads located on acid-generating material will be covered with 36 inches of the suitable cover material and revegetated.

5.0 CLOSURE & POST-CLOSURE MONITORING, REPORTING, AND CONTINGENCY PLANS

Closure and post-closure monitoring, reporting, and contingency plans are required under Chino DP-376, DP-1340, and the MMD Permit.

The MMD guidelines require periodic monitoring of revegetation and annual reports during the responsibility period to evaluate revegetation success, and DP-1340 requires the development of post- closure monitoring and contingency plans that are consistent with the terms and conditions of the applicable DP. The following sections summarize the general approach that will used to meet these requirements.

5.1 Erosion and Drainage Control Structures

Post construction/reclamation inspection schedules will be developed to include provisions for periodic (monthly for the first year following completion of reclamation construction activities, and quarterly thereafter) and extreme event monitoring as appropriate. Chino will report evidence of excessive erosion and/or structural failures to the appropriate agencies (MMD, NMED, or NMOSE) in a timely manner. A written report detailing the nature and extent of the problem and a corrective action plan will be developed within 30 days after the problem is identified.

Chino will routinely inspect and maintain all drainage channels, diversion structures, retention impoundments, and auxiliary erosion control features in accordance with professionally recognized standards such as Natural Resources Conservation Service and NMOSE.

5.2 Ground Water and Surface Water Control Facilities

During post closure Chino will perform quarterly inspections and annual evaluations of all seepage interceptor systems and groundwater remediation systems and perform maintenance as necessary to ensure that all water contaminants are managed in a manner that is protective of ground water quality. Monitoring of site water quality will be accomplished through sampling and analysis of potentially impacted water in accordance with the samping plan in DP-1340. Ground water quality will be monitored throughout the post-closure period.

5.3 Revegetation Success Monitoring

The reclaimed area will be monitored in accordance with 20.6.7.35.C NMAC and the MMD Permit after the final grading and the initial establishment of vegetation on the reclaimed land. Chino will conduct vegetation monitoring of both volunteer revegetation and re-seeded areas during the third year after seeding. Revegetation monitoring will be performed at the sixth year after planting and for two consecutive years prior to bond release. The revegetation monitoring will be conducted to meet

statistical adequacy for the monitoring conducted during the two consecutive years prior to bond release.

5.4 Wildlife Monitoring

Chino submitted a wildlife monitoring plan for post closure in December 2004 (Golder, 2004b). This plan was conditionally approved by the MMD and New Mexico Department of Game and Fish on February 15, 2006. The monitoring plan provides a description of the proposed reclamation plan as it applies to wildlife and wildlife habitat, an overview of the existing species and wildlife habitat within the vicinity of the Chino Mine, and the proposed methods for deer pellet group counts and bird diversity surveys. Results of the monitoring will be evaluated to determine wildlife use trends during re-establishment of a self-sustaining ecosystem.

The results of the surveys will not be a condition of or given consideration with regard to financial assurance release.

5.5 Construction Quality Assurance Plan

Chino will submit a CQAP to MMD for approval no less than 180 days prior to regrading of the NLLS extension and placement of any cover material for final closure. The CQAP will besupplemented with a CQAR to be submitted to the MMD within 180 days after completion of construction.

6.0 POST-MINING LAND USE DESIGNATION

This section provides the PMLU for the NLLS Extension based upon the requirements of the MMD Permit, NMMA Section 69-36-11.6, and Subparts 507.A, 507.B, and 508 of the NMMA Rules (MMD, 1996). PMLUs are specified in Section 3.G. of the MMD Permit. The approved PMLUs for Chino are wildlife habitat and industrial (MMD, 2003). Wildlife habitat is the primary PMLU for the majority of the Chino mine permit area and is the proposed PMLU for the NLLS extension (Figure 6-1). Reclamation of the NLLS extension will result in the development of an early-stage grass/shrub community that will provide a locally important increase in community-level diversity. Some infrastructures may have a post-mining wildlife use such as power poles for raptor perches and main roads for land management. Native vegetation will be established on the reclaimed area resulting in increased erosion protection, direct habitat improvement, and reduced percolation of water into the underlying materials relative to current conditions. The proposed reclamation seed mix and seeding rates for the NLLS extension are presented in Table 6-1 and is in accordance with Appendix C of the MMD Permit and applicable modifications. These species have broad ecological amplitudes and provide structural diversity.

The proposed seed mix was selected to provide early establishment of ground cover, erosion control, and diversity in growth forms. The species selected for the NLLS extension have been successfully used in mine reclamation and range improvement projects in many parts of New Mexico, including the Chino Mine. The primary reclamation seed mix proposed includes cool and warm season grasses, perennial shrubs, and forbs. Depending on availability, alternate species may be substituted for the primary species. The seed mix is designed for application prior to the summer rains. Table 6-2 lists some of the major attributes of the vegetation selected for use at the NLLS extension. The selected vegetation will provide erosion control, promote soil development, and provide forage, seeds, and cover for small mammals and birds. The seed mix includes a number of valuable, nutritious forage and browse species that could be used by wildlife.

6.1 Site-Specific Revegetation Success Guidelines

Section 507.A of the NMMA rules (MMD, 1996) requires that the permit area of an existing mine be reclaimed to a condition that allows the establishment of a self-sustaining ecosystem appropriate for the life zone of the surrounding area unless it conflicts with the approved PMLU. Demonstration of the establishment of a self-sustaining ecosystem is made by comparison of the vegetation on the reclaimed areas to vegetation attributes on a reference area and/or technical standards (MMD, 1996).

New disturbances located outside the current design limit will meet the reclamation standards set forth in 19.10.5.507 NMAC and will also comply with the new unit standards set forth in 19.10.5.508.E NMAC. Disturbances located within the current design limit are considered existing mine units and will meet the reclamation standards set forth in 19.10.5.507 NMAC. Site-specific revegetation success guidelines for each of these areas (Figure 6-2) will follow the established permit conditions for vegetation cover, shrub density, and diversity. The numerical diversity guidelines for the Chino mine are listed in Table 6-3.

7.0 BASIS FOR CAPITAL AND OPERATION AND MAINTENANCE COST ESTIMATES

This section provides a brief description of the material take-offs and factors that applied in the capital and O&M cost estimates associated with the NLLS extension reclamation plan.

7.1 North Lampbright Leach Stockpile Extension Material Take-Offs

The earthworks material takeoff for reclamation of the NLLS extension cost estimate was developed by Telesto Solutions, Inc. in accordance with standard engineering practice and is supported with data from various references and is fully documented in Appendix A. The material takeoffs for the major reclamation components are summarized below:

North Lampbright *Waste Rock* Stockpile Expansion Quantities[1]		
Item	**Quantity**	**Units**
Earthwork		
Grading	493,796	cubic yards
Bench Grading	19,885	linear feet
Cover Material	924,440	cubic yards
Cover and Revegetate	221	acres
Surface Water Conveyance Channels	31,826	linear feet

Footnote 1: Quantities based on original NLWRS CCP to elevation of 6800. Cover and Revegetate included the Reclamation of the borrow pit Rubio Peak.

North Lampbright *Leach* Stockpile Expansion Quantities for 6650 msl		
Item	**Quantity**	**Units**
Earthwork		
Grading	394,529	cubic yards
Bench Grading	8,305	linear feet
Cover Material	573,937	cubic yards
Cover and Revegetate	121	acres
Surface Water Conveyance Channels	3,261	linear feet

7.2 Basis for Capital Cost Estimates

The earthwork reclamation cost estimate is based on a template originally created by the New Mexico Energy, Minerals and Natural Resources Department, Mining and Minerals Division (MMD, 1996). The unit rates that will be used to develop the cost estimate and equipment production factors are provided in Appendix.

7.3 Basis of Operation and Maintenance Cost Estimates

Details and supporting documentation for the basis of the O&M cost estimate are provided in Appendix A.

The basis for O&M costs related to periodic erosion control and road maintenance are included in the NLLS extension O&M cost estimate. Erosion control is split into three timeframes (years 0-19, years 20-39, and years 40 to 99) based on experience with similar ongoing reclaimed areas. Revegetation maintenance assumes 2% failure every year for a total of 12 years, starting the year reclamation is completed. Therefore, 100 % of the initial vegetation is costed as capital and an additional 24% as O&M. Total indirect costs are calculated as 17.5% of long-term O&M costs as agreed between the agencies Freeport-McMoRan in 2019.

8.0 CLOSURE SCHEDULE

The proposed reclamation schedule for the NLLS extension summarizes Chino's existing mine

plans, near-term mine operation and reclamation commitments and longer-term projections. More specifically, the schedule is based on the following considerations:

- Ongoing reclamation projects and previous schedule commitments;
- Practical phasing of the reclamation projects to account for water management, water treatment and the anticipated labor, equipment and other resources that would be necessary to complete these projects based on current conditions;
- Sequential closure of facilities in a phased cost-efficient manner (i.e., closure of select leach and waste rock piles as mining operations cease followed by closure of the leach stockpiles utilized as part of the process solution elimination system); and
- Total annual acreages that would be reclaimed over this period.

The NLLS extension will be reclaimed in conjunction with the Main and South Lampbright stockpiles. The current schedule for these stockpiles specifies the start of reclamation five years following the cessation of leaching operations at the Main Lampbright Stockpile. The anticipated duration to complete closure of the Main, South, and NLLS extension is approximately 5 years.

9.0 USE OF THIS REPORT

Freeport-McMoRan Chino Mines Company has prepared this CCP for the NLLS extension for the NMED and the MMD of the New Mexico Energy, Minerals and Natural Resources Department. In the compilation of this plan, Chino collaborated with Telesto Solutions, Inc., who prepared the basis of the reclamation cost estimate. The NLLS extension CCP has been updated to fulfill the requirements of the following permits and rules:

- **Supplemental Discharge Permit for Closure, DP-1340, Chino Mines Company**, issued by the NMED on May, 2020 ;
- **Revision 18-1 to Permit GR009RE**, issued by the Director of the MMD of the New Mexico Energy, Minerals and Natural Resources Department on September 24, 2020;
- Applicable conditions of the **Copper Mine Rules (Section 20.6.7 NMAC)**, respectively.

10.0 REFERENCES

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11.0 TABLES

Table 2-1: Vegetation Map Units in the Chino Survey Area

Name	Acreage	Elevation Range (ft amsl)
Mixed-Grama Herbaceous Alliance	6,717	5,200-5,750
Mesquite/Mixed Grama Shrubland Alliance	8,858	5,200-5,800
Fluvial Forest and Shrubland Alliance	1,585	5,200-5,600
Alligator juniper-Oak/Grama Woodland Alliance	10,257	5,800-7,700
Alligator juniper-Oak Woodland Alliance	4,456	5,800-7,400
Mountain mahogany Shrubland Alliance	10,038	5,600-7,600
Ponderosa pine-Oak Forest Alliance	1,552	6,000-7,600
Mine Facilities/Urban	10,122	NA

Notes: NA = Not applicable

Table 2-2: Summary of Chino Closure/Closeout-Related Permits Pertinent to the North Lampbright Leach Stockpile Extension

Permit or Requirement	Agency	ID Number	Area Covered
Mining Act Permit	New Mexico Mining & Minerals Division	GR009RE	Chino Mine
Groundwater Discharge Plans	NMED Ground Water Quality Bureau	DP-376, DP-1340	Operational DP for the Lampbright Leach System Supplemental DP for Closure
Water Rights	New Mexico Office of State Engineer	M-3527, M-4425, M- 5010 through 5019, M-6724	Chino Mine Areas
Air Quality	U.S. EPA (Region 6)	P066R3 0298M7	Title V Mine-wide Cobre and Chino Mines

Notes:
NMED = New Mexico Environment Department
NA = Not applicable

Table 4-1: Summary of Key Design Criteria for Closure of the North Lampbright Leach Stockpile Extension

Stockpile Regrading: ■ Outslope to be graded to inter-bench slopes of between 3.0H:1V ■ Maximum uninterrupted slope length of 200 feet for outslopes ■ Terrace benches will have maximum bench width 50 feet (conceptual designs at 15 feet wide) ■ Bench longitudinal slopes at maximum of 5 percent ■ Bench cross slopes and channels between 1 and 5 percent ■ Top surface graded at a minimum final grade of 1 percent ■ Regrading to be done in such a manner that orients surface water conveyances to the exterior perimeter of the stockpile ■ Slope channels will be located where possible in natural junctions or drainage chutes, but all channels will contain riprap and energy dissipation structures as appropriate ■ Top surface and outslope to be covered with 36 inches of suitable cover material ■ Top surface and outslope to be revegetated in accordance with Appendix C of the MMD Permit and applicable modifications ■ A moderate maintenance program will be acceptable until cover vegetation establishes
Haul Roads (all haul roads except those located within PMLU access roads) ■ Where located on acid-generating material, surface to be covered with 36 inches of suitable cover material ■ Cover surfaces to be revegetated in accordance with Appendix C of the MMD Permit and applicable modifications ■ Where located on non-acid-generating material, surface to be ripped and revegetated in accordance with Appendix C of the MMD Permit and applicable modifications ■ A moderate maintenance program will be acceptable until cover vegetation establishes

Notes:
MMD = Mining and Minerals Department
PMLU = Post Mining Land Use
OPSDA = Open Pit Surface Drainage Area

Table 6-1: Proposed Interim Seed Mix and Rates for the North Lampbright Leach StockpileExtension Site

Species[a]	Life-Form	Duration[b]	Seasonality	Rate[a,c]
Primary				
Blue grama (*Bouteloua gracilis*)	Grass	Per	Warm	0.50
Side-oats grama (*Bouteloua curtipendula*)	Grass	Per	Warm	1.50
Black grama (*Bouteloua eriopoda*)	Grass	Per	Warm	0.10
Green sprangletop (*Leptochloa dubia*)	Grass	Per	Warm	0.25
Plains lovegrass (*Eragrostis intermedia*)	Grass	Per	Intermediate	0.05
Apache plume (*Fallugia pardoxa*)	Shrub	Per	NA	0.10
Mountain mahogany (*Cercocarpus montanus*)	Shrub	Per	NA	1.50
Winterfat (*Eurotia lanata*)	Shrub	Per	NA	1.00
White prairie clover (*Dalea candida*)	Shrub	Per	NA	0.25
Globe mallow (*Sphaeralcea sp.*)	Forb	Per	NA	0.10
Blue flax (*Linum lewisii*)	Forb	Per	NA	0.25
Total PLS (lb/ac)				**5.60**
Alternate				
Sand dropseed (*Sporobolus cryptandrus*)	Grass	Per	Intermediate	ND
Tobosa (*Hilaria mutica*)	Grass	Per	Warm	ND
Bush muhly (*Mohlenbergia porteri*)	Grass	Per	Warm	ND
Squawberry (*Rhus trilobata*)	Shrub	Per	NA	ND
Fourwing saltbush (*Atriplex canescens*)	Shrub	Per	NA	ND
Prairie coneflower (*Ratibida columnaris*)	Forb	Per	NA	ND
White sweet clover (*Melilotus alba*)	Forb	Ann	NA	ND

Notes:
[a] Seed mix and rates are subject to change based on future investigations
[b] Per – Perennial; Ann = Annual
[c] Rate is in pounds of pure live seed per acre; substitutions may change seeding rates
lb/ac = pounds per acre
NA = Not applicable
ND = Not determined
PLS = Pure live se

Table 6-2: Functions and Attributes of the Primary Plant Species Proposed for the North Lampbright Leach Stockpile ExtensionSite

Species	Character[a]	Attributes and Function
Blue grama (*Bouteloua gracilis*)	N,P,W,G	Sod and bunch grass providing ground cover and forage
Side-oats grama (*Bouteloua curtipendula*)	N,P,W,G	Bunch grass providing ground cover and forage
Black grama (*Bouteloua eriopoda*)	N,P,W,G	Bunch grass providing ground cover and forage
Green sprangletop (*Leptochloa dubia*)	N,P,W,G	Erect bunch grass; aggressive short-lived nurse plant with forage value
Plains lovegrass (*Eragrostis intermedia*)	N,P,C,G	Bunch grass providing ground cover and early spring forage
Apache plume (*Fallugia pardoxa*)	N,P,S	Mid-height shrub providing browse, cover, and erosion control
Mountain mahogany (*Cercocarpus montanus*)	N,P,S	Mid-height to tall shrub providing browse and cover
Winterfat (*Eurotia lanata*)	N,P,HS	Low shrub providing winter browse
White prairie clover (*Dalea candida*)	N,P,S	Early season legume providing ground cover and forage
Globe mallow (*Sphaeralcea sp.*)	N,P,F	Persistent mid-height forb providing browse
Rubber rabbitbush (*Chrysothamnus nauseosus*)	N,P,S	Mid-height shrub providing cover and erosion control
Blue flax (*Linum lewisii*)	N,P,F	Persistent forb with a pretty blue flower

Notes:

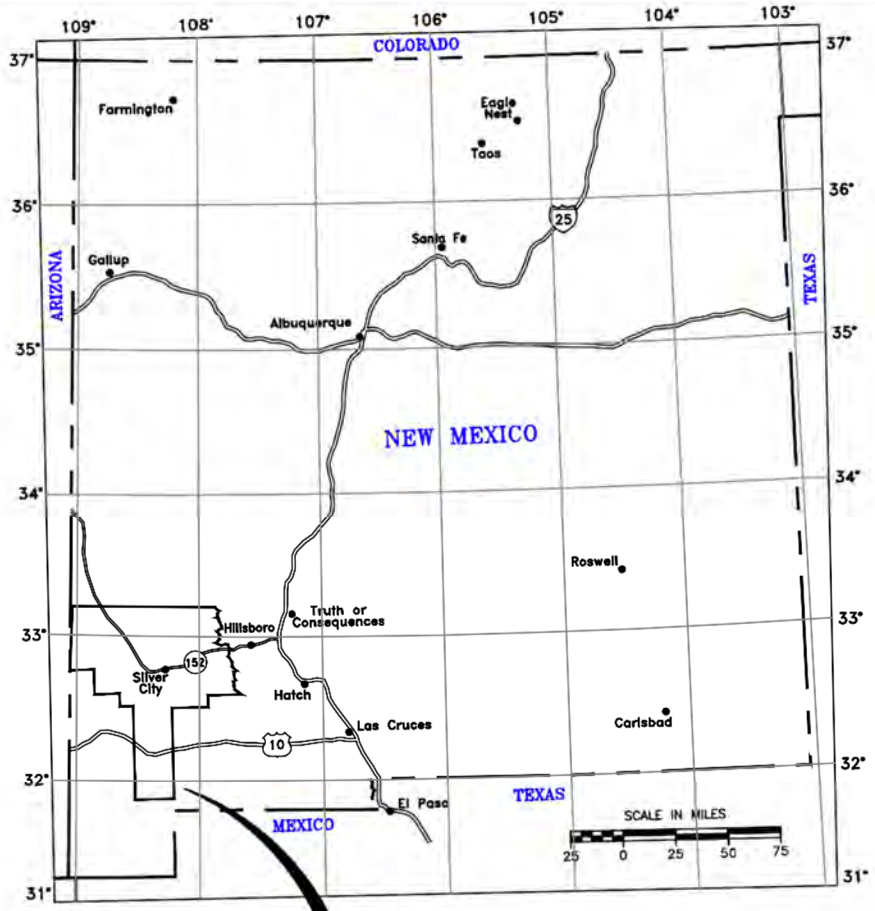
[a] N = Native
I = Introduced
P = Perennial
A/B = Annual or biannual
W = Warm season
C = Cool season
G = Grass
S = Shrub HS = Half shrub
F = Forb

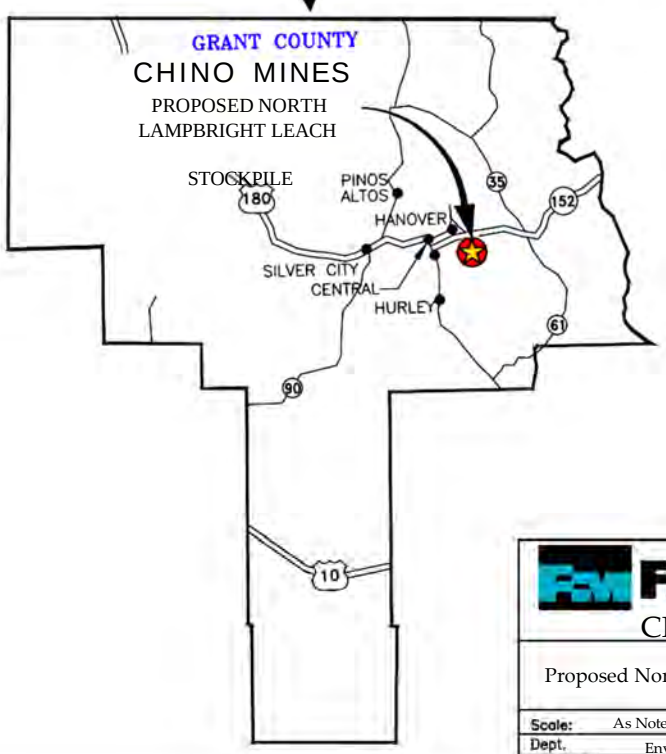
Table 6-3: Proposed Diversity Guidelines for the North Lampbright Leach Stockpile Extension Site

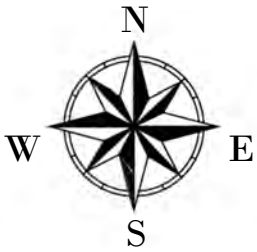
Class	Seasonality	Number	Minimum Occurrence (% cover)
Grasses	Warm	3	1
Shrub	NA	2	0.5
Forbs	NA	2	0.1

Note:
NA = NOT APP

12.0 FIGURES





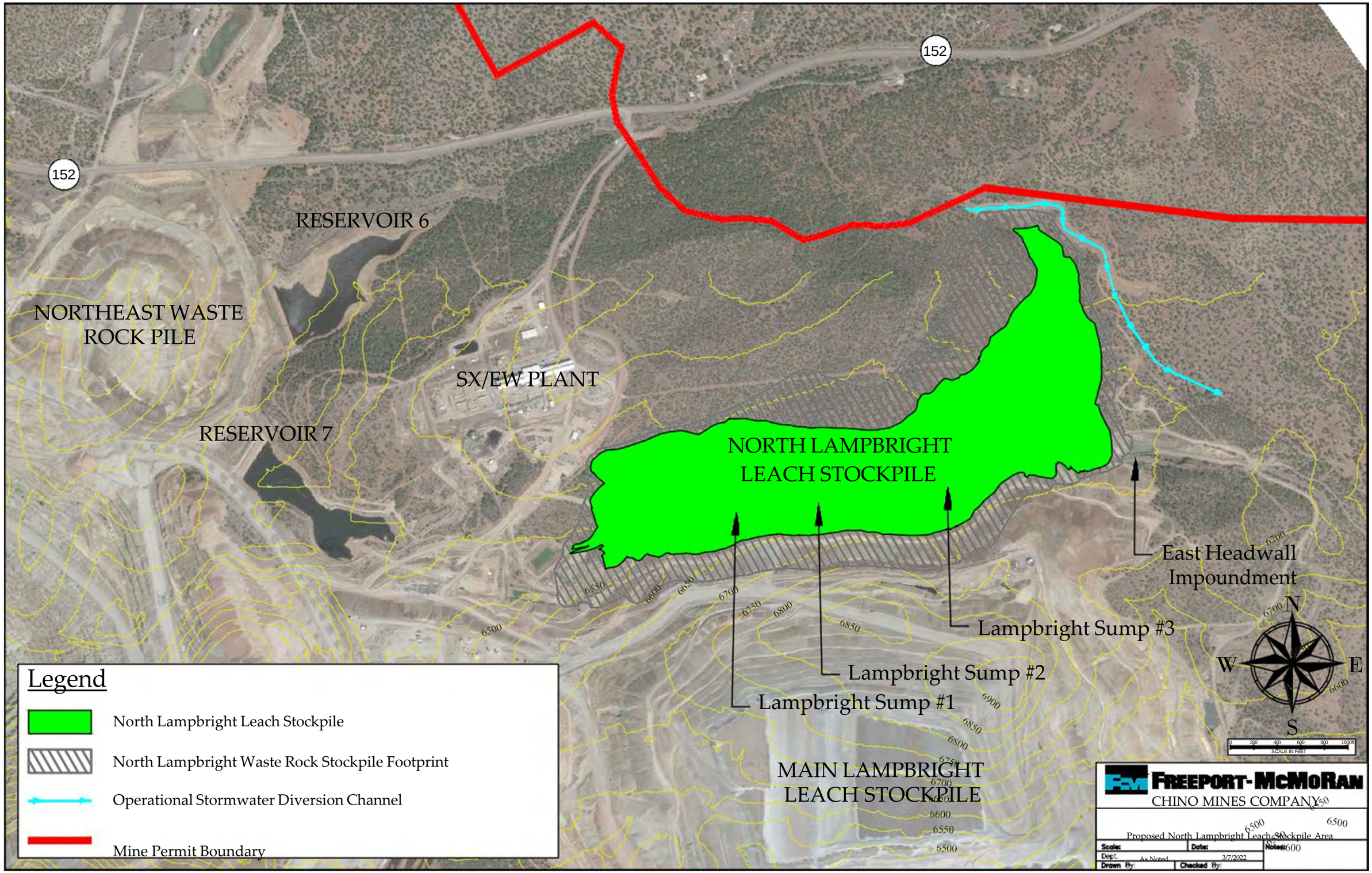


FREEPORT-MCMORAN

CHINO MINES COMPANY

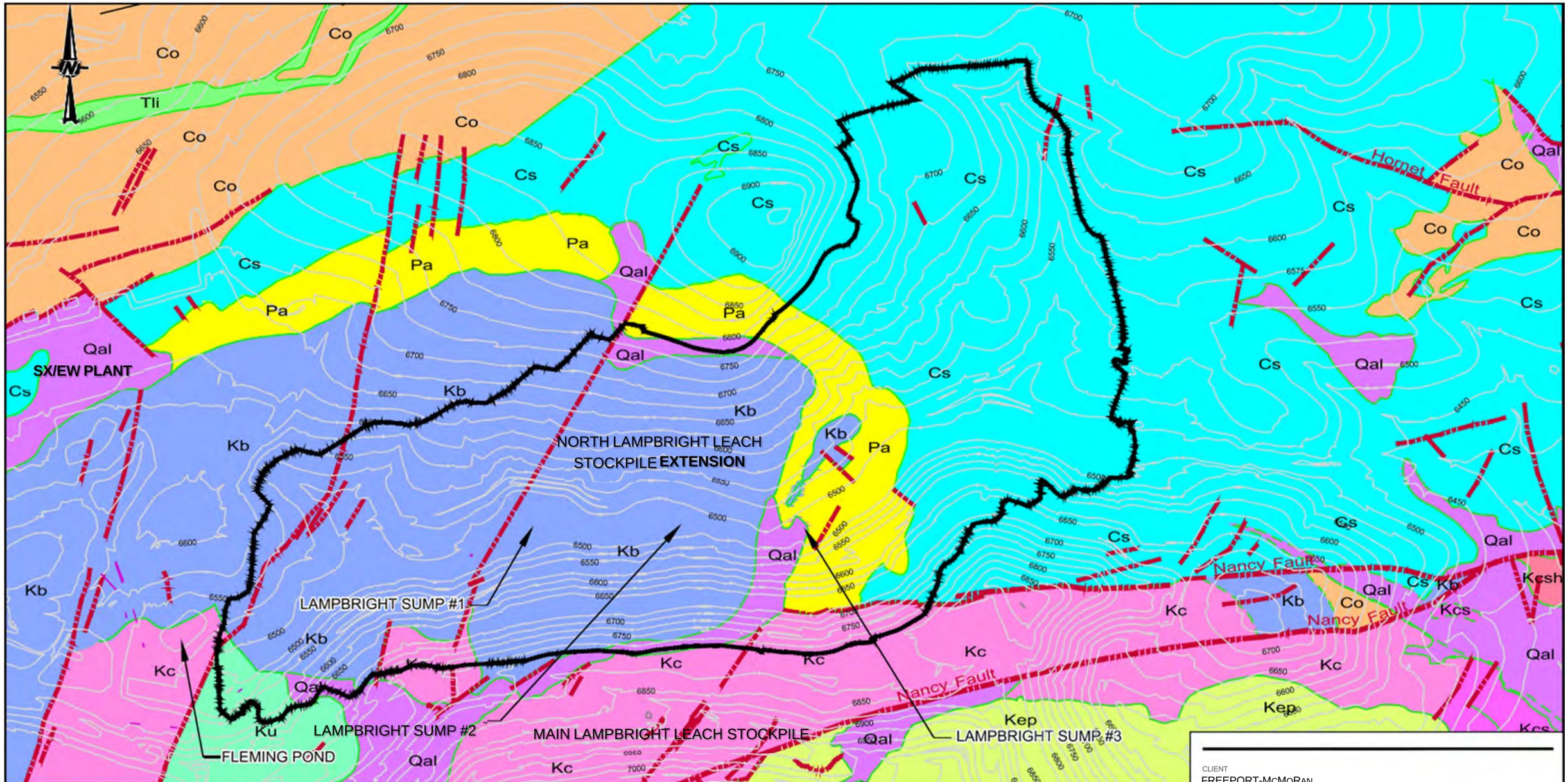
Proposed North Lampbright Leach Stockpile Location Map

Scale: As Noted	Date: 12/14/2021	Notes:	
Dept. Environmental Services			Figure 1-1
Drawn By: SMG	Checked By: KES		



Environmental Services

Figure 1-2



LEGEND

Approved NORTH LAMPBRIGHT WASTE ROCK STOCKPILE

GEOLOGIC LEGEND

Qal		Kcs		Kcsh		Cs	
Tli	YOUNGER ALLUVIUM	Ku	COLORADO FORMATION SANDSTONE MEMBER	Kep	COLORADO FORMATION SHALE MEMBER	Co	SYRENE FORMATION
Kb	RHYODACITE PORPHYRY	Kc	UNDIFFERENTIATED	Pa	QUARTZ DIORITE PORPHYRY		OSWALDO FORMATION
	BEARTOOTH QUARTZITE		COLORADO FORMATION		ABO FORMATION		GEOLOGIC CONTACT FAULT

NOTES

1. MAP COORDINATES ARE BASED ON THE NEW MEXICO STATE PLANE (NMSP) NAD 83, WEST ZONE
2. SOURCE: SEPTEMBER 2014 AERIAL IMAGE FROM CHINO MINE COMPANY.
3. TOPOGRAPHY IS BASED ON 2014 DATA FROM CHINO MINES COMPANY.
4. GEOLOGIC MAP FROM FIGURE 6 OF CHINO MINES - NORTH LAMPBRIGHT STAGE 1 ABATEMENT PLAN (GOLDER, 2003)

SCALE

0 205.50 510 FEET

0 75

CLIENT
FREEPORT-McMoRAN
CHINO MINES COMPANY
BAYARD, NEW MEXICO

PROJECT
NORTH LAMPBRIGHT LEACH STOCKPILE EXTENSION
CLOSURE/CLOSEOUT PLAN

TITLE
NORTH LAMPBRIGHT LEACH STOCKPILE EXTENSIONAREA
SURFACE GEOLOGY AND TOPOGRAPHIC MAP

CONSULTANT

Golder Associates

PROJECT NO. 1537066

PHASE
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YYYY-MM-DD PREPARED DESIGN
REVIEW APPROVED

2015-09-16
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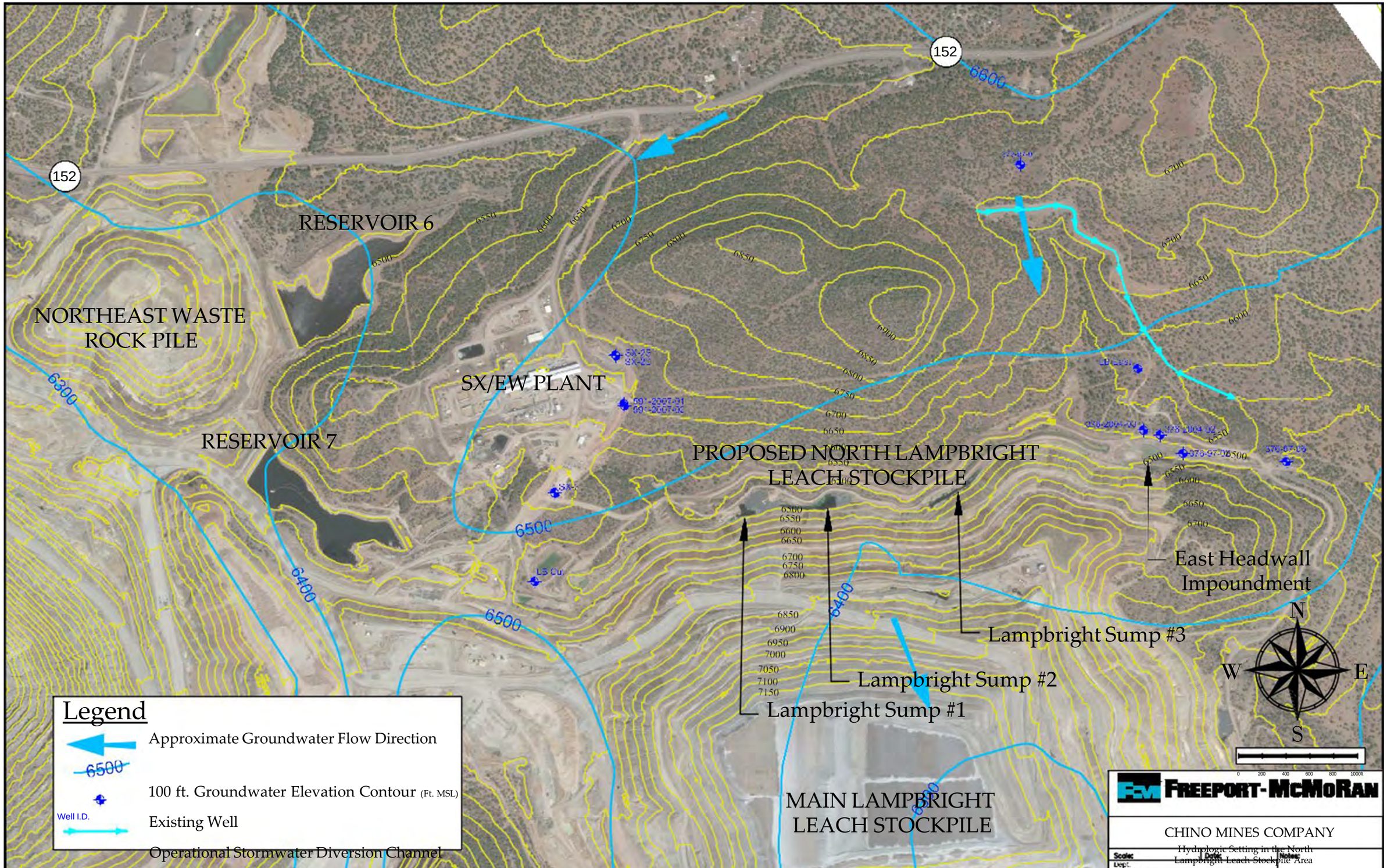
FIGURE
2-1



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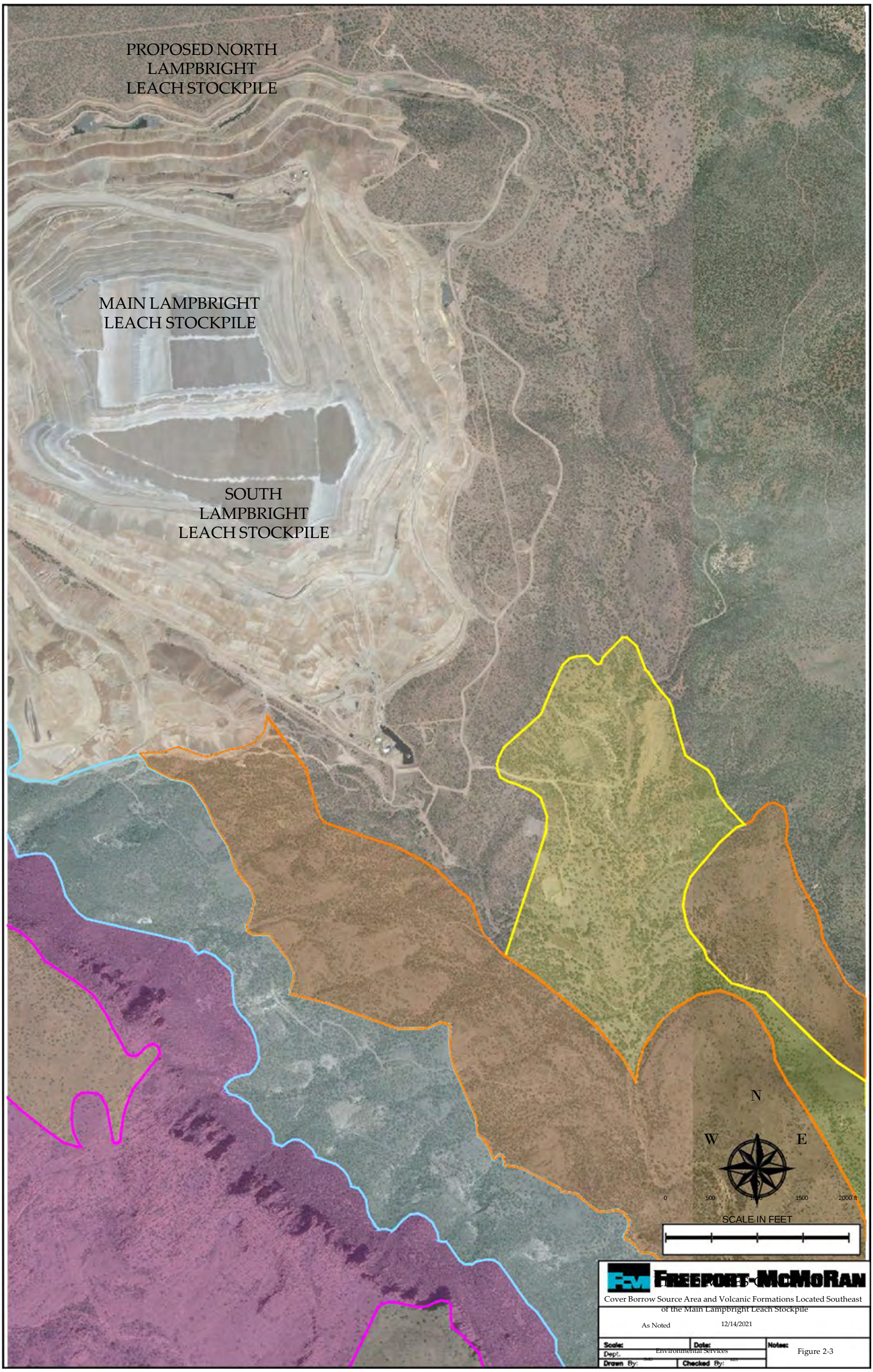
PROPOSED NORTH
LAMPBRIGHT
LEACH STOCKPILE
MAIN LAMPBRIGHT
LEACH STOCKPILE
SOUTH
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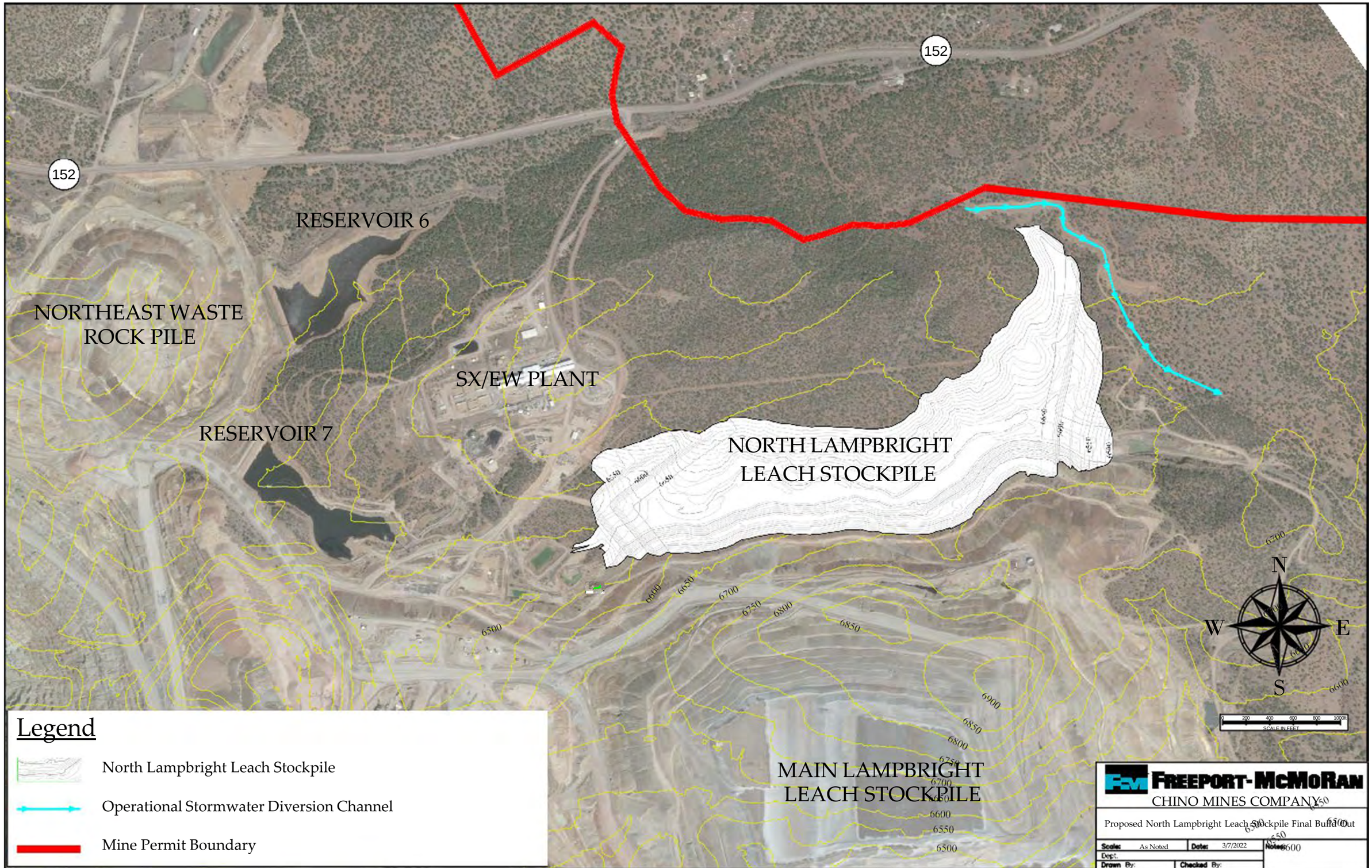
2000 ft
SCALE IN FEET
FREEPORT-McMoRAN
Cover Borrow Source Area and Volcanic Formations Located Southeast
of the Main Lampbright Leach Stockpile
As Noted
12/14/2021
Scale:
Date:
Notes:
Dept.
Environmental Services
Drawn By:
Checked By:
Figure 2-3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152
RESERVOIR 6
NORTHEAST WASTE
ROCK PILE
SX/EW PLANT
RESERVOIR 7
NORTH LAMPBRIGHT
LEACH STOCKPILE
MAIN LAMPBRIGHT
LEACH STOCKPILE
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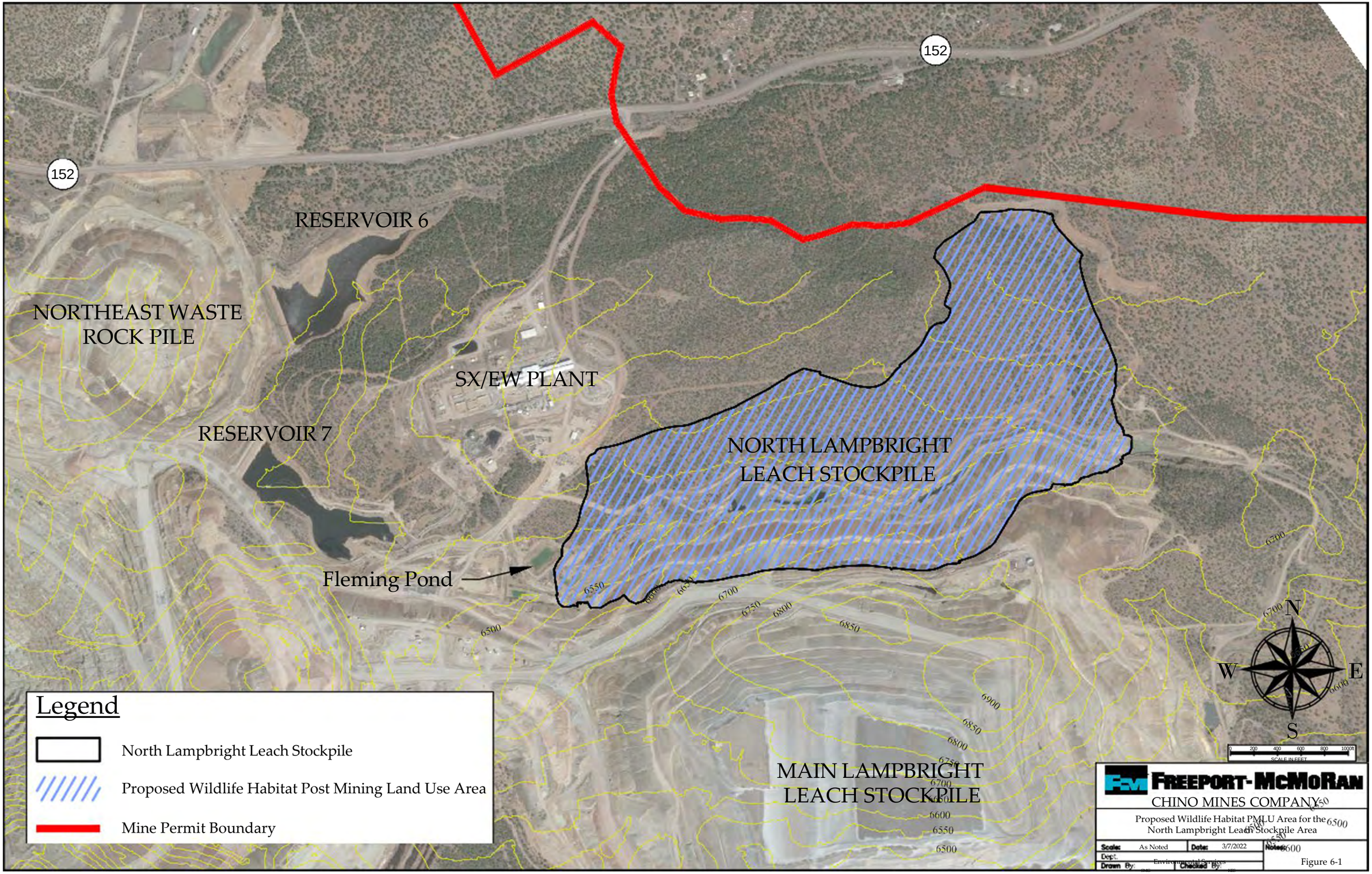
SCALE IN FEET
Legend
North Lampbright Leach Stockpile
Operational Stormwater Diversion Channel
Mine Permit Boundary
FREEPORT-McMoRAN
CHINO MINES COMPANY
Proposed North Lampbright Leach Stockpile Final Buffed Out
Scale: As Noted
Date: 3/7/2022
Dept:
Drawn By:
Checked By:
Notes:
Environmental Services

Figure 3-1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152
RESERVOIR 6
NORTHEAST WASTE
ROCK PILE
SX/EW PLANT
RESERVOIR 7
NORTH LAMPBRIGHT
LEACH STOCKPILE
Fleming Pond
MAIN LAMPBRIGHT
LEACH STOCKPILE
Legend
North Lampbright Leach Stockpile
Proposed Wildlife Habitat Post Mining Land Use Area
Mine Permit Boundary
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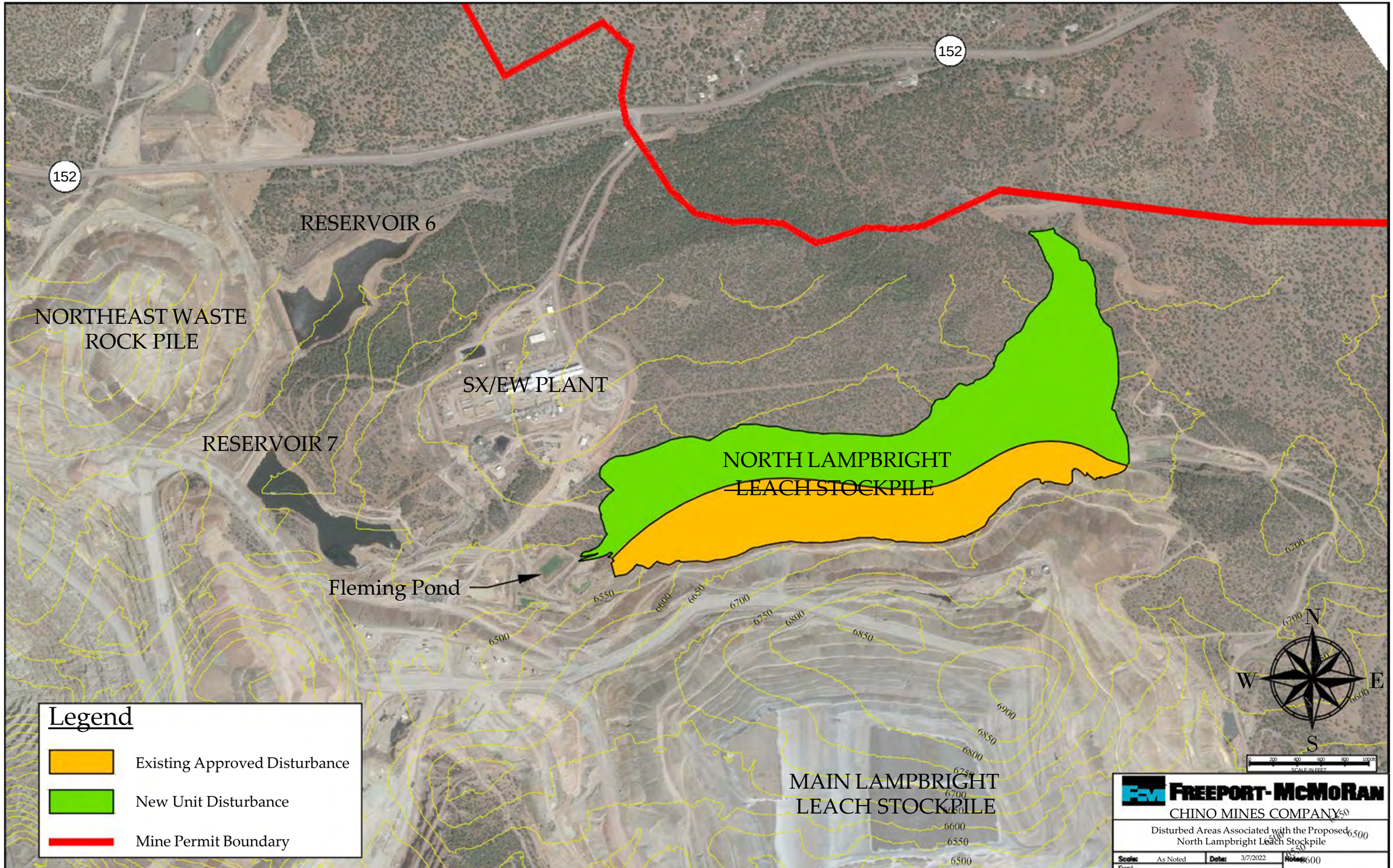
SCALE IN FEET
FREEPORT-MCMORAN
CHINO MINES COMPANY
Proposed Wildlife Habitat PMLU Area for the
North Lampbright Leach Stockpile Area
Scale: As Noted
Date: 3/7/2022
Dept.: Environmental Services
Drawn By:
Checked By:
Notes:
Figure 6-1


152
152
RESERVOIR 6
NORTHEAST WASTE
ROCK PILE
SX/EW PLANT
RESERVOIR 7
NORTH LAMPBRIGHT
LEACH STOCKPILE
Fleming Pond
MAIN LAMPBRIGHT
LEACH STOCKPILE
Legend
Existing Approved Disturbance
New Unit Disturbance
Mine Permit Boundary
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FREEPORT-MCMORAN
CHINO MINES COMPANY
Disturbed Areas Associated with the Proposed
North Lampbright Leach Stockpile
Scale: As Noted
Date: 3/7/2022
Dept: Environmental Services
Drawn By:
Checked By:
Notes:
Figure 6-2

APPENDIX A
EARTHWORK COST ESTIMATE PROCESS REPORT AND RECLAMATION DESIGN DRAWINGS

Earthwork Cost Estimate Summary Report

North Lampbright Leach Stockpile Closeout/Closure Plan

Prepared for

Freeport-McMoRan Chino Mines Company
99 Chino Mine Road
Vanadium, New Mexico 88023

Prepared by

Telesto Solutions, Inc.
750 14th Street SW
Loveland, CO 80537

March 2022

TELESTO
SOLUTIONS • INCORPORATED

Signature Page

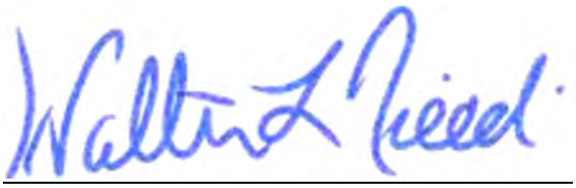
Earthwork Cost Estimate Summary Report

North Lampbright Leach Stockpile Closeout/Closure Plan

March 2022

Report Authors and Contributors

Telesto Solutions, Inc.



Walter L. Niccoli, PE

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1.0 INTRODUCTION

The New Mexico Environmental Department, Groundwater Bureau (NMED) and the New Mexico Energy, Minerals and Natural Resources Department, Mining and Minerals Division (MMD; collectively the Agencies) regulations require posting financial assurance (FA) to cover facility closure and reclamation costs (New Mexico Administrative Code NMAC 20.6.7.29 and NMAC 19.10.12, respectively). Freeport-McMoRan Chino Mines Company (Chino) began the FA process by submitting a reclamation cost estimate (RCE) in 2016 for its North Lampbright Waste Rock Stockpile (Chino, 2016). The RCE totaled $4,424,540. After reaching agreement with the Agencies on discount and inflation rates for a net present value (NPV) calculation, Chino posted FA in 2017 for $3,581,931 (Chino, 2017).

Since 2017, the need arose to expand leaching operations at the Chino Mine. Thus, in 2021, Chino applied to the NMED to modify and renew Discharge Permit 376 (DP-376) that includes changing the use of the North Lampbright Waste Rock Stockpile to a leached stockpile (i.e., North Lampbright Leach Stockpile). The application describes Chino plans to maintain the same stockpile footprint, and the same closure/closeout plan (CCP), with only the topography of the stockpile changing to accommodate leaching operations. Chino plans no expansion of the volume of leaching fluids or increased capacity of the solvent extraction/electro-winning (SX/EW) plant from this change. Thus, Chino proposed no changes to GR009RE 18-1 and the requirements of Section 9 E are still applicable.

1.1 Purpose

Chino submitted and the agencies accepted the 2018 CCP and associated RCE and FA, through two permitting mechanisms (DP-1340 and GR009RE 18-1). The Agencies hold FA for the North Lampbright Waste Rock Stockpile in a separate surety bond, with the plan to roll it into the next site-wide CCP. Thus, this report documents the RCE and resulting FA due to the proposed change from waste rock to leaching at the North Lampbright stockpile to ensure that the Agencies currently hold enough FA until the North Lampbright Leach Stockpile is incorporated into the next site-wide CCP/RCE.

1.2 RCE Overview

Telesto based the earthwork RCE upon the life-of-mine configuration for the North Lampbright Leach Stockpile as planned by Chino, provided in Appendix A. Activities considered for the RCE include:

- Rough grading the stockpile to achieve required reclamation slopes
- Hauling and placing cover
- Installing necessary stormwater controls including bench channels and down drains
- Vegetating
- Ongoing operations and maintenance including replacement of liner for the "New Frog pond"

The primary closure criteria upon which the RCE is based includes:

- An overall outslope gradient of 3.5H:1V with inter-bench slope lengths of 200 ft and 3H:1V interbench slopes
- Slopes ensure positive drainage
- Bench and other channels include a 5-foot base width and 3:1 (inner) and 2.5:1 (outer) side slopes, 2.0% maximum cross-bench slope, and 2.0% longitudinal bench slope
- Down drains utilize ACBs and dissipators
- Three feet of cover over the entire stockpile
- Haul roads are ripped and revegetated in place

The remainder of this report provides details specific to the earthwork RCE. The costing approach, assumptions, and indirect cost percentages are consistent with agreements reached with the Agencies in the recent past.

2.0 DATA AND ASSUMPTIONS

Life of mine configuration and reclamation grading provided by Chino is the foundational data for the RCE. Chino also provided the reclamation quantities and engineering takeoffs utilizing their internal mine-development software. Telesto verified these quantities through spot checks and provides the summary in Appendix B. Equipment rates and direct quotes are provided Appendix C and Appendix D.

2.1 Earthwork Processes and Equipment

Data and assumptions used in the RCE for earthwork processes and equipment include the following:

- Dozer push distance are calculated as the distance from the centroid of the cut block to the centroid of the fill block
- Cover placement assumes Komatsu 730E dump truck loaded Hitachi EX3600-5 hydraulic shovel with dozer assist (D11), a water truck, and motor grader perform cover loading and distribution. The economic optimum number of trucks per loader or hydraulic shovel is used for each haul route
- Haul distances assume a preferred route originating at the approximate centroid of the source and terminating at the approximate centroid of the reclamation area. Each haul route uses a maximum of three segments
- Rubio Peak is assumed as the cover borrow source
- A water truck and a motor grader are included as part of the fleet during reclamation (Table 2). The water truck and grader task time are assumed equal to loader or hydraulic shovel task time
- All labor rates are NMDOL Type H (Heavy Engineering) rates. These rates include the base, fringe benefit, and apprenticeship contribution rates
- EquipmentWatch Custom Cost Evaluator monthly rental rates for equipment unit operating costs
- 50 minutes of work per hour
- The revegetation based upon R.S. Means, EquipmentWatch, and direct quotes. Final surface scarification is a part of revegetation
- Equipment Production Factors as reported in Table 1
- Unit fuel price is based upon correlation between historical quotes and public data
- Labor and Equipment Unit Costs Table 2
- A one-time liner replacement in year 50 and demolition in year 100 for the new Frog Pond

2.2 Reclamation Timeframe

This earthwork cost estimate assumes that earthwork occurs relatively evenly (in terms of dollars spent) over a 4-year period (including 1 year of pre-construction work and 1 year of post-construction work). Revegetation monitoring concludes 12 years after year 1 of reclamation. Facility monitoring and O&M end 100 years after reclamation completion and assumes that because North Lampbright Leach Stockpile is small and attached to the Lampbright Leach Stockpile facility, that operation and maintenance are included in the

Chino Site-wide CCP, except for the "New Frog Pond." We assume a 50-year life of liner for the New Frog Pond installed as part of the North Lampbright Leach Stockpile, and that closure planning utilizes the New Frog Pond for water treatment for 100-years.

2.3 Indirect Costs

The RCE includes indirect costs for reclamation capital, operations, and maintenance and includes costs for:

- Mobilization and demobilization
- Contingencies
- Engineering redesign fees
- Contractor profit and overhead,
- Project management fees
- State Procurement Cost

As agreed, indirect costs are as follows:

- Capital indirect costs are 30% of the capital direct costs.
- Operations and maintenance indirect costs are 17.5% of the estimated long-term operation and maintenance costs

Table 1 Equipment Production Factors

Parameter	Value	Comment/Reference
Swell Factor[1]	0% for native rock and compacted fill 8% for cover load & haul sites	Regraded material and compacted fill has no swell factor. Cover material volumes are calculated based on the reclaimed area and the cover depth. A swell factor is included in the cost estimate while calculating the bank cover volume.
Coarse Regrading Tops and Outslopes (D11T CD)		
Operator Factor [1]	1.0	Due to large job size assume operator with excellent skills (CPH 48: 19-55, excellent)
Material Factor	1.2 1.0	(CPH 48: 19-55) 1.2 for fine grading cover, other surfaces, and channel, 1.0 for coarse regrading stockpiles and tailing
Work Hour (min/hr)	50	(CPH 48: 19-55) Job efficiency
Grade Factor - Outslopes[1]	1.6	(CPH 48: 19-55) 3H:1V Slopes
Material Weight (lb/cy)	3,600	Stockpiles & Cover Materials
Production Method/Blade Factor	1.2	(CPH 48: 19-55) Slot dozing
Visibility Factor	1.0	(CPH 48: 19-55) Clear, dust controlled by water trucks
Elevation Factor	1.0	(CPH 48: 30-7) Horsepower reduction table
Direct Drive Transmission	1.0	-
Fine Grading Cover, Other Surfaces, and Channels (D11T CD, D9T, D6T, 16M, 14M)		
Material Factor	1.2	(CPH 48: 19-55) fine grading cover
Grade Factor	1.0	(CPH 48: 19-55) 1-5% slopes
Grade Factor – Outslopes[1]	1.6	(CPH 48: 19-55) 3H:1V Slopes
Material Weight (lb/cy)	3,600	Fine grading cover material
Production Method/Blade	1.2 1.0	(CPH 48: 19-55, slot dozing) No correction applied channels, downdrains, and benches
Effective Blade Width (feet [ft])	22.0 ft D11T CD 14.08 ft D9T Semi Universal Blade 16 ft 16M, 14 ft 14M 10.67' D6T SU	(CPH 48: 19-17, 19-49) (CPH 48: 19-47) (CPH 48: 11-17) (CPH 48: 19-10, 19-43)
Speed (miles/hr)	2.5 mph D11T CD, 16M, and 14M	(CPH 48: 11-19, 19-24, 19-25) maximum equipment speeds based on information provided in the Cat

Parameter	Value	Comment/Reference
	1.0 mph D9T and D6T	Handbook and Safe mining practices
Operator Factor[1]	0.75	(CPH 48: 19-55) Average operator skill
Work Hour (min/hr)	50	(CPH 48: 19-55) Job efficiency
Visibility Factor	1.0	(CPH 48: 19-55) Clear, dust controlled by water trucks
Elevation	1.0	(CPH 48: 30-7)
Direct Drive Transmission	1.0	-
Ripper (D11T CD Multi-shank [w/MSR-359H])		
Ripping Length (ft)	1,000	-
Penetration (in)	18	-
Pocket Spacing (in)	59	(CPH 48: 19-72)
Number of Pockets	3	(CPH 48: 19-72)
Turn Time (min/pass)	0.25	(CPH 48: 19-72 to 19-75)
Speed (mph)	1	(CPH 48: 19-72 to 19-75)
Work Hour (min/hr)	50	(CPH 48: 19-55) Job efficiency
Distance between passes (in)	59	Maintain pocket spacing value between passes
Loader (992K)		
Heaped Capacity (cy)	16.0	(CPH 48: 23-223, 23-365)
Loader Cycle Time (load, dump, and maneuver; min)	0.65	(CPH 48: 23-287)
Bucket Fill Factor	0.875	(CPH 48: 23-287) $\geq$ 1" Loose Material
Speed (mph)	7.6 12.8	(CPH 48: 23-18) 7.6 mph loaded, forward 2nd gear; 12.8 mph empty, forward 3rd gear
Work Hour (min/hr)	50	(CPH 48: 19-55)
Loaders (988H, 980H)		
Heaped Capacity (cy)	8.3 (988H) 7.5 (980H)	(CPH 41: 19-75) (CPH 48: 23-213, 23-214)
Loader Cycle Time (load, dump, and maneuver; min)	0.575 (988H) 0.525 (980H)	(CPH 44: 23-223) (CPH 48: 23-287)
Bucket Fill Factor	0.875	(CPH 48: 23-287) $\geq$ 1" Loose Material
Speed (mph)	7.3 12.9	(CPH 41: 12-7 [988H], 48:23-17 [980H]) 7.3 mph loaded, forward 2nd gear; 12.9 mph empty, forward 3rd gear
Work Hour (min/hr)	50	(CPH 48: 19-55)
Loader (966H)		
Heaped Capacity (cy)	5.5	(CPH 48: 23-209, 23-210)
Loader Cycle Time (load, dump, and maneuver; min)	0.525	(CPH 48: 23-287)
Bucket Fill Factor	0.875	(CPH 48: 23-287) $\geq$ 1" Loose Material
Speed (mph)	7.8 13.7	(CPH 48: 23-16) 7.8 mph loaded, forward 2nd gear; 13.7 mph empty, forward 3rd gear
Work Hour (min/hr)	50	(CPH 48: 19-55)
Shovel (Hitachi EX3600-5/CAT 5230B FS)[2]		

Parameter	Value	Comment/Reference
Heaped Bucket Capacity (cy)	27.4	EquipmentWatch Spec for Hitachi EX3600-5
Loader Cycle Time (min)	0.45	(CPH 35: 4-236)
Bucket Fill Factor	1.025	(CPH 48: 30-2) assuming rock dirt mixture factor range from 1.00 to 1.05
Work Hour (min/hr)	50	(CPH 48: 19-55) Job efficiency
Trucks (CAT 789D/Komatsu 730E)[3]		
Struck Capacity (cy)	101	EquipmentWatch Spec for Komatsu 730E
Heaped Capacity (cy)	145	EquipmentWatch Spec for Komatsu 730E
Rolling Resistance	2.5%	(CPH 48: 30-2) Radial tires, dirt road maintained fairly regularly, watered, flexing slightly
Truck Exchange Time (min)	0.7	(CPH 48: 10-20) Avg. 0.6-0.8
Dump/Maneuver Time (min)	1.1	(CPH 48: 10-20) Avg. 1.0-1.2
Speed (mph)	35.5	(CPH 48: 10-14) top speed (loaded)
Work Hour (min/hr)	50	(CPH 48: 19-55) Job efficiency
Trucks (CAT 769D)		
Struck Capacity (cy)	22.2	(CPH 29: 9-2) Capacity assumed for bench channel materials
Heaped Capacity (cy)	31.7	(CPH 29: 9-2) Capacity assumed for bench channel materials
Rolling Resistance	2.5%	(CPH 48: 30-2) Radial tires, dirt road maintained fairly regularly, watered, flexing slightly
Truck Exchange Time (min)	0.7	(CPH 48: 10-20) Avg. 0.6-0.8
Dump/Maneuver Time (min)	1.1	(CPH 48: 10-20) Avg. 1.0-1.2
Speed (mph)	47	(CPH 29: 9-2) top speed (loaded)
Work Hour (min/hr)	50	(CPH 48: 19-55) Job efficiency
Trucks (CAT 725)		
Struck Capacity (cy)	14.5	EquipmentWatch spec
Heaped Capacity (cy)	19.0	EquipmentWatch spec
Rolling Resistance	2.5%	(CPH 48: 30-2) Radial tires, dirt road maintained fairly regularly, watered, flexing slightly
Truck Exchange Time (min)	0.7	(CPH 48: 10-20) Avg. 0.6-0.8
Dump/Maneuver Time (min)	1.1	(CPH 48: 10-20) Avg. 1.0-1.2
Speed (mph)	34	(CPH 48: 1-2) top speed (loaded)
Work Hour (min/hr)	50	(CPH 48: 19-55) Job efficiency
Scraper (657G) Push-Pull		
Heaped Capacity (cy)	44	(CPH 48: 24-4)

Parameter	Value	Comment/Reference
Struck Capacity (cy)	32	(CPH 48: 24-4)
Rated Load (lb)	104,000	(CPH 48: 24-4)
Rolling Resistance	2.5%	(CPH 48: 30-2) Radial tires, dirt road maintained fairly regularly, watered, flexing slightly
Load Time (min)	0.85	(CPH 48: 24-17) 0.6 to 1.1
Maneuver & Spread Time (min)	0.65	(CPH 48: 24-17) 0.6 to 0.7
Push Cycle Time (min)	0.10 Boost Time 1.19 return time (140% of scraper load time) 0.15 maneuver time	(CPH 48: 28-10)
Speed (mph)	33	(CPH 48: 24-4)
Work Hour (min/hr)	50	(CPH 48: 19-55) Job efficiency
Excavator (319D L)		
Work Hour (min/hr)	50	(CPH 48: 19-55) Job efficiency
Heaped Capacity (cy)	1	EquipmentWatch spec
Sheepsfoot Roller Length (ft)	3	Estimated
Maximum Reach at Ground Level (in)	380	EquipmentWatch spec
Swing Time (Loaded) (min)	0.09	(CPH 48: 7-247)
Swing Time (Empty) (min)	0.07	(CPH 48: 7-247)
Deere 7430 (and Finn B260 Mulcher, MSR-189H Ripper)		
Operating Width (ft)	12	Assigned based on typical width of revegetation equipment/implements
Speed (mph)	3	Assigned as average speed of tractor pulling revegetation equipment/implements
Work Hour (min/hr)	50	Assigned for consistency with other earthwork operations

CPH = Caterpillar Performance Handbook (Multiple Editions)
(1) The swell and operator factors used are consistent with factors presented to MMD and NMED in meetings with Tyrone on June 11, 2012, November 2, 2012, and a letter to MMD and NMED from Tyrone dated September 5, 2012 (Freeport-McMoRan Copper & Gold, 2012). Furthermore, these were agreed to in discussions on Chino expansion projects.
(2) Performance information for the CAT 5230B FS is used for parameters unavailable for the Hitachi EX3600-5.
(3) Performance information for the CAT 789D is used for parameters unavailable for the Komatsu 730E.

Table 2 Labor and Equipment Unit Costs

Equipment Description	Type	Fuel Cost ($/hr)	Total Rental Cost (w/o fuel) ($/hr)	NMDOL Operator Group	NMDOL Labor Rates	Total Cost ($/hr)
Cat D11T CD	Dozer	$71.92	$233.66	Equip. Op. IV	$28.65	$334.24
Cat D9T, SU Blade	Dozer	$35.31	$203.92	Equip. Op. IV	$28.65	$267.89
Cat D6T, SU Blade	Dozer	$17.75	$64.33	Equip. Op. IV	$28.65	$110.73
Cat D6T XL, SU Blade	Dozer	$17.45	$86.02	Equip. Op. IV	$28.65	$132.12
Cat 319D L	Excavator	$6.59	$47.77	Equip. Op. VI	$28.95	$83.31
Cat 992K	Loader	$52.82	$231.84	Equip. Op. VII	$28.97	$313.62
Cat 988H	Loader	$24.74	$121.23	Equip. Op. VII	$28.97	$174.94
Cat 980H	Loader	$14.50	$85.07	Equip. Op. VII	$28.97	$128.54
Cat 966H	Loader	$10.46	$66.00	Equip. Op. VII	$28.97	$105.43
Cat 16M - Final Grading	Motor Grader	$25.75	$85.54	Equip. Op. VIII	$30.93	$142.21
Cat 16M - Rough Grading	Motor Grader	$25.75	$85.54	Equip. Op. VI	$28.95	$140.23
Cat 14M - Final Grading	Motor Grader	$22.47	$88.60	Equip. Op. VIII	$30.93	$141.99
Cat 14M - Rough Grading	Motor Grader	$22.47	$88.60	Equip. Op. VI	$28.95	$140.01
Finn B260	Mulcher	$11.19	$16.00	Truck Driver III	$24.57	$51.76
Cat D11T CD Multi-shank (w/MSR-359H)	Dozer w/Ripper	$71.92	$250.85	Equip. Op. IV	$28.65	$351.42
Ripper (MSR-189H)	Ripper	0	$6.78	-	-	$6.78
Cat 657G	Scraper	$131.03	$232.47	Equip. Op. IV	$28.65	$762.33
Hitachi EX3600-5	Shovel	$224.17	$509.18	Equip. Op. VII	$28.97	$762.33
Deere 7430	Tractor	$16.21	$27.63	Truck Driver III	$24.57	$68.40
Cat 769D	Truck	$22.52	$100.18	Truck Driver VII	$24.57	$147.27
Cat 725	Truck	$16.31	$74.29	Truck Driver VI	$24.57	$115.18
Komatsu 730E	Truck	$77.51	$221.35	Truck Driver VIII	$25.16	$324.02
Off-Hwy Water Truck,6,000-gal.	Water Truck	$30.49	$74.67	Truck Driver VIII	$25.16	$130.32
1 Deck Screening Plant (5X16, 48X60)	Screening Plant	$13.14	$74.61	Laborer I	$23.88	$111.63
3 Deck Screening Plant (5X16, 42X60)	Screening Plant	$13.14	$110.28	Laborer I	$23.88	$147.30

Table 3 Miscellaneous Unit Costs

Activity	Base Per Unit Cost	Fuel Per Unit Cost	Units	Source	Reference
Fuel	$2.71	$-	gal	-	Diesel fuel cost is estimated by correlating historical local quotes with public data, as agreed upon in November 2018 discussions with the agencies. Fuel cost includes direct and indirect costs at $2.71/gal, calculated 9/02/2021.
Revegetation	$852.45	$4.46	ac	Revegetation Unit Cost Sheet	See unit rates calculations - Cost is based on a calculated unit rate that includes tractor rental and maintenance, fuel, scarifying, discing, drill seeding, mulching, crimping, seed, and mulch.
Seed	$222.85	$0.00	ac	Quote	Rocky Mountain Reclamation, 4/2018, est. cost for seed at 8.9 PLS/ac, $210/ac. Escalated 2% 2018-2021= $222.85/ac
Mulch	$260.00	$0.00	ton	Quote	Rocky Mountain Reclamation, 4/2018, est. cost for hay mulch (nox. weed free, native), $245/ton). Escalated 2% 2018-2021= $260.00/ton
Bench Grading Stockpile	$1.60	$0.42	ft	Bench Grading Unit Cost Sheet	See unit rates calculations
Down Drain Construction	$392.04	$-	ft	Down Drain Unit Cost Sheet	See unit rates calculations
Down Drain Dissipater	$15,106.89	$0.00	ea	Down Drain Unit Cost Sheet	See unit rates calculations
Channel Construction w/ Riprap	$7.04	$1.25	ft	Channel Unit Cost Sheet	See unit rates calculations
Channel Construction w/o Riprap	$0.48	$0.13	ft	Channel Unit Cost Sheet	See unit rates calculations
Erosion Control	$2,919.12	$344.71	day	Modified Crew B-13A	Erosion control for O&M - includes 1 foreman, 2 laborers, 1 equipment operator, 2 truck drivers, 1 loader (4 cy), 2 dump trucks (8 cy)
Disc harrow attachment, for tractor	$670.65	$-	month	Means Line Item 015433.20 1500	Equipment rental costs
Cast-In-Place Concrete	$262.58	$-	cy	Means Line Item 033053.40 6200	Structural concrete, in place, gravity retaining wall (3000 psi), includes forms and reinforcement
Road Maintenance	$877.44	$224.36	month		Road maintenance for O&M - includes one 14M motor grader and one 6,000-gal water truck
Berming	$0.36	$-	ft	See Berm Unit Cost Sheet	See unit rates calculations
Chain Link Fencing	$24.65	$-	ft	Means Line Item 323113.20 0800	Fence, chain link industrial, galvanized steel, 6 ga. wire, 2" posts @ 10' OC, 6' high, includes excavation, & concrete, excludes barbed wire
Vehicle Gates, Pit Perimeters	$957.01	$-	ea	Means Line Item 323113.20 5070	Fence, chain link industrial, double swing gates, 6' high, 20' opening, includes excavation, posts & hardware in concrete
Signs every 500 ft., pit perimeters	$73.63	$-	ea	Means Line Item 101453.20 0600	Signs, guide and directional signs, reflectorized, 12" x 18", excludes posts
Culvert Removal	$12.46	$-	ft	Means Line Item 024113.40 0190	Selective demolition, metal drainage piping, CMP, steel, 48"-60", diameter, excludes excavation
Grade Control Wall	$170.79	$-	cy	Means Line Item 033053.40 3945	Structural concrete, in place, continuous strip footing (3000 psi), 36" wide x 12" deep, unreinforced, includes forms(4 uses), concrete (Portland cement Type I), placing and finishing, excludes reinforcing
Earth Fill Removal (dozer excavate, haul, spread)	$5.20	$-	cy	Means Line Item 312316.46 6070	Excavating, bulk, dozer, open site, bank measure, common earth, 700 HP dozer, 300' haul
Electric Rate	$0.06	$-	kWh	-	Industrial rate data 9/27/2021 (http://www.electricitylocal.com/states/new-mexico/silver-city/)
Shade Covers	$8.25	$-	sf	-	Unit rate from published project (https://www.nationalgeographic.com/science/article/150812-shade-balls-los-angeles-California-drought-water-environment)
Pond Re-Lining with 60 mil HDPE	$2.21		sf	Means Line Item 310519.53 1200	

3.0 CALCULATIONS

3.1 Earthworks

Appendix D (RCE costing spreadsheet) quantifies the RCE while Appendix E describes specific supporting calculations. The costing approach is straightforward based upon the quantities and unit costs. Step by step, the RCE process:

1. Projects the effort required to perform each of the various reclamation activities (i.e., material quantities, distances, slopes, equipment choices, work type)
2. Incorporates construction industry equipment information, labor and fuel costs, to estimate the unit cost of each reclamation activity
3. Multiplies the corresponding quantities by the unit costs to calculate the sub-total cost for each reclamation activity which are summed into a total
4. Adds indirect costs as a percentage of the direct costs to complete the cost estimate

The cost estimating process follows the typical, standard approach used in the engineering and construction industries as summarized in Figure 1. Additionally, the RCE spreadsheet incorporates optimization routines that calculate the most efficient truck/loader/scraper combinations.

3.2 Net Present Value

The RCE costing approach provides a total cost estimate as if the expense were to happen immediately and instantaneously. Because that is not realistic, an NPV calculation accounts for the likely construction timing and spending schedule to set the FA. Chino and the Agencies typically negotiate the escalation rate (i.e., inflation) and discount (i.e., return on investment) rates when calculating the FA. For comparison purposes, this report uses the latest agreed upon escalation and discount rates:

- Escalation:
  - Years 1 through 10 – 2.24% per annum
  - Years 11 through 100 2.54% per annum
- Discount:
  - Years 1 through 10 – 2.24% per annum
  - Years 11 through 100 2.54% per annum

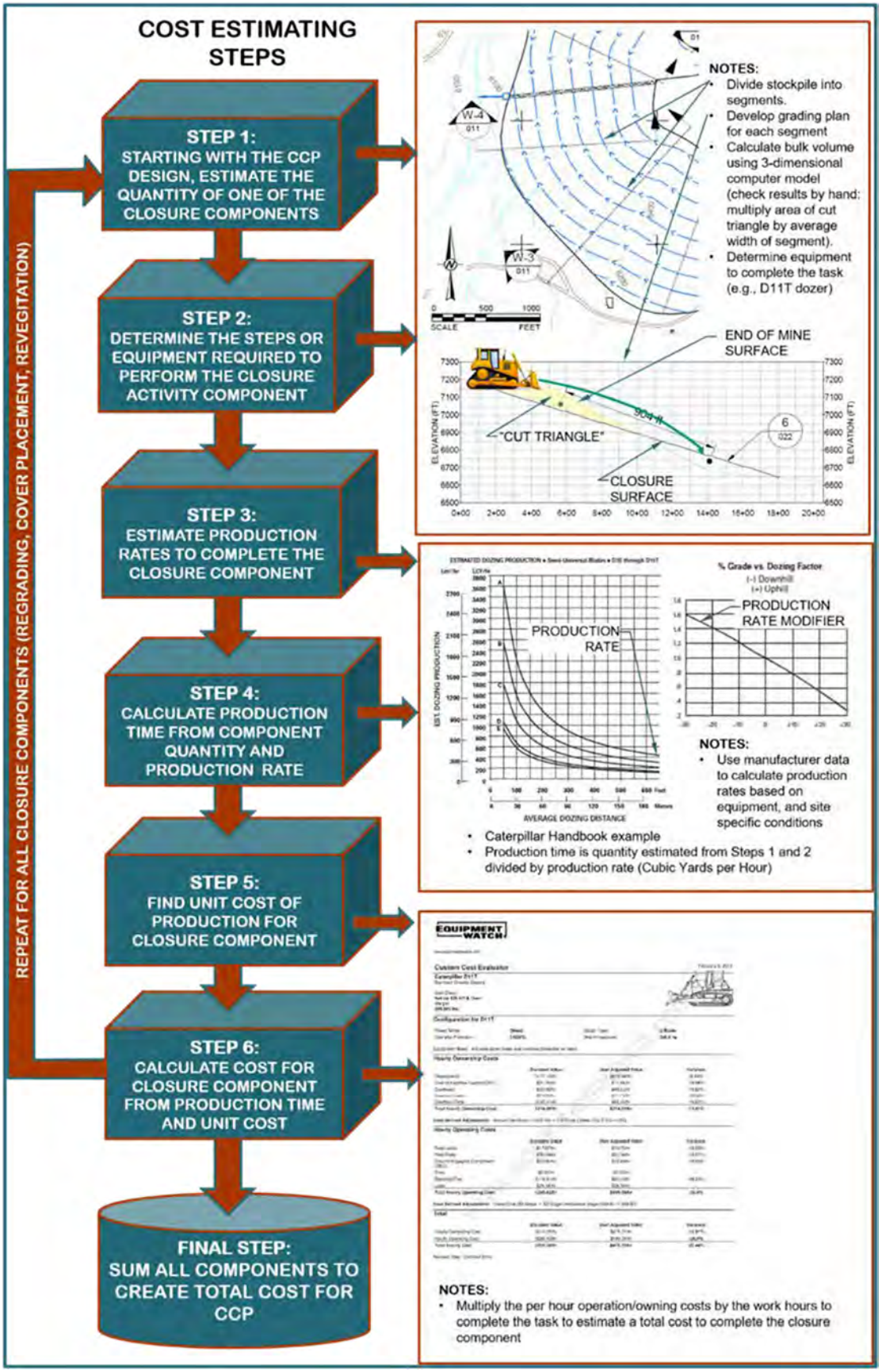


Figure 1 Earthwork Cost Estimating Process

The NPV for each year is calculated from:

$$NNNNNN = \left(\frac{(1 + i_{ee})}{(1 + ii_{dd})}\right)^{tt}$$

Where:

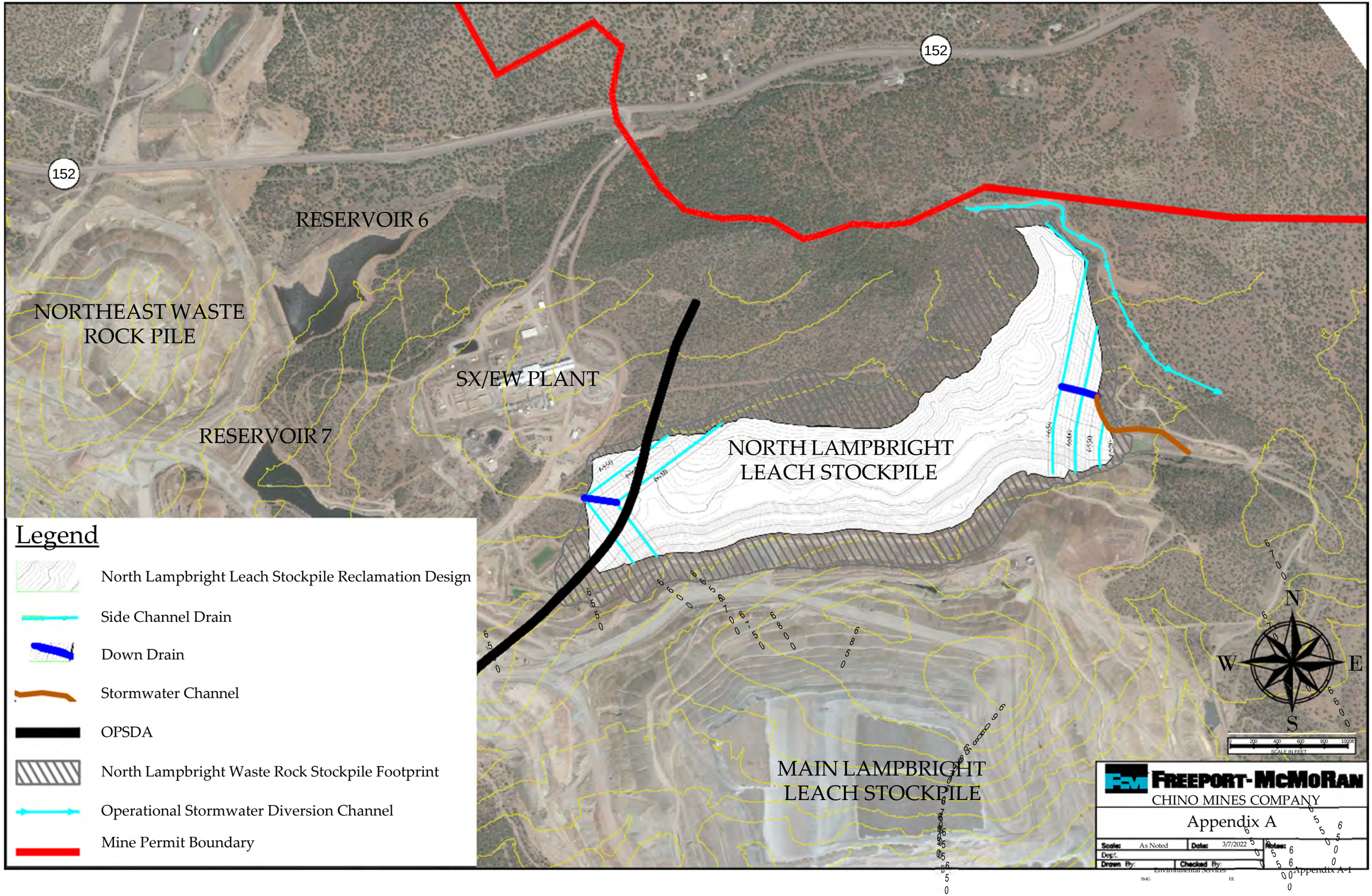
- i_e = escalation rate
- i_d = discount rate
- t = elapsed time

4.0 RESULTS AND DISCUSSION

The earthwork RCE for the North Lampbright Leach Stockpile CCP is $2,496,965 and the NPV is $2,331,014. The currently held FA for the North Lampbright Waste Rock Stockpile is based up on an RCE of $4,424,540 and a resulting NPV of $3,581,931. Thus, the reclamation costs and NPV are both lower than that currently held in FA. The decrease in RCE is mostly due to the construction layout of the leach stockpile, and the 5-year timeframe. This RCE is an adequate placeholder until the North Lampbright Leach Stockpile is included in the site-wide Chino CCP/RCE coming due in the near future.

Appendix A

Reclamation Plan – North Lampbright Leach Stockpile by Freeport-McMoRan Chino Mines Company


152
152
RESERVOIR 6
NORTHEAST WASTE
ROCK PILE
SX/EW PLANT
RESERVOIR 7
NORTH LAMPBRIGHT
LEACH STOCKPILE
MAIN LAMPBRIGHT
LEACH STOCKPILE
Legend
North Lampbright Leach Stockpile Reclamation Design
Side Channel Drain
Down Drain
Stormwater Channel
OPSDA
North Lampbright Waste Rock Stockpile Footprint
Operational Stormwater Diversion Channel
Mine Permit Boundary
N
W
E
S
SCALE IN FEET
FREEPORT-McMoRAN
CHINO MINES COMPANY
Appendix A
Scale: As Noted
Date: 3/7/2022
Dept.
Drawn By:
Checked By:
Notes:
Environmental Services
SMG
EE

Appendix B
Engineering Take-offs/Quantities

1	2	3	4	5	6	7	8	11	12	13	14	Segment 1 15	Segment 1 16	Segment 2 17	Segment 2 18	Segment 3 19	Segment 3 20
Item	Facility	Sub Area or Destination for Cover Material	Description	Area (sf)	Volume (cy)	Push Distance 1ft)	Coarse Regrading and Fine Grading (o/G)	Down Drains 1ft)	Downdrain Dissipater I••)	Channels 1ft)	Bench Grading 1ft)	Distance 1ft)	Average Grade 1%)	Distance 1ft)	Average Grade 1%)	Distance 1ft)	Average Grade 1'4)
							-1.0%										
				3,[illegible]	3[illegible]		-28.6%	287	1	3,267	3,267						
					[illegible]		-28.6%	329	1	5,038	5,038						
1002	North lampbright Leach Stockpile - West Outslope	NLLS-2	Outslopes		193,094	180	10.0%										
1003	North Lampbright Leach Etockpilc - Eaat Oublopc		Oublopc.a	627,[illegible]	202,436	180											
1004	North lampbrght Leach Stockpile - Haul Road	NLLS-4	Haul Road to top	57,392		45		-	-	-	-						
1100	New frog Pond	NIP-1	New frog Pond	30,144													
5000	Rubio Peak		1001 Cover Material	3,935,433								3,919	6.5%	4,935	1.6%	2,880	7.7%
5001	Rubio Peak		1002 Cover Material	601,997								3,919	6.5%		1.6%	2,880	7.7%
5002	Rubio Peak		1003 Cover Material	627,999								3,919	6.5%	4,935	1.6%	2,880	7.7%

Page 1

1	2	3	4	21	22	23	24	25	26	27
Item	Facility	Sub Area or Destination for Cover Material	Description	Cover Depth (In)	Swell Factor (%)	Material Factor for Coarse Regrading	Material Factor for Fine Grading Cover	Material Weight for Coarse Regrading (lb/cy)	Material Weight for Fine Grading Cover (lb/cy)	Ripping Length (ft)
1000	North Lampbright Leach Stockpile	NLLS-0	Entire Stockpile	36.0	0%	1.0	1.2	3,600	3,600	
1001	North Lampbright Leach Stockpile-top	NLLS-1	Top of Stockpile	36.0	0%	1.0	1.2	3,600	3,600	816
1002	North Lampbright Leach Stockpile - West Outslope	NLLS-2	Outslopes	36.0	0%	1.0	1.2	3,600	3,600	90
1003	North Lampbright Leach Stockpile - East Outslope	NLLS-3	Outslopes	36.0	0%	1.0	1.2	3,600	3,600	90
1004	North Lampbright Leach Stockpile - Haul Road	NLLS-4	Haul Road to top	36.0	0%	1.0	1.2	3,600	3,600	45
1100	New Frog Pond	NFP-1	New Frog Pond							
5000	Rubio Peak		1001 Cover Material	36.0	8%	1.0	1.2	2,900	2,900	1,000
5001	Rubio Peak		1002 Cover Material	36.0	8%	1.0	1.2	2,900	2,900	1,000
5002	Rubio Peak		1003 Cover Material	36.0	8%	1.0	1.2	2,900	2,900	1,000

Appendix C
Supporting Data for Cost Estimation

Attachment C.1
2021 Labor Rates (NMDOL)

Labor Rates

NMDOL Type A Operator Group	Base rate	Fringe rate	Apprenticeship	Total 2021 Rate ($/hr)
Equipment Operator IV	21.51	6.54	0.6	$ 28.65
Equipment Operator V	21.63	6.54	0.6	$ 28.77
Equipment Operator VI	21.81	6.54	0.6	$ 28.95
Equipment Operator VII	21.83	6.54	0.6	$ 28.97
Equipment Operator VIII	23.79	6.54	0.6	$ 30.93
Laborer I	17.06	6.22	0.6	$ 23.88
Laborer II	17.81	6.22	0.6	$ 24.63
Truck Driver III	17.72	6.25	0.60	$ 24.57
Truck Driver V	17.80	6.25	0.60	$ 24.65
Truck Driver VIII	18.31	6.25	0.60	$ 25.16

Labor rates based on NM Department of Labor Type H (Heavy Engineering) 2021 labor rates. Rates include
https://www.dws.state.nm.us/Portals/0/DM/LaborRelations/Prevailing_Wage_Poster_H_2021.pdf

Attachment C.2
EquipmentWatch Data

EquipmentWatch

www.equipmentwatch.com

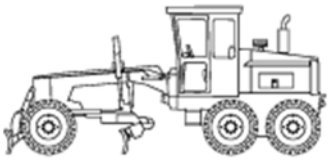
All prices shown in US dollars ($)

AED Green Book®

October 5, 2021

Caterpillar 14M (disc. 2015)
Articulated Frame Graders

Size Class:
250 HP & Over
Weight:
46796 lbs



Configuration for 14M (disc. 2015)

Moldboard Size	**14.0 ft**	Operator Protection	**EROPS**
Power Mode	**Diesel**		

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $15,082.00	USD $5,050.00	USD $1,701.00
Adjustments			
Region (New Mexico: 81%)	(USD $2,848.54)	(USD $953.80)	(USD $321.27)
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $12,233.46**	**USD $4,096.20**	**USD $1,379.73**

Date Last Updated: Jun 01, 2021

The equipment represented in this report has been exclusively prepared for MANDY LILLA (mlilla@fmi.com)

www.equipmentwatch.com

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EquipmentWatch

www.equipmentwatch.com

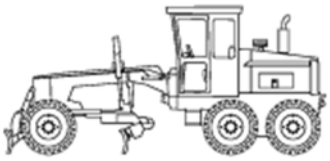
All prices shown in US dollars ($)

Custom Cost Evaluator

October 5, 2021

Caterpillar 14M (disc. 2015)
Articulated Frame Graders

Size Class:
250 HP & Over
Weight:
46796 lbs



Configuration for 14M (disc. 2015)

Moldboard Size	**14.0 ft**	Operator Protection	**EROPS**
Power Mode	**Diesel**		

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $43.90/hr	USD $41.10/hr	-6.4%
Cost of Facilities Capital (CFC)	USD $3.53/hr	USD $2.02/hr	-42.7%
Overhead	USD $19.93/hr	USD $10.93/hr	-45.2%
Overhaul Labor	USD $12.06/hr	USD $2.49/hr	-79.3%
Overhaul Parts	USD $24.44/hr	USD $13.40/hr	-45.2%
Total Hourly Ownership Cost:	**USD $103.86/hr**	**USD $69.94/hr**	**-32.7%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (942hrs -> 1,718hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $10.05/hr	USD $2.08/hr	-79.3%
Field Parts	USD $23.70/hr	USD $3.25/hr	-86.3%
Ground Engaging Component (GEC)	USD $1.97/hr	USD $0.00/hr	-100%
Tire	USD $7.26/hr	-	-
Electrical/Fuel	USD $27.95/hr	USD $8.29/hr	-70.3%
Lube	USD $6.50/hr	-	-
Total Operating Ownership Cost:	**USD $77.44/hr**	**USD $27.38/hr**	**-64.6%**

User Defined Adjustments: Fuel (USD $3.37 -> USD $1.00) Annual Ground Engaging Component (USD $1,860.38 -> USD $0.00) Mechanics Wage (USD $63.11 -> USD $23.80) Annual Misc Supply Parts (USD $3,720.75 -> USD $0.00) Annual Field Repair Parts Cost (USD $18,603.77 -> USD $5,581.14)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $103.86/hr	USD $69.94/hr	-32.7%
Hourly Operating Costs	USD $77.44/hr	USD $27.38/hr	-64.6%
Total Hourly Cost	**USD $181.29**	**USD $97.32/hr**	**-46.3%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $67.36/hr	USD $54.05/hr	-19.8%
Idle	USD $131.81/hr	USD $78.23/hr	-40.6%

Revised Date: 4th quarter 2021

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www.equipmentwatch.com

EquipmentWatch

www.equipmentwatch.com

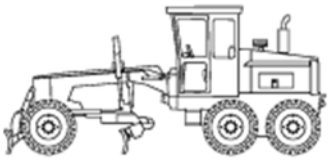
All prices shown in US dollars ($)

AED Green Book®

October 5, 2021

Caterpillar 16M (disc. 2015)
Articulated Frame Graders

Size Class:
250 HP & Over
Weight:
59435 lbs



Configuration for 16M (disc. 2015)

Moldboard Size	**16.0 ft**	Operator Protection	**EROPS**
Power Mode	**Diesel**		

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $15,082.00	USD $5,050.00	USD $1,701.00
Adjustments			
Region (New Mexico: 81%)	(USD $2,848.54)	(USD $953.80)	(USD $321.27)
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $12,233.46**	**USD $4,096.20**	**USD $1,379.73**

Date Last Updated: Jun 01, 2021

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EquipmentWatch

www.equipmentwatch.com

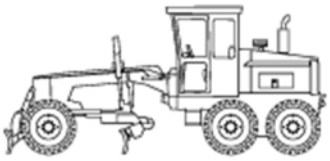
All prices shown in US dollars ($)

Custom Cost Evaluator

October 5, 2021

Caterpillar 16M (disc. 2015)
Articulated Frame Graders

Size Class:
250 HP & Over
Weight:
59435 lbs



Configuration for 16M (disc. 2015)

Moldboard Size	**16.0 ft**	Operator Protection	**EROPS**
Power Mode	**Diesel**		

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $33.17/hr	USD $31.05/hr	-6.4%
Cost of Facilities Capital (CFC)	USD $2.67/hr	USD $1.53/hr	-42.7%
Overhead	USD $15.07/hr	USD $8.26/hr	-45.2%
Overhaul Labor	USD $12.06/hr	USD $2.50/hr	-79.3%
Overhaul Parts	USD $18.46/hr	USD $10.12/hr	-45.2%
Total Hourly Ownership Cost:	**USD $81.43/hr**	**USD $53.47/hr**	**-34.3%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (942hrs -> 1,718hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $10.05/hr	USD $2.08/hr	-79.3%
Field Parts	USD $17.90/hr	USD $2.45/hr	-86.3%
Ground Engaging Component (GEC)	USD $1.49/hr	USD $0.00/hr	-100%
Tire	USD $5.49/hr	-	-
Electrical/Fuel	USD $32.05/hr	USD $9.50/hr	-70.3%
Lube	USD $6.01/hr	-	-
Total Operating Ownership Cost:	**USD $72.99/hr**	**USD $25.54/hr**	**-65%**

User Defined Adjustments: Fuel (USD $3.37 -> USD $1.00) Annual Ground Engaging Component (USD $1,405.54 -> USD $0.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $2,811.07 -> USD $0.00) Annual Field Repair Parts Cost (USD $14,055.36 -> USD $4,216.61)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $81.43/hr	USD $53.47/hr	-34.3%
Hourly Operating Costs	USD $72.99/hr	USD $25.54/hr	-65%
Total Hourly Cost	**USD $154.41**	**USD $79.00/hr**	**-48.8%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $50.91/hr	USD $40.84/hr	-19.8%
Idle	USD $113.48/hr	USD $62.97/hr	-44.5%

Revised Date: 4th quarter 2021

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EquipmentWatch

www.equipmentwatch.com

All prices shown in US dollars ($)

AED Green Book®

October 5, 2021

Caterpillar 319D L (disc. 2012)
Crawler Mounted Hydraulic Excavators

Size Class:
19.1 - 21.0 MTons
Weight:
43872 lbs

Configuration for 319D L (disc. 2012)

Operating Weight	**19.9 mt**	Power Mode	**Diesel**

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $6,704.00	USD $2,768.00	USD $985.00
Adjustments			
Region (New Mexico: 101%)	USD $83.00	USD $34.27	USD $12.20
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $6,787.00**	**USD $2,802.27**	**USD $997.20**

Date Last Updated: Jun 01, 2021

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EquipmentWatch

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All prices shown in US dollars ($)

Custom Cost Evaluator

October 5, 2021

Caterpillar 319D L (disc. 2012)
Crawler Mounted Hydraulic Excavators

Size Class:
19.1 - 21.0 MTons
Weight:
43872 lbs

Configuration for 319D L (disc. 2012)

Operating Weight **19.9 mt** Power Mode **Diesel**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $23.69/hr	USD $22.17/hr	-6.4%
Cost of Facilities Capital (CFC)	USD $1.65/hr	USD $0.83/hr	-49.7%
Overhead	USD $5.87/hr	USD $2.73/hr	-53.4%
Overhaul Labor	USD $22.02/hr	USD $3.88/hr	-82.4%
Overhaul Parts	USD $11.76/hr	USD $5.48/hr	-53.4%
Total Hourly Ownership Cost:	**USD $64.99/hr**	**USD $35.09/hr**	**-46%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (745hrs -> 1,599hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $26.68/hr	USD $4.70/hr	-82.4%
Field Parts	USD $12.01/hr	USD $2.01/hr	-83.2%
Ground Engaging Component (GEC)	USD $1.92/hr	USD $0.00/hr	-100%
Tire	USD $0.00/hr	-	-
Electrical/Fuel	USD $8.20/hr	USD $2.43/hr	-70.3%
Lube	USD $2.50/hr	-	-
Total Operating Ownership Cost:	**USD $51.33/hr**	**USD $11.66/hr**	**-77.3%**

User Defined Adjustments: Fuel (USD $3.37 -> USD $1.00) Annual Ground Engaging Component (USD $1,431.86 -> USD $0.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $1,789.83 -> USD $0.00) Annual Field Repair Parts Cost (USD $7,159.31 -> USD $3,221.69)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $64.99/hr	USD $35.09/hr	-46%
Hourly Operating Costs	USD $51.33/hr	USD $11.66/hr	-77.3%
Total Hourly Cost	**USD $116.32**	**USD $46.75/hr**	**-59.8%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $31.21/hr	USD $25.73/hr	-17.6%
Idle	USD $73.20/hr	USD $37.53/hr	-48.7%

Revised Date: 4th quarter 2021

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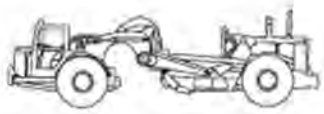
All prices shown in US dollars ($)

AED Green Book®

October 5, 2021

Caterpillar 637G (disc. 2010)
Dual Engine Conventional Scrapers

Size Class:
18CY & Over
Weight:
114744 lbs



Configuration for 637G (disc. 2010)

Operator Protection	**EROPS**	Power Mode	**Diesel**
Scraper Capacity	**24.0 - 34.0 cu yd**	Scraper Horsepower	**283.0**

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $27,250.00	USD $6,812.00	USD $1,362.00
Adjustments			
Region (New Mexico: 101%)	USD $346.56	USD $86.63	USD $17.32
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $27,596.56**	**USD $6,898.63**	**USD $1,379.32**

Date Last Updated: Jun 01, 2021

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All prices shown in US dollars ($)

Custom Cost Evaluator

October 5, 2021

Caterpillar 637G (disc. 2010)
Dual Engine Conventional Scrapers

Size Class:
18CY & Over
Weight:
114744 lbs

Configuration for 637G (disc. 2010)

Operator Protection	**EROPS**	Power Mode	**Diesel**
Scraper Capacity	**24.0 - 34.0 cu yd**	Scraper Horsepower	**283.0**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $105.74/hr	USD $99.56/hr	-5.8%
Cost of Facilities Capital (CFC)	USD $7.99/hr	USD $5.11/hr	-36.1%
Overhead	USD $28.87/hr	USD $17.76/hr	-38.5%
Overhaul Labor	USD $37.94/hr	USD $8.83/hr	-76.7%
Overhaul Parts	USD $74.87/hr	USD $46.04/hr	-38.5%
Total Hourly Ownership Cost:	**USD $255.42/hr**	**USD $177.30/hr**	**-30.6%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (998hrs -> 1,623hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $56.91/hr	USD $13.24/hr	-76.7%
Field Parts	USD $75.46/hr	USD $8.89/hr	-88.2%
Ground Engaging Component (GEC)	USD $3.21/hr	USD $0.00/hr	-100%
Tire	USD $8.35/hr	-	-
Electrical/Fuel	USD $134.23/hr	USD $39.81/hr	-70.3%
Lube	USD $25.40/hr	-	-
Total Operating Ownership Cost:	**USD $303.57/hr**	**USD $95.69/hr**	**-68.5%**

User Defined Adjustments: Fuel (USD $3.37 -> USD $1.00) Annual Ground Engaging Component (USD $3,204.63 -> USD $0.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $11,216.20 -> USD $0.00) Annual Field Repair Parts Cost (USD $64,092.57 -> USD $14,420.83)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $255.42/hr	USD $177.30/hr	-30.6%
Hourly Operating Costs	USD $303.57/hr	USD $95.69/hr	-68.5%
Total Hourly Cost	**USD $558.99**	**USD $272.98/hr**	**-51.2%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $142.60/hr	USD $122.43/hr	-14.1%
Idle	USD $389.65/hr	USD $217.10/hr	-44.3%

Revised Date: 4th quarter 2021

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EquipmentWatch

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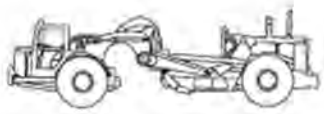
All prices shown in US dollars ($)

AED Green Book®

October 5, 2021

Caterpillar 657G
Dual Engine Conventional Scrapers

Size Class:
18CY & Over
Weight:
149417 lbs



Configuration for 657G

Operator Protection	**EROPS**	Power Mode	**Diesel**
Scraper Capacity	**32.0 - 44.0 cu yd**	Scraper Horsepower	**410.0**

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $27,250.00	USD $6,812.00	USD $1,362.00
Adjustments			
Region (New Mexico: 101%)	USD $346.56	USD $86.63	USD $17.32
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $27,596.56**	**USD $6,898.63**	**USD $1,379.32**

Date Last Updated: Jun 01, 2021

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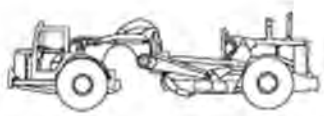
All prices shown in US dollars ($)

Custom Cost Evaluator

October 5, 2021

Caterpillar 657G
Dual Engine Conventional Scrapers

Size Class:
18CY & Over
Weight:
149417 lbs



Configuration for 657G

Operator Protection	**EROPS**	Power Mode	**Diesel**
Scraper Capacity	**32.0 - 44.0 cu yd**	Scraper Horsepower	**410.0**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $166.92/hr	USD $157.18/hr	-5.8%
Cost of Facilities Capital (CFC)	USD $12.61/hr	USD $8.06/hr	-36.1%
Overhead	USD $101.36/hr	USD $62.33/hr	-38.5%
Overhaul Labor	USD $37.94/hr	USD $8.83/hr	-76.7%
Overhaul Parts	USD $118.20/hr	USD $72.68/hr	-38.5%
Total Hourly Ownership Cost:	**USD $437.04/hr**	**USD $309.08/hr**	**-29.3%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (998hrs -> 1,623hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $56.91/hr	USD $13.24/hr	-76.7%
Field Parts	USD $119.12/hr	USD $14.03/hr	-88.2%
Ground Engaging Component (GEC)	USD $5.07/hr	USD $0.00/hr	-100%
Tire	USD $13.18/hr	-	-
Electrical/Fuel	USD $163.05/hr	USD $48.35/hr	-70.3%
Lube	USD $35.22/hr	-	-
Total Operating Ownership Cost:	**USD $392.55/hr**	**USD $124.02/hr**	**-68.4%**

User Defined Adjustments: Fuel (USD $3.37 -> USD $1.00) Annual Ground Engaging Component (USD $5,059.00 -> USD $0.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $17,706.51 -> USD $0.00) Annual Field Repair Parts Cost (USD $101,180.05 -> USD $22,765.51)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $437.04/hr	USD $309.08/hr	-29.3%
Hourly Operating Costs	USD $392.55/hr	USD $124.02/hr	-68.4%
Total Hourly Cost	**USD $829.59**	**USD $433.10/hr**	**-47.8%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $280.89/hr	USD $227.56/hr	-19%
Idle	USD $600.08/hr	USD $357.43/hr	-40.4%

Revised Date: 4th quarter 2021

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EquipmentWatch

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All prices shown in US dollars ($)

AED Green Book®

October 5, 2021

Caterpillar 725 (disc. 2014)
Articulated Rear Dumps

Size Class:
20 - 25 MTons
Weight:
49075 lbs

Configuration for 725 (disc. 2014)

Axle Configuration	**6 X 6**	Power Mode	**Diesel**
Rated Payload	**23.6 mt**		

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $9,023.00	USD $3,197.00	USD $1,122.00
Adjustments			
Region (New Mexico: 109%)	USD $798.52	USD $282.93	USD $99.30
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $9,821.52**	**USD $3,479.93**	**USD $1,221.30**

Date Last Updated: Jun 01, 2021

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EquipmentWatch

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All prices shown in US dollars ($)

Custom Cost Evaluator

October 5, 2021

Caterpillar 725 (disc. 2014)
Articulated Rear Dumps

Size Class:
20 - 25 MTons
Weight:
49075 lbs

Configuration for 725 (disc. 2014)

Axle Configuration	**6 X 6**	Power Mode	**Diesel**
Rated Payload	**23.6 mt**		

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $37.88/hr	USD $35.62/hr	-6%
Cost of Facilities Capital (CFC)	USD $2.33/hr	USD $1.23/hr	-47.3%
Overhead	USD $9.10/hr	USD $4.39/hr	-51.7%
Overhaul Labor	USD $24.53/hr	USD $4.48/hr	-81.7%
Overhaul Parts	USD $16.38/hr	USD $7.91/hr	-51.7%
Total Hourly Ownership Cost:	**USD $90.22/hr**	**USD $53.63/hr**	**-40.6%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (1,029hrs -> 2,131hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $19.01/hr	USD $3.47/hr	-81.7%
Field Parts	USD $10.27/hr	USD $0.83/hr	-92%
Ground Engaging Component (GEC)	USD $0.00/hr	-	-
Tire	USD $8.60/hr	-	-
Electrical/Fuel	USD $20.29/hr	USD $6.02/hr	-70.3%
Lube	USD $5.59/hr	-	-
Total Operating Ownership Cost:	**USD $63.75/hr**	**USD $24.50/hr**	**-61.6%**

User Defined Adjustments: Fuel (USD $3.37 -> USD $1.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $1,761 21 -> USD $0.00) Annual Field Repair Parts Cost (USD $8,806.07 -> USD $1,761.21)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $90.22/hr	USD $53.63/hr	-40.6%
Hourly Operating Costs	USD $63.75/hr	USD $24.50/hr	-61.6%
Total Hourly Cost	**USD $153.97**	**USD $78.13/hr**	**-49.3%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $49.31/hr	USD $41.24/hr	-16.4%
Idle	USD $110.51/hr	USD $59.64/hr	-46%

Revised Date: 4th quarter 2021

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All prices shown in US dollars ($)

AED Green Book®

October 5, 2021

Caterpillar 740 (disc. 2014)
Articulated Rear Dumps

Size Class:
35 MTons & Over
Weight:
72973 lbs

Configuration for 740 (disc. 2014)

Axle Configuration	**6 X 6**	Power Mode	**Diesel**
Rated Payload	**39.5 mt**		

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $16,177.00	USD $5,535.00	USD $1,867.00
Adjustments			
Region (New Mexico: 109%)	USD $1,431.64	USD $489.84	USD $165.23
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $17,608.63**	**USD $6,024.84**	**USD $2,032.23**

Date Last Updated: Jun 01, 2021

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Custom Cost Evaluator

October 5, 2021

Caterpillar 740 (disc. 2014)
Articulated Rear Dumps

Size Class:
35 MTons & Over
Weight:
72973 lbs

Configuration for 740 (disc. 2014)

Axle Configuration	**6 X 6**	Power Mode	**Diesel**
Rated Payload	**39.5 mt**		

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $42.84/hr	USD $40.30/hr	-5.9%
Cost of Facilities Capital (CFC)	USD $3.04/hr	USD $1.66/hr	-45.5%
Overhead	USD $11.38/hr	USD $5.79/hr	-49.1%
Overhaul Labor	USD $32.38/hr	USD $6.24/hr	-80.7%
Overhaul Parts	USD $18.04/hr	USD $9.18/hr	-49.1%
Total Hourly Ownership Cost:	**USD $107.68/hr**	**USD $63.17/hr**	**-41.3%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (1,072hrs -> 2,106hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $23.25/hr	USD $4.48/hr	-80.7%
Field Parts	USD $11.13/hr	USD $0.94/hr	-91.5%
Ground Engaging Component (GEC)	USD $0.00/hr	-	-
Tire	USD $10.64/hr	-	-
Electrical/Fuel	USD $27.23/hr	USD $8.07/hr	-70.3%
Lube	USD $7.63/hr	-	-
Total Operating Ownership Cost:	**USD $79.89/hr**	**USD $31.78/hr**	**-60.2%**

User Defined Adjustments: Fuel (USD $3.37 -> USD $1.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $1,989 41 -> USD $0.00) Annual Field Repair Parts Cost (USD $9,947.04 -> USD $1,989.41)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $107.68/hr	USD $63.17/hr	-41.3%
Hourly Operating Costs	USD $79.89/hr	USD $31.78/hr	-60.2%
Total Hourly Cost	**USD $187.58**	**USD $94.95/hr**	**-49.4%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $57.26/hr	USD $47.75/hr	-16.6%
Idle	USD $134.91/hr	USD $71.25/hr	-47.2%

Revised Date: 4th quarter 2021

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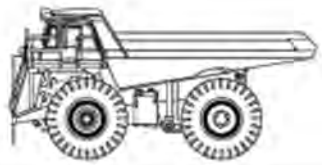
All prices shown in US dollars ($)

AED Green Book®

October 5, 2021

Caterpillar 769D (disc. 2007)
Mechanical Drive Rear Dumps

Size Class:
30 - 39 MTons
Weight:
66800 lbs



Configuration for 769D (disc. 2007)

Power Mode	**Diesel**	Rated Payload	**36.4 mt**

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $13,700.00	USD $4,600.00	USD $1,150.00
Adjustments			
Region (New Mexico: 98%)	(USD $241.84)	(USD $81.20)	(USD $20.30)
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $13,458.16**	**USD $4,518.80**	**USD $1,129.70**

Date Last Updated: Jun 01, 2021

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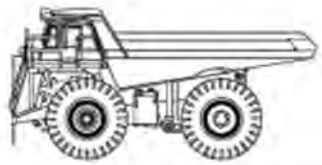
Custom Cost Evaluator

October 5, 2021

Caterpillar 769D (disc. 2007)
Mechanical Drive Rear Dumps

Size Class:
30 - 39 MTons
Weight:
66800 lbs



Configuration for 769D (disc. 2007)

Power Mode **Diesel** Rated Payload **36.4 mt**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $34.20/hr	USD $32.21/hr	-5.8%
Cost of Facilities Capital (CFC)	USD $2.61/hr	USD $1.80/hr	-30.9%
Overhead	USD $5.86/hr	USD $3.92/hr	-33.1%
Overhaul Labor	USD $22.32/hr	USD $5.65/hr	-74.7%
Overhaul Parts	USD $15.55/hr	USD $10.40/hr	-33.1%
Total Hourly Ownership Cost:	**USD $80.54/hr**	**USD $53.98/hr**	**-33%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (1,414hrs -> 2,114hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $17.63/hr	USD $4.46/hr	-74.7%
Field Parts	USD $9.48/hr	USD $1.06/hr	-88.9%
Ground Engaging Component (GEC)	USD $0.00/hr	-	-
Tire	USD $9.80/hr	-	-
Electrical/Fuel	USD $28.03/hr	USD $8.31/hr	-70.3%
Lube	USD $8.39/hr	-	-
Total Operating Ownership Cost:	**USD $73.32/hr**	**USD $32.01/hr**	**-56.3%**

User Defined Adjustments: Fuel (USD $3.37 -> USD $1.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $2,233 68 -> USD $0.00) Annual Field Repair Parts Cost (USD $11,168.40 -> USD $2,233.68)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $80.54/hr	USD $53.98/hr	-33%
Hourly Operating Costs	USD $73.32/hr	USD $32.01/hr	-56.3%
Total Hourly Cost	**USD $153.86**	**USD $86.00/hr**	**-44.1%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $42.67/hr	USD $37.93/hr	-11.1%
Idle	USD $108.57/hr	USD $62.29/hr	-42.6%

Revised Date: 4th quarter 2021

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EquipmentWatch

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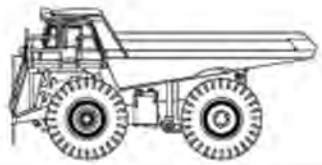
All prices shown in US dollars ($)

AED Green Book®

October 5, 2021

Caterpillar 777F (disc. 2012)
Mechanical Drive Rear Dumps

Size Class:
90 - 104 MTons
Weight:
154753 lbs



Configuration for 777F (disc. 2012)

Power Mode	**Diesel**	Rated Payload	**90.7 mt**

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $54,000.00	USD $18,000.00	USD $6,000.00
Adjustments			
Region (New Mexico: 100%)	-	-	-
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $54,000.00**	**USD $18,000.00**	**USD $6,000.00**

Date Last Updated: Mar 01, 2018

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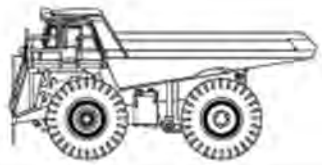
All prices shown in US dollars ($)

Custom Cost Evaluator

October 5, 2021

Caterpillar 777F (disc. 2012)
Mechanical Drive Rear Dumps

Size Class:
90 - 104 MTons
Weight:
154753 lbs



Configuration for 777F (disc. 2012)

Power Mode **Diesel** Rated Payload **90.7 mt**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $64.79/hr	USD $61.01/hr	-5.8%
Cost of Facilities Capital (CFC)	USD $4.51/hr	USD $4.59/hr	+1.9%
Overhead	USD $17.97/hr	USD $18.34/hr	+2.1%
Overhaul Labor	USD $27.83/hr	USD $10.75/hr	-61.4%
Overhaul Parts	USD $26.71/hr	USD $27.26/hr	+2.1%
Total Hourly Ownership Cost:	**USD $141.81/hr**	**USD $121.95/hr**	**-14%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (2,086hrs -> 2,044hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $17.09/hr	USD $6.60/hr	-61.4%
Field Parts	USD $16.48/hr	USD $2.80/hr	-83%
Ground Engaging Component (GEC)	USD $0.00/hr	-	-
Tire	USD $24.83/hr	-	-
Electrical/Fuel	USD $47.01/hr	USD $13.94/hr	-70.3%
Lube	USD $18.85/hr	-	-
Total Operating Ownership Cost:	**USD $124.26/hr**	**USD $67.02/hr**	**-46.1%**

User Defined Adjustments: Fuel (USD $3.37 -> USD $1.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $5,730 98 -> USD $0.00) Annual Field Repair Parts Cost (USD $28,654.88 -> USD $5,730.98)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $141.81/hr	USD $121.95/hr	-14%
Hourly Operating Costs	USD $124.26/hr	USD $67.02/hr	-46.1%
Total Hourly Cost	**USD $266.07**	**USD $188.97/hr**	**-29%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $87.27/hr	USD $83.94/hr	-3.8%
Idle	USD $188.82/hr	USD $135.89/hr	-28%

Revised Date: 4th quarter 2021

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All prices shown in US dollars ($)

AED Green Book®

October 5, 2021

Caterpillar 966H (disc. 2015)
4-Wd Articulated Wheel Loaders

Size Class:
250 - 274 HP
Weight:
52254 lbs

Configuration for 966H (disc. 2015)

Operator Protection	**EROPS**	Power Mode	**Diesel**

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $8,776.00	USD $3,166.00	USD $1,112.00
Adjustments			
Region (New Mexico: 103%)	USD $263.66	USD $95.12	USD $33.41
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $9,039.66**	**USD $3,261.12**	**USD $1,145.41**

Date Last Updated: Jun 01, 2021

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All prices shown in US dollars ($)

Custom Cost Evaluator

October 5, 2021

Caterpillar 966H (disc. 2015)
4-Wd Articulated Wheel Loaders

Size Class:
250 - 274 HP
Weight:
52254 lbs

Configuration for 966H (disc. 2015)

Operator Protection **EROPS** Power Mode **Diesel**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $23.94/hr	USD $22.31/hr	-6.8%
Cost of Facilities Capital (CFC)	USD $2.24/hr	USD $1.35/hr	-39.8%
Overhead	USD $6.55/hr	USD $3.78/hr	-42.2%
Overhaul Labor	USD $15.59/hr	USD $3.41/hr	-78.1%
Overhaul Parts	USD $8.31/hr	USD $4.80/hr	-42.2%
Total Hourly Ownership Cost:	**USD $56.63/hr**	**USD $35.65/hr**	**-37%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (1,012hrs -> 1,751hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $19.02/hr	USD $4.16/hr	-78.1%
Field Parts	USD $9.17/hr	USD $1.51/hr	-83.5%
Ground Engaging Component (GEC)	USD $1.25/hr	USD $0.00/hr	-100%
Tire	USD $5.18/hr	-	-
Electrical/Fuel	USD $13.00/hr	USD $3.86/hr	-70.3%
Lube	USD $3.79/hr	-	-
Total Operating Ownership Cost:	**USD $51.41/hr**	**USD $18.49/hr**	**-64%**

User Defined Adjustments: Fuel (USD $3.37 -> USD $1.00) Annual Ground Engaging Component (USD $1,263.03 -> USD $0.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $1,381.44 -> USD $0.00) Annual Field Repair Parts Cost (USD $7,893.96 -> USD $2,644.47)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $56.63/hr	USD $35.65/hr	-37%
Hourly Operating Costs	USD $51.41/hr	USD $18.49/hr	-64%
Total Hourly Cost	**USD $108.03**	**USD $54.15/hr**	**-49.9%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $32.73/hr	USD $27.44/hr	-16.2%
Idle	USD $69.63/hr	USD $39.51/hr	-43.3%

Revised Date: 4th quarter 2021

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All prices shown in US dollars ($)

AED Green Book®

October 5, 2021

Caterpillar 980H (disc. 2013)
4-Wd Articulated Wheel Loaders

Size Class:
275 - 349 HP
Weight:
67294 lbs

Configuration for 980H (disc. 2013)

Operator Protection	**EROPS**	Power Mode	**Diesel**

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $11,282.00	USD $4,119.00	USD $1,456.00
Adjustments			
Region (New Mexico: 103%)	USD $338.94	USD $123.75	USD $43.74
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $11,620.94**	**USD $4,242.75**	**USD $1,499.74**

Date Last Updated: Jun 01, 2021

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All prices shown in US dollars ($)

Custom Cost Evaluator

October 5, 2021

Caterpillar 980H (disc. 2013)
4-Wd Articulated Wheel Loaders

Size Class:
275 - 349 HP
Weight:
67294 lbs

Configuration for 980H (disc. 2013)

Operator Protection **EROPS** Power Mode **Diesel**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $28.31/hr	USD $26.34/hr	-6.9%
Cost of Facilities Capital (CFC)	USD $2.25/hr	USD $1.59/hr	-29.2%
Overhead	USD $4.85/hr	USD $3.33/hr	-31.4%
Overhaul Labor	USD $13.13/hr	USD $3.41/hr	-74%
Overhaul Parts	USD $8.24/hr	USD $5.66/hr	-31.4%
Total Hourly Ownership Cost:	**USD $56.77/hr**	**USD $40.33/hr**	**-29%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (1,202hrs -> 1,751hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $16.01/hr	USD $4.16/hr	-74%
Field Parts	USD $9.09/hr	USD $1.78/hr	-80.4%
Ground Engaging Component (GEC)	USD $1.24/hr	USD $0.00/hr	-100%
Tire	USD $8.37/hr	-	-
Electrical/Fuel	USD $18.04/hr	USD $5.35/hr	-70.3%
Lube	USD $4.73/hr	-	-
Total Operating Ownership Cost:	**USD $57.49/hr**	**USD $24.39/hr**	**-57.6%**

User Defined Adjustments: Fuel (USD $3.37 -> USD $1.00) Annual Ground Engaging Component (USD $1,487.83 -> USD $0.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $1,627.31 -> USD $0.00) Annual Field Repair Parts Cost (USD $9,298.94 -> USD $3,115.15)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $56.77/hr	USD $40.33/hr	-29%
Hourly Operating Costs	USD $57.49/hr	USD $24.39/hr	-57.6%
Total Hourly Cost	**USD $114.26**	**USD $64.72/hr**	**-43.4%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $35.41/hr	USD $31.26/hr	-11.7%
Idle	USD $74.82/hr	USD $45.68/hr	-38.9%

Revised Date: 4th quarter 2021

The equipment represented in this report has been exclusively prepared for MANDY LILLA (mlilla@fmi.com)

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All prices shown in US dollars ($)

AED Green Book®

October 5, 2021

Caterpillar 988H (disc. 2014)
4-Wd Articulated Wheel Loaders

Size Class:
350 - 499 HP
Weight:
109230 lbs

Configuration for 988H (disc. 2014)

Operator Protection	**EROPS**	Power Mode	**Diesel**

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $15,457.00	USD $5,361.00	USD $1,864.00
Adjustments			
Region (New Mexico: 103%)	USD $464.37	USD $161.06	USD $56.00
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $15,921.37**	**USD $5,522.06**	**USD $1,920.00**

Date Last Updated: Jun 01, 2021

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All prices shown in US dollars ($)

Custom Cost Evaluator

October 5, 2021

Caterpillar 988H (disc. 2014)
4-Wd Articulated Wheel Loaders

Size Class:
350 - 499 HP
Weight:
109230 lbs

Configuration for 988H (disc. 2014)

Operator Protection **EROPS** Power Mode **Diesel**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $52.48/hr	USD $48.93/hr	-6.8%
Cost of Facilities Capital (CFC)	USD $3.84/hr	USD $3.26/hr	-15.1%
Overhead	USD $6.69/hr	USD $5.60/hr	-16.3%
Overhaul Labor	USD $10.76/hr	USD $3.41/hr	-68.3%
Overhaul Parts	USD $13.98/hr	USD $11.71/hr	-16.3%
Total Hourly Ownership Cost:	**USD $87.75/hr**	**USD $72.90/hr**	**-16.9%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (1,466hrs -> 1,751hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $13.13/hr	USD $4.16/hr	-68.3%
Field Parts	USD $15.43/hr	USD $3.68/hr	-76.1%
Ground Engaging Component (GEC)	USD $2.10/hr	USD $0.00/hr	-100%
Tire	USD $13.79/hr	-	-
Electrical/Fuel	USD $30.77/hr	USD $9.13/hr	-70.3%
Lube	USD $9.14/hr	-	-
Total Operating Ownership Cost:	**USD $84.36/hr**	**USD $39.90/hr**	**-52.7%**

User Defined Adjustments: Fuel (USD $3.37 -> USD $1.00) Annual Ground Engaging Component (USD $3,079.29 -> USD $0.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $3,367.97 -> USD $0.00) Annual Field Repair Parts Cost (USD $19,245.54 -> USD $6,447.26)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $87.75/hr	USD $72.90/hr	-16.9%
Hourly Operating Costs	USD $84.36/hr	USD $39.90/hr	-52.7%
Total Hourly Cost	**USD $172.11**	**USD $112.80/hr**	**-34.5%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $63.01/hr	USD $57.79/hr	-8.3%
Idle	USD $118.52/hr	USD $82.03/hr	-30.8%

Revised Date: 4th quarter 2021

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AED Green Book®

October 5, 2021

Caterpillar 992K
4-Wd Articulated Wheel Loaders

Size Class:
500 - 999 HP
Weight:
214948 lbs

Configuration for 992K

Operator Protection	**EROPS**	Power Mode	**Diesel**

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $24,283.00	USD $8,110.00	USD $2,554.00
Adjustments			
Region (New Mexico: 103%)	USD $729.53	USD $243.65	USD $76.73
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $25,012.53**	**USD $8,353.65**	**USD $2,630.73**

Date Last Updated: Jun 01, 2021

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Custom Cost Evaluator

October 5, 2021

Caterpillar 992K
4-Wd Articulated Wheel Loaders

Size Class:
500 - 999 HP
Weight:
214948 lbs

Configuration for 992K

Operator Protection **EROPS** Power Mode **Diesel**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $117.34/hr	USD $109.18/hr	-7%
Cost of Facilities Capital (CFC)	USD $6.76/hr	USD $7.71/hr	+13.9%
Overhead	USD $51.43/hr	USD $59.30/hr	+15.3%
Overhaul Labor	USD $7.81/hr	USD $3.41/hr	-56.4%
Overhaul Parts	USD $24.19/hr	USD $27.89/hr	+15.3%
Total Hourly Ownership Cost:	**USD $207.53/hr**	**USD $207.49/hr**	**0%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (2,019hrs -> 1,751hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $9.53/hr	USD $4.16/hr	-56.4%
Field Parts	USD $26.68/hr	USD $8.77/hr	-67.1%
Ground Engaging Component (GEC)	USD $3.63/hr	USD $0.00/hr	-100%
Tire	USD $55.78/hr	-	-
Electrical/Fuel	USD $65.72/hr	USD $19.49/hr	-70.3%
Lube	USD $21.01/hr	-	-
Total Operating Ownership Cost:	**USD $182.37/hr**	**USD $109.22/hr**	**-40.1%**

User Defined Adjustments: Fuel (USD $3.37 -> USD $1.00) Annual Ground Engaging Component (USD $7,335.94 -> USD $0.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $8,023.68 -> USD $0.00) Annual Field Repair Parts Cost (USD $45,849.60 -> USD $15,359.62)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $207.53/hr	USD $207.49/hr	0%
Hourly Operating Costs	USD $182.37/hr	USD $109.22/hr	-40.1%
Total Hourly Cost	**USD $389.90**	**USD $316.70/hr**	**-18.8%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $175.53/hr	USD $176.19/hr	+0.4%
Idle	USD $273.25/hr	USD $226.98/hr	-16.9%

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AED Green Book®

October 5, 2021

Caterpillar 993K
4-Wd Articulated Wheel Loaders

Size Class:
500 - 999 HP
Weight:
294800 lbs

Configuration for 993K

Operator Protection	**EROPS**	Power Mode	**Diesel**

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $24,283.00	USD $8,110.00	USD $2,554.00
Adjustments			
Region (New Mexico: 103%)	USD $729.53	USD $243.65	USD $76.73
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $25,012.53**	**USD $8,353.65**	**USD $2,630.73**

Date Last Updated: Jun 01, 2021

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Custom Cost Evaluator

October 5, 2021

Caterpillar 993K
4-Wd Articulated Wheel Loaders

Size Class:
500 - 999 HP
Weight:
294800 lbs

Configuration for 993K

Operator Protection **EROPS** Power Mode **Diesel**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $140.77/hr	USD $130.98/hr	-7%
Cost of Facilities Capital (CFC)	USD $8.11/hr	USD $9.24/hr	+13.9%
Overhead	USD $57.23/hr	USD $65.98/hr	+15.3%
Overhaul Labor	USD $7.81/hr	USD $3.41/hr	-56.4%
Overhaul Parts	USD $29.01/hr	USD $33.45/hr	+15.3%
Total Hourly Ownership Cost:	**USD $242.93/hr**	**USD $243.07/hr**	**+0.1%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (2,019hrs -> 1,751hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $9.53/hr	USD $4.16/hr	-56.4%
Field Parts	USD $32.01/hr	USD $10.52/hr	-67.1%
Ground Engaging Component (GEC)	USD $4.36/hr	USD $0.00/hr	-100%
Tire	USD $66.92/hr	-	-
Electrical/Fuel	USD $77.94/hr	USD $23.11/hr	-70.3%
Lube	USD $25.12/hr	-	-
Total Operating Ownership Cost:	**USD $215.89/hr**	**USD $129.84/hr**	**-39.9%**

User Defined Adjustments: Fuel (USD $3.37 -> USD $1.00) Annual Ground Engaging Component (USD $8,800.54 -> USD $0.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $9,625.59 -> USD $0.00) Annual Field Repair Parts Cost (USD $55,003.40 -> USD $18,426.14)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $242.93/hr	USD $243.07/hr	+0.1%
Hourly Operating Costs	USD $215.89/hr	USD $129.84/hr	-39.9%
Total Hourly Cost	**USD $458.82**	**USD $372.91/hr**	**-18.7%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $206.10/hr	USD $206.21/hr	+0.1%
Idle	USD $320.87/hr	USD $266.19/hr	-17%

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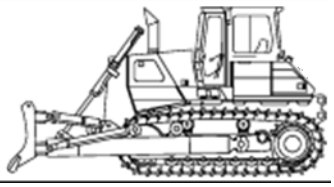
AED Green Book®

October 5, 2021

Caterpillar D6T (disc. 2019)
Standard Crawler Dozers

Size Class:
160 - 189 HP
Weight:
40550 lbs



Configuration for D6T (disc. 2019)

Dozer Type	**Semi-U**	Operator Protection	**EROPS**
Power Mode	**Diesel**		

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $7,997.00	USD $2,722.00	USD $882.00
Adjustments			
Region (New Mexico: 110%)	USD $825.13	USD $280.85	USD $91.00
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $8,822.13**	**USD $3,002.85**	**USD $973.00**

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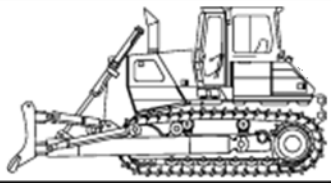
Custom Cost Evaluator

October 5, 2021

Caterpillar D6T (disc. 2019)
Standard Crawler Dozers

Size Class:
160 - 189 HP
Weight:
40550 lbs



Configuration for D6T (disc. 2019)

Dozer Type	**Semi-U**	Operator Protection	**EROPS**
Power Mode	**Diesel**		

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $40.40/hr	USD $37.61/hr	-6.9%
Cost of Facilities Capital (CFC)	USD $3.52/hr	USD $1.86/hr	-47%
Overhead	USD $21.92/hr	USD $11.07/hr	-49.5%
Overhaul Labor	USD $16.83/hr	USD $3.21/hr	-80.9%
Overhaul Parts	USD $31.07/hr	USD $15.68/hr	-49.5%
Total Hourly Ownership Cost:	**USD $113.75/hr**	**USD $69.43/hr**	**-39%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (806hrs -> 1,597hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $20.75/hr	USD $3.96/hr	-80.9%
Field Parts	USD $30.11/hr	USD $5.06/hr	-83.2%
Ground Engaging Component (GEC)	USD $5.02/hr	USD $0.00/hr	-100%
Tire	USD $0.00/hr	-	-
Electrical/Fuel	USD $22.07/hr	USD $6.55/hr	-70.3%
Lube	USD $5.18/hr	-	-
Total Operating Ownership Cost:	**USD $83.13/hr**	**USD $20.76/hr**	**-75%**

User Defined Adjustments: Fuel (USD $3.37 -> USD $1.00) Annual Ground Engaging Component (USD $4,044.32 -> USD $0.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $4,044.32 -> USD $0.00) Annual Field Repair Parts Cost (USD $20,221.59 -> USD $8,088.64)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $113.75/hr	USD $69.43/hr	-39%
Hourly Operating Costs	USD $83.13/hr	USD $20.76/hr	-75%
Total Hourly Cost	**USD $196.88**	**USD $90.19/hr**	**-54.2%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $65.84/hr	USD $50.54/hr	-23.2%
Idle	USD $135.82/hr	USD $75.98/hr	-44.1%

Revised Date: 4th quarter 2021

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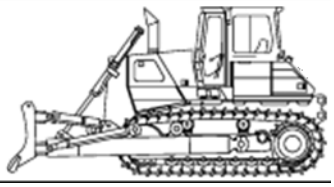
All prices shown in US dollars ($)

AED Green Book®

October 5, 2021

Caterpillar D6T XL (disc. 2018)
Standard Crawler Dozers

Size Class:
190 - 259 HP
Weight:
44420 lbs



Configuration for D6T XL (disc. 2018)

Dozer Type	**Semi-U**	Operator Protection	**EROPS**
Power Mode	**Diesel**		

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $11,442.00	USD $3,990.00	USD $1,403.00
Adjustments			
Region (New Mexico: 110%)	USD $1,180.58	USD $411.69	USD $144.75
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $12,622.58**	**USD $4,401.69**	**USD $1,547.76**

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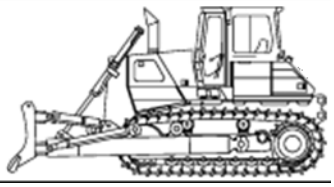
Custom Cost Evaluator

October 5, 2021

Caterpillar D6T XL (disc. 2018)
Standard Crawler Dozers

Size Class:
190 - 259 HP
Weight:
44420 lbs



Configuration for D6T XL (disc. 2018)

Dozer Type	**Semi-U**	Operator Protection	**EROPS**
Power Mode	**Diesel**		

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $44.12/hr	USD $41.28/hr	-6.4%
Cost of Facilities Capital (CFC)	USD $3.53/hr	USD $1.84/hr	-47.7%
Overhead	USD $19.33/hr	USD $9.56/hr	-50.5%
Overhaul Labor	USD $17.18/hr	USD $3.20/hr	-81.3%
Overhaul Parts	USD $32.24/hr	USD $15.95/hr	-50.5%
Total Hourly Ownership Cost:	**USD $116.40/hr**	**USD $71.84/hr**	**-38.3%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (790hrs -> 1,597hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $21.17/hr	USD $3.95/hr	-81.3%
Field Parts	USD $31.25/hr	USD $5.15/hr	-83.5%
Ground Engaging Component (GEC)	USD $5.21/hr	USD $0.00/hr	-100%
Tire	USD $0.00/hr	-	-
Electrical/Fuel	USD $21.72/hr	USD $6.44/hr	-70.3%
Lube	USD $5.20/hr	-	-
Total Operating Ownership Cost:	**USD $84.54/hr**	**USD $20.74/hr**	**-75.5%**

User Defined Adjustments: Fuel (USD $3.37 -> USD $1.00) Annual Ground Engaging Component (USD $4,114.14 -> USD $0.00) Mechanics Wage (USD $63.11 -> USD $23.80) Annual Misc Supply Parts (USD $4,114.14 -> USD $0.00) Annual Field Repair Parts Cost (USD $20,570.71 -> USD $8,228.28)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $116.40/hr	USD $71.84/hr	-38.3%
Hourly Operating Costs	USD $84.54/hr	USD $20.74/hr	-75.5%
Total Hourly Cost	**USD $200.93**	**USD $92.58/hr**	**-53.9%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $66.98/hr	USD $52.69/hr	-21.3%
Idle	USD $138.11/hr	USD $78.28/hr	-43.3%

Revised Date: 4th quarter 2021

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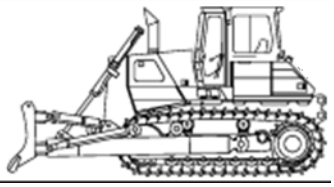
AED Green Book®

October 5, 2021

Caterpillar D9T
Standard Crawler Dozers

Size Class:
360 - 519 HP
Weight:
105600 lbs



Configuration for D9T

Dozer Type	**Semi-U**	Operator Protection	**ROPS/FOPS**
Power Mode	**Diesel**		

AED Rental Rates

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	Monthly	Weekly	Daily
Published Rates	USD $26,926.00	USD $9,306.00	USD $3,273.00
Adjustments			
Region (New Mexico: 110%)	USD $2,778.21	USD $960.19	USD $337.71
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $29,704.21**	**USD $10,266.19**	**USD $3,610.71**

Date Last Updated: Jun 01, 2021

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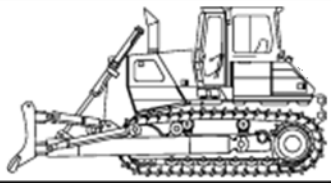
Custom Cost Evaluator

October 5, 2021

Caterpillar D9T
Standard Crawler Dozers

Size Class:
360 - 519 HP
Weight:
105600 lbs



Configuration for D9T

Dozer Type	**Semi-U**	Operator Protection	**ROPS/FOPS**
Power Mode	**Diesel**		

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $69.45/hr	USD $65.34/hr	-5.9%
Cost of Facilities Capital (CFC)	USD $5.28/hr	USD $4.01/hr	-24.1%
Overhead	USD $40.36/hr	USD $30.05/hr	-25.6%
Overhaul Labor	USD $20.70/hr	USD $5.83/hr	-71.8%
Overhaul Parts	USD $62.12/hr	USD $46.25/hr	-25.6%
Total Hourly Ownership Cost:	**USD $197.90/hr**	**USD $151.47/hr**	**-23.5%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (1,250hrs -> 1,679hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $24.23/hr	USD $6.83/hr	-71.8%
Field Parts	USD $60.50/hr	USD $15.01/hr	-75.2%
Ground Engaging Component (GEC)	USD $10.08/hr	USD $0.00/hr	-100%
Tire	USD $0.00/hr	-	-
Electrical/Fuel	USD $43.93/hr	USD $13.03/hr	-70.3%
Lube	USD $13.31/hr	-	-
Total Operating Ownership Cost:	**USD $152.06/hr**	**USD $48.18/hr**	**-68.3%**

User Defined Adjustments: Fuel (USD $3.37 -> USD $1.00) Annual Ground Engaging Component (USD $12,604.04 -> USD $0.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $12,604.04 -> USD $0.00) Annual Field Repair Parts Cost (USD $63,020.18 -> USD $25,208.08)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $197.90/hr	USD $151.47/hr	-23.5%
Hourly Operating Costs	USD $152.06/hr	USD $48.18/hr	-68.3%
Total Hourly Cost	**USD $349.96**	**USD $199.65/hr**	**-43%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $115.09/hr	USD $99.39/hr	-13.6%
Idle	USD $241.83/hr	USD $164.49/hr	-32%

Revised Date: 4th quarter 2021

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EquipmentWatch

www.equipmentwatch.com

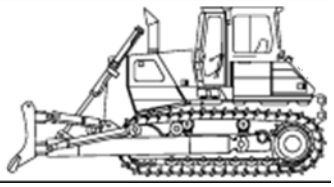
All prices shown in US dollars ($)

AED Green Book®

October 5, 2021

Caterpillar D11T CD (disc. 2018)
Standard Crawler Dozers

Size Class:
520 HP & Over
Weight:
N/A



Configuration for D11T CD (disc. 2018)

Dozer Type	**U Blade**	Operator Protection	**EROPS**
Power Mode	**Diesel**		

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $30,648.00	USD $10,566.00	USD $3,597.00
Adjustments			
Region (New Mexico: 110%)	USD $3,162.24	USD $1,090.19	USD $371.14
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $33,810.24**	**USD $11,656.19**	**USD $3,968.14**

Date Last Updated: Jun 01, 2021

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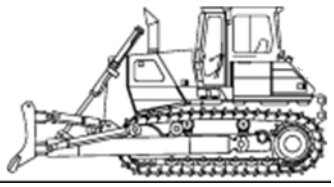
All prices shown in US dollars ($)

Custom Cost Evaluator

October 5, 2021

Caterpillar D11T CD (disc. 2018)
Standard Crawler Dozers

Size Class:
520 HP & Over
Weight:
N/A



Configuration for D11T CD (disc. 2018)

Dozer Type	**U Blade**	Operator Protection	**EROPS**
Power Mode	**Diesel**		

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $69.61/hr	USD $65.50/hr	-5.9%
Cost of Facilities Capital (CFC)	USD $4.00/hr	USD $4.29/hr	+7.4%
Overhead	USD $25.98/hr	USD $28.06/hr	+8%
Overhaul Labor	USD $14.27/hr	USD $5.83/hr	-59.1%
Overhaul Parts	USD $46.13/hr	USD $49.82/hr	+8%
Total Hourly Ownership Cost:	**USD $159.99/hr**	**USD $153.49/hr**	**-4.1%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (1,813hrs -> 1,679hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $16.71/hr	USD $6.83/hr	-59.1%
Field Parts	USD $44.93/hr	USD $16.17/hr	-64%
Ground Engaging Component (GEC)	USD $7.49/hr	USD $0.00/hr	-100%
Tire	USD $0.00/hr	-	-
Electrical/Fuel	USD $89.51/hr	USD $26.54/hr	-70.3%
Lube	USD $18.56/hr	-	-
Total Operating Ownership Cost:	**USD $177.20/hr**	**USD $68.10/hr**	**-61.6%**

User Defined Adjustments: Fuel (USD $3.37 -> USD $1.00) Annual Ground Engaging Component (USD $13,577.33 -> USD $0.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $13,577.33 -> USD $0.00) Annual Field Repair Parts Cost (USD $67,886.64 -> USD $27,154.66)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $159.99/hr	USD $153.49/hr	-4.1%
Hourly Operating Costs	USD $177.20/hr	USD $68.10/hr	-61.6%
Total Hourly Cost	**USD $337.19**	**USD $221.59/hr**	**-34.3%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $99.59/hr	USD $97.84/hr	-1.8%
Idle	USD $249.50/hr	USD $180.04/hr	-27.8%

Revised Date: 4th quarter 2021

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EquipmentWatch

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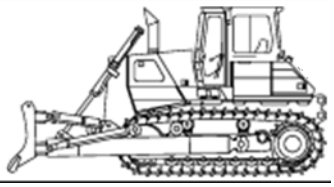
All prices shown in US dollars ($)

AED Green Book®

October 5, 2021

Caterpillar D11T (disc. 2018)
Standard Crawler Dozers

Size Class:
520 HP & Over
Weight:
208885 lbs



Configuration for D11T (disc. 2018)

Dozer Type	**U Blade**	Operator Protection	**EROPS**
Power Mode	**Diesel**		

AED Rental Rates

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Published Rates	USD $30,648.00	USD $10,566.00	USD $3,597.00
Adjustments			
Region (New Mexico: 110%)	USD $3,162.24	USD $1,090.19	USD $371.14
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $33,810.24**	**USD $11,656.19**	**USD $3,968.14**

Date Last Updated: Jun 01, 2021

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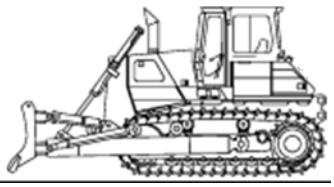
Custom Cost Evaluator

October 5, 2021

Caterpillar D11T (disc. 2018)
Standard Crawler Dozers

Size Class:
520 HP & Over
Weight:
208885 lbs



Configuration for D11T (disc. 2018)

Dozer Type	**U Blade**	Operator Protection	**EROPS**
Power Mode	**Diesel**		

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $135.34/hr	USD $127.35/hr	-5.9%
Cost of Facilities Capital (CFC)	USD $7.77/hr	USD $8.34/hr	+7.4%
Overhead	USD $42.16/hr	USD $45.52/hr	+8%
Overhaul Labor	USD $14.27/hr	USD $5.83/hr	-59.1%
Overhaul Parts	USD $89.70/hr	USD $96.86/hr	+8%
Total Hourly Ownership Cost:	**USD $289.24/hr**	**USD $283.90/hr**	**-1.8%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (1,813hrs -> 1,679hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $16.71/hr	USD $6.83/hr	-59.1%
Field Parts	USD $87.37/hr	USD $31.45/hr	-64%
Ground Engaging Component (GEC)	USD $14.56/hr	USD $0.00/hr	-100%
Tire	USD $0.00/hr	-	-
Electrical/Fuel	USD $89.51/hr	USD $26.54/hr	-70.3%
Lube	USD $27.63/hr	-	-
Total Operating Ownership Cost:	**USD $235.77/hr**	**USD $92.45/hr**	**-60.8%**

User Defined Adjustments: Fuel (USD $3.37 -> USD $1.00) Annual Ground Engaging Component (USD $26,399.19 -> USD $0.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $26,399.19 -> USD $0.00) Annual Field Repair Parts Cost (USD $131,995.97 -> USD $52,798.38)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $289.24/hr	USD $283.90/hr	-1.8%
Hourly Operating Costs	USD $235.77/hr	USD $92.45/hr	-60.8%
Total Hourly Cost	**USD $525.01**	**USD $376.35/hr**	**-28.3%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $185.27/hr	USD $181.21/hr	-2.2%
Idle	USD $378.75/hr	USD $310.44/hr	-18%

Revised Date: 4th quarter 2021

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EquipmentWatch

www.equipmentwatch.com

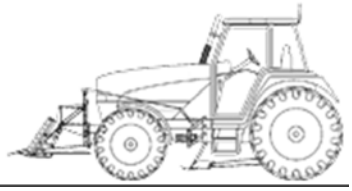
All prices shown in US dollars ($)

AED Green Book®

October 5, 2021

Deere 7430 (disc. 2011)
Wheel Tractors

Size Class:
125 to 174 hp
Weight:
N/A



Configuration for 7430 (disc. 2011)

Horsepower	**166.0 hp**	Power Mode	**Diesel**

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $3,891.00	USD $1,303.00	USD $462.00
Adjustments			
Region (New Mexico: 95%)	(USD $213.18)	(USD $71.39)	(USD $25.31)
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $3,677.82**	**USD $1,231.61**	**USD $436.69**

Date Last Updated: Jun 01, 2021

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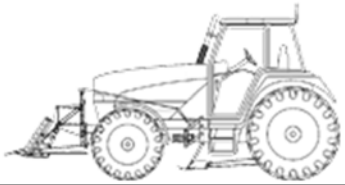
All prices shown in US dollars ($)

Custom Cost Evaluator

October 5, 2021

Deere 7430 (disc. 2011)
Wheel Tractors

Size Class:
125 to 174 hp
Weight:
N/A



Configuration for 7430 (disc. 2011)

Horsepower **166.0 hp** Power Mode **Diesel**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $11.78/hr	USD $11.05/hr	-6.2%
Cost of Facilities Capital (CFC)	USD $1.11/hr	USD $0.56/hr	-49.7%
Overhead	USD $6.66/hr	USD $3.17/hr	-52.4%
Overhaul Labor	USD $11.02/hr	USD $1.99/hr	-82%
Overhaul Parts	USD $6.96/hr	USD $3.31/hr	-52.4%
Total Hourly Ownership Cost:	**USD $37.53/hr**	**USD $20.08/hr**	**-46.5%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (647hrs -> 1,359hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $14.53/hr	USD $2.62/hr	-82%
Field Parts	USD $6.10/hr	USD $0.48/hr	-92.1%
Ground Engaging Component (GEC)	USD $0.00/hr	-	-
Tire	USD $0.80/hr	-	-
Electrical/Fuel	USD $20.15/hr	USD $5.98/hr	-70.3%
Lube	USD $2.83/hr	-	-
Total Operating Ownership Cost:	**USD $44.42/hr**	**USD $12.71/hr**	**-71.4%**

User Defined Adjustments: Fuel (USD $3.37 -> USD $1.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $658.26 -> USD $0.00) Annual Field Repair Parts Cost (USD $3,291.28 -> USD $658.26)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $37.53/hr	USD $20.08/hr	-46.5%
Hourly Operating Costs	USD $44.42/hr	USD $12.71/hr	-71.4%
Total Hourly Cost	**USD $81.95**	**USD $32.78/hr**	**-60%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $19.54/hr	USD $14.77/hr	-24.4%
Idle	USD $57.68/hr	USD $26.05/hr	-54.8%

Revised Date: 4th quarter 2021

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EquipmentWatch

www.equipmentwatch.com

All prices shown in US dollars ($)

Custom Cost Evaluator

October 5, 2021

Finn B260
Trailer Mounted Mulchers

Size Class:
51 HP & Over
Weight:
4880 lbs

Configuration for B260

Horsepower **115.0** Power Mode **Diesel**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $5.80/hr	USD $5.45/hr	-6.2%
Cost of Facilities Capital (CFC)	USD $0.26/hr	USD $0.17/hr	-33.5%
Overhead	USD $1.44/hr	USD $0.90/hr	-38%
Overhaul Labor	USD $4.40/hr	USD $1.03/hr	-76.5%
Overhaul Parts	USD $3.10/hr	USD $1.92/hr	-38%
Total Hourly Ownership Cost:	**USD $15.01/hr**	**USD $9.47/hr**	**-36.9%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (861hrs -> 1,388hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $5.50/hr	USD $1.29/hr	-76.5%
Field Parts	USD $1.79/hr	USD $0.15/hr	-91.9%
Ground Engaging Component (GEC)	USD $0.00/hr	-	-
Tire	USD $0.60/hr	-	-
Electrical/Fuel	USD $13.92/hr	USD $4.13/hr	-70.3%
Lube	USD $1.64/hr	-	-
Total Operating Ownership Cost:	**USD $23.45/hr**	**USD $7.81/hr**	**-66.7%**

User Defined Adjustments: Fuel (USD $3.37 -> USD $1.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $201.40 -> USD $0.00) Annual Field Repair Parts Cost (USD $1,342.66 -> USD $201.40)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $15.01/hr	USD $9.47/hr	-36.9%
Hourly Operating Costs	USD $23.45/hr	USD $7.81/hr	-66.7%
Total Hourly Cost	**USD $38.46**	**USD $17.28/hr**	**-55.1%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $7.51/hr	USD $6.52/hr	-13.2%
Idle	USD $28.93/hr	USD $13.60/hr	-53%

Revised Date: 4th quarter 2021

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All prices shown in US dollars ($)

Rental Rate Blue Book®

October 5, 2021

Finn B260
Trailer Mounted Mulchers

Size Class:
51 HP & Over
Weight:
4880 lbs

Configuration for B260

Horsepower	**115.0**	Power Mode	**Diesel**

Blue Book Rates

Non-current (i.e. archived) rates: Jan 1, 2019 - Jun 30, 2019

** FHWA Rate is equal to the monthly ownership cost divided by 176 plus the hourly estimated operating cost.

	Ownership Costs				Estimated Operating Costs	FHWA Rate**
	Monthly	**Weekly**	**Daily**	**Hourly**	**Hourly**	**Hourly**
Published Rates	USD $2,425.00	USD $680.00	USD $170.00	USD $26.00	USD $21.35	USD $35.13
Adjustments						
Region (Las Cruces, New Mexico: 89.4%)	(USD $257.05)	(USD $72.08)	(USD $18.02)	(USD $2.76)		
Model Year (2021: 100%)	-	-	-	-		
Adjusted Hourly Ownership Cost (100%)	-	-	-	-		
Hourly Operating Cost (100%)					-	
Total:	**USD $2,167.95**	**USD $607.92**	**USD $151.98**	**USD $23.24**	**USD $21.35**	**USD $33.67**

Non-Active Use Rates	**Hourly**
Standby Rate	USD $6.16
Idling Rate	USD $25.82

Rate Element Allocation

Element	**Percentage**	**Value**
Depreciation (ownership)	37%	USD $897.25/mo
Overhaul (ownership)	50%	USD $1,212.50/mo
CFC (ownership)	6%	USD $145.50/mo
Indirect (ownership)	7%	USD $169.75/mo
Fuel (operating) @ USD 3.27	63%	USD $13.50/hr

Revised Date: 1st half 2019

These are the most accurate rates for the selected Revision Date(s). However, due to more frequent online updates, these rates may not match Rental Rate Blue Book Print. Visit the Cost Recovery Product Guide on our Help page for more information.

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EquipmentWatch

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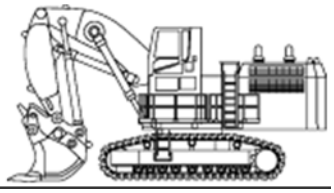
All prices shown in US dollars ($)

Rental Rate Blue Book®

October 5, 2021

Hitachi EX3600-5 (disc. 2009)
Hydraulic Shovels

Size Class:
150.1 MTons & Over
Weight:
772000 lbs



Configuration for EX3600-5 (disc. 2009)

Operating Weight **350.0 mt** Power Mode **Diesel**

Blue Book Rates

Non-current (i.e. archived) rates: Jan 1, 2019 - Jun 30, 2019
** FHWA Rate is equal to the monthly ownership cost divided by 176 plus the hourly estimated operating cost.

	Ownership Costs				Estimated Operating Costs	FHWA Rate**
	Monthly	Weekly	Daily	Hourly	Hourly	Hourly
Published Rates	USD $76,625.00	USD $21,455.00	USD $5,365.00	USD $805.00	USD $530.00	USD $965.37
Adjustments						
Region (Las Cruces, New Mexico: 90.4%)	(USD $7,356.00)	(USD $2,059.68)	(USD $515.04)	(USD $77.28)		
Model Year (2009: 100%)	-	-	-	-		
Adjusted Hourly Ownership Cost (100%)	-	-	-	-		
Hourly Operating Cost (100%)					-	
Total:	**USD $69,269.00**	**USD $19,395.32**	**USD $4,849.96**	**USD $727.72**	**USD $530.00**	**USD $923.57**

Non-Active Use Rates	Hourly
Standby Rate	USD $196.79
Idling Rate	USD $664.06

Rate Element Allocation

Element	Percentage	Value
Depreciation (ownership)	32%	USD $24,520.00/mo
Overhaul (ownership)	50%	USD $38,312.50/mo
CFC (ownership)	9%	USD $6,896.25/mo
Indirect (ownership)	9%	USD $6,896.25/mo
Fuel (operating) @ USD 3.27	51%	USD $270.49/hr

Revised Date: 1st half 2019

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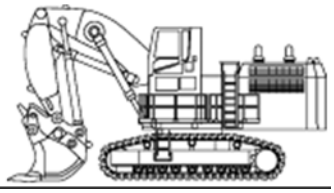
Custom Cost Evaluator

October 5, 2021

Hitachi EX3600-5 (disc. 2009)
Hydraulic Shovels

Size Class:
150.1 MTons & Over
Weight:
772000 lbs



Configuration for EX3600-5 (disc. 2009)

Operating Weight **350.0 mt** Power Mode **Diesel**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $157.56/hr	USD $148.69/hr	-5.6%
Cost of Facilities Capital (CFC)	USD $11.66/hr	USD $10.65/hr	-8.6%
Overhead	USD $72.89/hr	USD $66.17/hr	-9.2%
Overhaul Labor	USD $32.75/hr	USD $11.25/hr	-65.7%
Overhaul Parts	USD $113.67/hr	USD $103.19/hr	-9.2%
Total Hourly Ownership Cost:	**USD $388.53/hr**	**USD $339.94/hr**	**-12.5%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (1,850hrs -> 2,038hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $43.49/hr	USD $14.94/hr	-65.7%
Field Parts	USD $124.46/hr	USD $40.67/hr	-67.3%
Ground Engaging Component (GEC)	USD $19.91/hr	USD $0.00/hr	-100%
Tire	USD $0.00/hr	-	-
Electrical/Fuel	USD $278.93/hr	USD $82.72/hr	-70.3%
Lube	USD $60.00/hr	-	-
Total Operating Ownership Cost:	**USD $526.80/hr**	**USD $198.33/hr**	**-62.4%**

User Defined Adjustments: Fuel (USD $3.37 -> USD $1.00) Annual Ground Engaging Component (USD $36,841.54 -> USD $0.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $46,051.93 -> USD $0.00) Annual Field Repair Parts Cost (USD $184,207.72 -> USD $82,893.47)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $388.53/hr	USD $339.94/hr	-12.5%
Hourly Operating Costs	USD $526.80/hr	USD $198.33/hr	-62.4%
Total Hourly Cost	**USD $915.34**	**USD $538.28/hr**	**-41.2%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $242.11/hr	USD $225.51/hr	-6.9%
Idle	USD $667.46/hr	USD $422.66/hr	-36.7%

Revised Date: 4th quarter 2021

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All prices shown in US dollars ($)

Spec Finder

October 5, 2021

Kenworth T800
On-Highway Truck Tractors

Size Class:
45,001 - 60,000 GVW
Weight:
N/A

Specifications

Engine	
Engine	ISM
Engine Manufacturer	Cummins
Horsepower	330.0 hp
Power Mode	Diesel
Transmission	
Number of Speeds	10-Speed
Transmission	FRO-13210C
Transmission Manufacturer	Fuller

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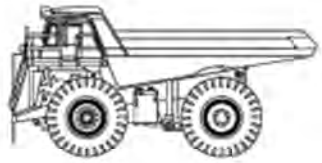
All prices shown in US dollars ($)

Custom Cost Evaluator

October 5, 2021

Komatsu 730E
Electric Drive Rear Dumps

Size Class:
170 - 199 MTons
Weight:
309950 lbs



Configuration for 730E

Power Mode	**Diesel**	Rated Payload	**183.7 mt**
Wheel Motor Model	**GE788**		

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $57.77/hr	USD $54.40/hr	-5.8%
Cost of Facilities Capital (CFC)	USD $4.53/hr	USD $4.39/hr	-3.1%
Overhead	USD $29.49/hr	USD $28.51/hr	-3.3%
Overhaul Labor	USD $57.99/hr	USD $21.21/hr	-63.4%
Overhaul Parts	USD $23.65/hr	USD $22.86/hr	-3.3%
Total Hourly Ownership Cost:	**USD $173.43/hr**	**USD $131.36/hr**	**-24.3%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (1,850hrs -> 1,914hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $33.77/hr	USD $12.35/hr	-63.4%
Field Parts	USD $11.14/hr	USD $1.80/hr	-83.9%
Ground Engaging Component (GEC)	USD $0.00/hr	-	-
Tire	USD $21.21/hr	-	-
Electrical/Fuel	USD $96.44/hr	USD $28.60/hr	-70.3%
Lube	USD $19.19/hr	-	-
Total Operating Ownership Cost:	**USD $181.75/hr**	**USD $83.15/hr**	**-54.3%**

User Defined Adjustments: Fuel (USD $3.37 -> USD $1.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $3,436 08 -> USD $0.00) Annual Field Repair Parts Cost (USD $17,180.42 -> USD $3,436.09)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $173.43/hr	USD $131.36/hr	-24.3%
Hourly Operating Costs	USD $181.75/hr	USD $83.15/hr	-54.3%
Total Hourly Cost	**USD $355.18**	**USD $214.50/hr**	**-39.6%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $91.79/hr	USD $87.29/hr	-4.9%
Idle	USD $269.87/hr	USD $159.96/hr	-40.7%

Revised Date: 4th quarter 2021

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EquipmentWatch

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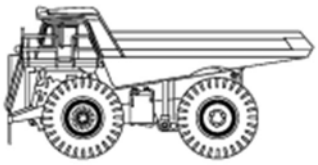
All prices shown in US dollars ($)

Rental Rate Blue Book®

October 5, 2021

Komatsu 730E
Electric Drive Rear Dumps

Size Class:
170 - 199 MTons
Weight:
309950 lbs



Configuration for 730E

Power Mode	**Diesel**	Rated Payload	**183.7 mt**
Wheel Motor Model	**GE788**		

Blue Book Rates

Non-current (i.e. archived) rates: Jan 1, 2019 - Jun 30, 2019
** FHWA Rate is equal to the monthly ownership cost divided by 176 plus the hourly estimated operating cost.

	Ownership Costs				Estimated Operating Costs	FHWA Rate**
	Monthly	**Weekly**	**Daily**	**Hourly**	**Hourly**	**Hourly**
Published Rates	USD $32,225.00	USD $9,025.00	USD $2,255.00	USD $340.00	USD $193.80	USD $376.90
Adjustments						
Region (Las Cruces, New Mexico: 91.1%)	(USD $2,868.02)	(USD $803.22)	(USD $200.70)	(USD $30.26)		
Model Year (2021: 100%)	-	-	-	-		
Adjusted Hourly Ownership Cost (100%)	-	-	-	-		
Hourly Operating Cost (100%)					-	
Total:	**USD $29,356.97**	**USD $8,221.78**	**USD $2,054.30**	**USD $309.74**	**USD $193.80**	**USD $360.60**

Non-Active Use Rates	**Hourly**
Standby Rate	USD $88.40
Idling Rate	USD $276.28

Rate Element Allocation

Element	**Percentage**	**Value**
Depreciation (ownership)	31%	USD $9,989.75/mo
Overhaul (ownership)	47%	USD $15,145.75/mo
CFC (ownership)	9%	USD $2,900.25/mo
Indirect (ownership)	13%	USD $4,189.25/mo
Fuel (operating) @ USD 3.27	56%	USD $109.48/hr

Revised Date: 1st half 2019

These are the most accurate rates for the selected Revision Date(s). However, due to more frequent online updates, these rates may not match Rental Rate Blue Book Print. Visit the Cost Recovery Product Guide on our Help page for more information.

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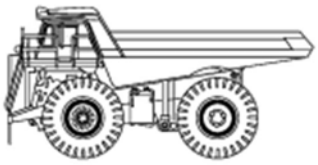
All prices shown in US dollars ($)

Rental Rate Blue Book®

October 5, 2021

Komatsu HD1500-5 (disc. 2008)
Mechanical Drive Rear Dumps

Size Class:
105 - 139 MTons
Weight:
221481 lbs



Configuration for HD1500-5 (disc. 2008)

Power Mode	**Diesel**	Rated Payload	**136.0 mt**

Blue Book Rates

Non-current (i.e. archived) rates: Jan 1, 2019 - Jun 30, 2019
** FHWA Rate is equal to the monthly ownership cost divided by 176 plus the hourly estimated operating cost.

	Ownership Costs				Estimated Operating Costs	FHWA Rate**
	Monthly	**Weekly**	**Daily**	**Hourly**	**Hourly**	**Hourly**
Published Rates	USD $27,675.00	USD $7,750.00	USD $1,940.00	USD $290.00	USD $169.35	USD $326.59
Adjustments						
Region (Las Cruces, New Mexico: 91.1%)	(USD $2,463.07)	(USD $689.75)	(USD $172.66)	(USD $25.81)		
Model Year (2008: 100%)	-	-	-	-		
Adjusted Hourly Ownership Cost (100%)	-	-	-	-		
Hourly Operating Cost (100%)					-	
Total:	**USD $25,211.93**	**USD $7,060.25**	**USD $1,767.34**	**USD $264.19**	**USD $169.35**	**USD $312.60**

Non-Active Use Rates	**Hourly**
Standby Rate	USD $70.19
Idling Rate	USD $235.20

Rate Element Allocation

Element	**Percentage**	**Value**
Depreciation (ownership)	33%	USD $9,132.75/mo
Overhaul (ownership)	51%	USD $14,114.25/mo
CFC (ownership)	8%	USD $2,214.00/mo
Indirect (ownership)	8%	USD $2,214.00/mo
Fuel (operating) @ USD 3.27	54%	USD $91.95/hr

Revised Date: 1st half 2019

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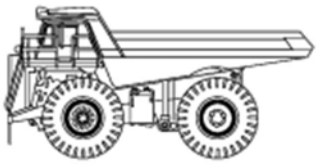
All prices shown in US dollars ($)

Custom Cost Evaluator

October 5, 2021

Komatsu HD1500-5 (disc. 2008)
Mechanical Drive Rear Dumps

Size Class:
105 - 139 MTons
Weight:
221481 lbs



Configuration for HD1500-5 (disc. 2008)

Power Mode **Diesel** Rated Payload **136.0 mt**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $56.76/hr	USD $53.45/hr	-5.8%
Cost of Facilities Capital (CFC)	USD $2.78/hr	USD $3.57/hr	+28.2%
Overhead	USD $17.37/hr	USD $22.84/hr	+31.5%
Overhaul Labor	USD $26.86/hr	USD $13.37/hr	-50.2%
Overhaul Parts	USD $14.33/hr	USD $18.84/hr	+31.5%
Total Hourly Ownership Cost:	**USD $118.10/hr**	**USD $112.06/hr**	**-5.1%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (2,643hrs -> 2,010hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $15.52/hr	USD $7.72/hr	-50.2%
Field Parts	USD $6.08/hr	USD $1.33/hr	-78.1%
Ground Engaging Component (GEC)	USD $0.00/hr	-	-
Tire	USD $18.78/hr	-	-
Electrical/Fuel	USD $90.56/hr	USD $26.86/hr	-70.3%
Lube	USD $19.76/hr	-	-
Total Operating Ownership Cost:	**USD $150.70/hr**	**USD $74.45/hr**	**-50.6%**

User Defined Adjustments: Fuel (USD $3.37 -> USD $1.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $2,676 50 -> USD $0.00) Annual Field Repair Parts Cost (USD $13,382.50 -> USD $2,676.50)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $118.10/hr	USD $112.06/hr	-5.1%
Hourly Operating Costs	USD $150.70/hr	USD $74.45/hr	-50.6%
Total Hourly Cost	**USD $268.80**	**USD $186.51/hr**	**-30.6%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $76.91/hr	USD $79.85/hr	+3.8%
Idle	USD $208.66/hr	USD $138.92/hr	-33.4%

Revised Date: 4th quarter 2021

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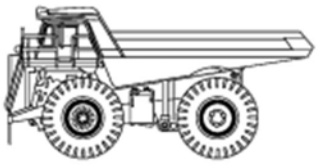
All prices shown in US dollars ($)

Custom Cost Evaluator

October 5, 2021

Komatsu HD1500-5 (disc. 2008)
Mechanical Drive Rear Dumps

Size Class:
105 - 139 MTons
Weight:
221481 lbs



Configuration for HD1500-5 (disc. 2008)

Power Mode **Diesel** Rated Payload **136.0 mt**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $56.76/hr	USD $53.45/hr	-5.8%
Cost of Facilities Capital (CFC)	USD $2.78/hr	USD $3.57/hr	+28.2%
Overhead	USD $17.37/hr	USD $22.84/hr	+31.5%
Overhaul Labor	USD $26.86/hr	USD $13.37/hr	-50.2%
Overhaul Parts	USD $14.33/hr	USD $18.84/hr	+31.5%
Total Hourly Ownership Cost:	**USD $118.10/hr**	**USD $112.06/hr**	**-5.1%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (2,643hrs -> 2,010hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $15.52/hr	USD $7.72/hr	-50.2%
Field Parts	USD $6.08/hr	USD $1.33/hr	-78.1%
Ground Engaging Component (GEC)	USD $0.00/hr	-	-
Tire	USD $18.78/hr	-	-
Electrical/Fuel	USD $90.56/hr	USD $26.86/hr	-70.3%
Lube	USD $19.76/hr	-	-
Total Operating Ownership Cost:	**USD $150.70/hr**	**USD $74.45/hr**	**-50.6%**

User Defined Adjustments: Fuel (USD $3.37 -> USD $1.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $2,676 50 -> USD $0.00) Annual Field Repair Parts Cost (USD $13,382.50 -> USD $2,676.50)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $118.10/hr	USD $112.06/hr	-5.1%
Hourly Operating Costs	USD $150.70/hr	USD $74.45/hr	-50.6%
Total Hourly Cost	**USD $268.80**	**USD $186.51/hr**	**-30.6%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $76.91/hr	USD $79.85/hr	+3.8%
Idle	USD $208.66/hr	USD $138.92/hr	-33.4%

Revised Date: 4th quarter 2021

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All prices shown in US dollars ($)

AED Green Book®

October 5, 2021

Miscellaneous 42 X 60' - 516
Triple Deck Portable Screening Plants

Size Class:
37 & Over
Weight:
26300 lbs

Configuration for 42 X 60' - 516

Conveyor Size	**42' X 60'**	Horsepower	**75.0**
Power Mode	**Electric**	Screen Size	**5' X 16'**

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $16,532.00	USD $5,512.00	USD $1,808.00
Adjustments			
Region (New Mexico: 108%)	USD $1,340.04	USD $446.79	USD $146.55
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $17,872.04**	**USD $5,958.79**	**USD $1,954.55**

Date Last Updated: Jun 01, 2021

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AED Green Book®

October 5, 2021

Miscellaneous 42 X 60' - 516
Single Deck Portable Screening Plants

Size Class:
37 & Over
Weight:
22200 lbs

Configuration for 42 X 60' - 516

Conveyor Size	**42' X 60'**	Horsepower	**75.0**
Power Mode	**Electric**	Screen Size	**5' X 16'**

AED Rental Rates

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	Monthly	Weekly	Daily
Published Rates	USD $11,400.00	USD $3,800.00	USD $1,200.00
Adjustments			
Region (New Mexico: 102%)	USD $225.00	USD $75.00	USD $23.68
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $11,625.00**	**USD $3,875.00**	**USD $1,223.68**

Date Last Updated: Jun 01, 2021

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All prices shown in US dollars ($)

Custom Cost Evaluator

October 5, 2021

Miscellaneous 42 X 60' - 516
Triple Deck Portable Screening Plants

Size Class:
37 & Over
Weight:
27900 lbs

Configuration for 42 X 60' - 516

Conveyor Size	**42' X 60'**	Horsepower	**110.0**
Power Mode	**Diesel**	Screen Size	**5' X 16'**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $10.18/hr	USD $9.62/hr	-5.5%
Cost of Facilities Capital (CFC)	USD $0.53/hr	USD $0.44/hr	-17.6%
Overhead	USD $3.52/hr	USD $2.84/hr	-19.4%
Overhaul Labor	USD $13.99/hr	USD $4.26/hr	-69.5%
Overhaul Parts	USD $7.56/hr	USD $6.09/hr	-19.4%
Total Hourly Ownership Cost:	**USD $35.78/hr**	**USD $23.25/hr**	**-35%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (1,250hrs -> 1,551hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $15.65/hr	USD $4.77/hr	-69.5%
Field Parts	USD $7.23/hr	USD $1.16/hr	-83.9%
Ground Engaging Component (GEC)	USD $0.00/hr	-	-
Tire	USD $0.37/hr	-	-
Electrical/Fuel	USD $16.36/hr	USD $4.85/hr	-70.3%
Lube	USD $2.43/hr	-	-
Total Operating Ownership Cost:	**USD $42.03/hr**	**USD $13.58/hr**	**-67.7%**

User Defined Adjustments: Fuel (USD $3.37 -> USD $1.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $1,806 29 -> USD $0.00) Annual Field Repair Parts Cost (USD $7,225.16 -> USD $1,806.29)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $35.78/hr	USD $23.25/hr	-35%
Hourly Operating Costs	USD $42.03/hr	USD $13.58/hr	-67.7%
Total Hourly Cost	**USD $77.80**	**USD $36.84/hr**	**-52.7%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $14.23/hr	USD $12.90/hr	-9.4%
Idle	USD $52.13/hr	USD $28.10/hr	-46.1%

Revised Date: 4th quarter 2021

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AED Green Book®

October 5, 2021

Miscellaneous 48 X 60' - 516
Double Deck Portable Screening Plants

Size Class:
37 & Over
Weight:
24800 lbs

Configuration for 48 X 60' - 516

Conveyor Size	**48' X 60'**	Horsepower	**100.0**
Power Mode	**Electric**	Screen Size	**5' X 16'**

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $11,594.00	USD $3,865.00	USD $1,247.00
Adjustments			
Region (New Mexico: 110%)	USD $1,103.08	USD $367.72	USD $118.64
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $12,697.08**	**USD $4,232.72**	**USD $1,365.64**

Date Last Updated: Jun 01, 2021

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All prices shown in US dollars ($)

AED Green Book®

October 5, 2021

Miscellaneous 48 X 60' - 516
Single Deck Portable Screening Plants

Size Class:
37 & Over
Weight:
23300 lbs

Configuration for 48 X 60' - 516

Conveyor Size	**48' X 60'**	Horsepower	**100.0**
Power Mode	**Electric**	Screen Size	**5' X 16'**

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $11,400.00	USD $3,800.00	USD $1,200.00
Adjustments			
Region (New Mexico: 102%)	USD $225.00	USD $75.00	USD $23.68
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $11,625.00**	**USD $3,875.00**	**USD $1,223.68**

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AED Green Book®

October 5, 2021

Miscellaneous 48 X 60' - 516
Triple Deck Portable Screening Plants

Size Class:
37 & Over
Weight:
27400 lbs

Configuration for 48 X 60' - 516

Conveyor Size	**48' X 60'**	Horsepower	**100.0**
Power Mode	**Electric**	Screen Size	**5' X 16'**

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $16,532.00	USD $5,512.00	USD $1,808.00
Adjustments			
Region (New Mexico: 108%)	USD $1,340.04	USD $446.79	USD $146.55
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $17,872.04**	**USD $5,958.79**	**USD $1,954.55**

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All prices shown in US dollars ($)

Custom Cost Evaluator

October 5, 2021

Miscellaneous 48 X 60' - 516
Single Deck Portable Screening Plants

Size Class:
37 & Over
Weight:
24900 lbs

Configuration for 48 X 60' - 516

Conveyor Size	**48' X 60'**	Horsepower	**110.0**
Power Mode	**Diesel**	Screen Size	**5' X 16'**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $10.30/hr	USD $9.74/hr	-5.5%
Cost of Facilities Capital (CFC)	USD $0.63/hr	USD $0.43/hr	-31.4%
Overhead	USD $4.25/hr	USD $2.80/hr	-34%
Overhaul Labor	USD $16.32/hr	USD $4.07/hr	-75%
Overhaul Parts	USD $9.26/hr	USD $6.11/hr	-34%
Total Hourly Ownership Cost:	**USD $40.76/hr**	**USD $23.16/hr**	**-43.2%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (1,025hrs -> 1,553hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $18.47/hr	USD $4.61/hr	-75%
Field Parts	USD $8.60/hr	USD $1.14/hr	-86.8%
Ground Engaging Component (GEC)	USD $0.00/hr	-	-
Tire	USD $0.39/hr	-	-
Electrical/Fuel	USD $16.36/hr	USD $4.85/hr	-70.3%
Lube	USD $2.42/hr	-	-
Total Operating Ownership Cost:	**USD $46.24/hr**	**USD $13.41/hr**	**-71%**

User Defined Adjustments: Fuel (USD $3.37 -> USD $1.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $1,763.65 -> USD $0.00) Annual Field Repair Parts Cost (USD $7,054.61 -> USD $1,763.65)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $40.76/hr	USD $23.16/hr	-43.2%
Hourly Operating Costs	USD $46.24/hr	USD $13.41/hr	-71%
Total Hourly Cost	**USD $87.00**	**USD $36.57/hr**	**-58%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $15.18/hr	USD $12.97/hr	-14.5%
Idle	USD $57.12/hr	USD $28.01/hr	-51%

Revised Date: 4th quarter 2021

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EquipmentWatch

www.equipmentwatch.com

All prices shown in US dollars ($)

Custom Cost Evaluator

October 5, 2021

Miscellaneous 48 X 60' - 516
Double Deck Portable Screening Plants

Size Class:
37 & Over
Weight:
26400 lbs

Configuration for 48 X 60' - 516

Conveyor Size	**48' X 60'**	Horsepower	**110.0**
Power Mode	**Diesel**	Screen Size	**5' X 16'**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $12.69/hr	USD $11.99/hr	-5.5%
Cost of Facilities Capital (CFC)	USD $0.80/hr	USD $0.45/hr	-43.3%
Overhead	USD $5.39/hr	USD $2.86/hr	-46.9%
Overhaul Labor	USD $20.65/hr	USD $4.15/hr	-79.9%
Overhaul Parts	USD $11.68/hr	USD $6.21/hr	-46.9%
Total Hourly Ownership Cost:	**USD $51.21/hr**	**USD $25.67/hr**	**-49.9%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (825hrs -> 1,553hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $22.95/hr	USD $4.61/hr	-79.9%
Field Parts	USD $10.79/hr	USD $1.15/hr	-89.4%
Ground Engaging Component (GEC)	USD $0.00/hr	-	-
Tire	USD $0.40/hr	-	-
Electrical/Fuel	USD $16.36/hr	USD $4.85/hr	-70.3%
Lube	USD $2.44/hr	-	-
Total Operating Ownership Cost:	**USD $52.93/hr**	**USD $13.44/hr**	**-74.6%**

User Defined Adjustments: Fuel (USD $3.37 -> USD $1.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $1,780.71 -> USD $0.00) Annual Field Repair Parts Cost (USD $7,122.85 -> USD $1,780.71)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $51.21/hr	USD $25.67/hr	-49.9%
Hourly Operating Costs	USD $52.93/hr	USD $13.44/hr	-74.6%
Total Hourly Cost	**USD $104.15**	**USD $39.11/hr**	**-62.4%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $18.88/hr	USD $15.31/hr	-18.9%
Idle	USD $67.57/hr	USD $30.52/hr	-54.8%

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Custom Cost Evaluator

October 5, 2021

Miscellaneous 48 X 60' - 516
Triple Deck Portable Screening Plants

Size Class:
37 & Over
Weight:
29000 lbs

Configuration for 48 X 60' - 516

Conveyor Size	**48' X 60'**	Horsepower	**110.0**
Power Mode	**Diesel**	Screen Size	**5' X 16'**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $10.88/hr	USD $10.28/hr	-5.5%
Cost of Facilities Capital (CFC)	USD $0.57/hr	USD $0.47/hr	-17.6%
Overhead	USD $3.76/hr	USD $3.03/hr	-19.4%
Overhaul Labor	USD $13.99/hr	USD $4.26/hr	-69.5%
Overhaul Parts	USD $8.08/hr	USD $6.51/hr	-19.4%
Total Hourly Ownership Cost:	**USD $37.27/hr**	**USD $24.55/hr**	**-34.1%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (1,250hrs -> 1,551hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $15.65/hr	USD $4.77/hr	-69.5%
Field Parts	USD $7.72/hr	USD $1.24/hr	-83.9%
Ground Engaging Component (GEC)	USD $0.00/hr	-	-
Tire	USD $0.39/hr	-	-
Electrical/Fuel	USD $16.36/hr	USD $4.85/hr	-70.3%
Lube	USD $2.48/hr	-	-
Total Operating Ownership Cost:	**USD $42.60/hr**	**USD $13.74/hr**	**-67.7%**

User Defined Adjustments: Fuel (USD $3.37 -> USD $1.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $1,929.86 -> USD $0.00) Annual Field Repair Parts Cost (USD $7,719.43 -> USD $1,929.86)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $37.27/hr	USD $24.55/hr	-34.1%
Hourly Operating Costs	USD $42.60/hr	USD $13.74/hr	-67.7%
Total Hourly Cost	**USD $79.87**	**USD $38.29/hr**	**-52.1%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $15.21/hr	USD $13.78/hr	-9.4%
Idle	USD $53.62/hr	USD $29.40/hr	-45.2%

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AED Green Book®

October 5, 2021

Miscellaneous 6000 330
Off-Highway Water Tanker Trucks

Size Class:
300 - 399 HP
Weight:
54400 lbs

Configuration for 6000 330

Horsepower	**330.0**	Power Mode	**Diesel**
Tank Capacity	**6000.0 gal**		

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $9,220.00	USD $3,256.00	USD $1,233.00
Adjustments			
Region (New Mexico: 101%)	USD $117.26	USD $41.41	USD $15.68
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $9,337.26**	**USD $3,297.41**	**USD $1,248.68**

Date Last Updated: Jun 01, 2021

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All prices shown in US dollars ($)

Custom Cost Evaluator

October 5, 2021

Miscellaneous 6000 330
Off-Highway Water Tanker Trucks

Size Class:
300 - 399 HP
Weight:
54400 lbs

Configuration for 6000 330

Horsepower	**330.0**	Power Mode	**Diesel**
Tank Capacity	**6000.0 gal**		

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $22.91/hr	USD $21.43/hr	-6.5%
Cost of Facilities Capital (CFC)	USD $1.71/hr	USD $1.24/hr	-27.4%
Overhead	USD $8.60/hr	USD $6.06/hr	-29.5%
Overhaul Labor	USD $11.38/hr	USD $3.04/hr	-73.3%
Overhaul Parts	USD $6.88/hr	USD $4.85/hr	-29.5%
Total Hourly Ownership Cost:	**USD $51.49/hr**	**USD $36.62/hr**	**-28.9%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (1,275hrs -> 1,809hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $27.97/hr	USD $7.46/hr	-73.3%
Field Parts	USD $12.57/hr	USD $1.48/hr	-88.3%
Ground Engaging Component (GEC)	USD $0.00/hr	-	-
Tire	USD $6.42/hr	-	-
Electrical/Fuel	USD $37.95/hr	USD $11.25/hr	-70.3%
Lube	USD $6.26/hr	-	-
Total Operating Ownership Cost:	**USD $91.17/hr**	**USD $32.88/hr**	**-63.9%**

User Defined Adjustments: Fuel (USD $3.37 -> USD $1.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $2,671 74 -> USD $0.00) Annual Field Repair Parts Cost (USD $13,358.67 -> USD $2,671.74)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $51.49/hr	USD $36.62/hr	-28.9%
Hourly Operating Costs	USD $91.17/hr	USD $32.88/hr	-63.9%
Total Hourly Cost	**USD $142.66**	**USD $69.49/hr**	**-51.3%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $33.22/hr	USD $28.73/hr	-13.5%
Idle	USD $89.43/hr	USD $47.87/hr	-46.5%

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AED Green Book®

October 5, 2021

Miscellaneous 10000 450
Off-Highway Water Tanker Trucks

Size Class:
400 - 499 HP
Weight:
82200 lbs

Configuration for 10000 450

Horsepower	**450.0**	Power Mode	**Diesel**
Tank Capacity	**10000.0 gal**		

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $13,290.00	USD $4,830.00	USD $1,450.00
Adjustments			
Region (New Mexico: 101%)	USD $169.02	USD $61.43	USD $18.44
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $13,459.02**	**USD $4,891.43**	**USD $1,468.44**

Date Last Updated: Jun 01, 2021

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All prices shown in US dollars ($)

Custom Cost Evaluator

October 5, 2021

Miscellaneous 10000 450
Off-Highway Water Tanker Trucks

Size Class:
400 - 499 HP
Weight:
82200 lbs

Configuration for 10000 450

Horsepower	**450.0**	Power Mode	**Diesel**
Tank Capacity	**10000.0 gal**		

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $37.32/hr	USD $34.91/hr	-6.5%
Cost of Facilities Capital (CFC)	USD $3.05/hr	USD $2.04/hr	-33.3%
Overhead	USD $15.47/hr	USD $9.97/hr	-35.6%
Overhaul Labor	USD $18.03/hr	USD $4.40/hr	-75.6%
Overhaul Parts	USD $11.71/hr	USD $7.55/hr	-35.6%
Total Hourly Ownership Cost:	**USD $85.58/hr**	**USD $58.85/hr**	**-31.2%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (1,155hrs -> 1,793hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $43.71/hr	USD $10.65/hr	-75.6%
Field Parts	USD $22.61/hr	USD $2.43/hr	-89.3%
Ground Engaging Component (GEC)	USD $0.00/hr	-	-
Tire	USD $10.47/hr	-	-
Electrical/Fuel	USD $51.74/hr	USD $15.35/hr	-70.3%
Lube	USD $9.19/hr	-	-
Total Operating Ownership Cost:	**USD $137.73/hr**	**USD $48.09/hr**	**-65.1%**

User Defined Adjustments: Fuel (USD $3.37 -> USD $1.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $4,352.35 -> USD $0.00) Annual Field Repair Parts Cost (USD $21,761.77 -> USD $4,352.35)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $85.58/hr	USD $58.85/hr	-31.2%
Hourly Operating Costs	USD $137.73/hr	USD $48.09/hr	-65.1%
Total Hourly Cost	**USD $223.31**	**USD $106.94/hr**	**-52.1%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $55.84/hr	USD $46.91/hr	-16%
Idle	USD $137.33/hr	USD $74.19/hr	-46%

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Custom Cost Evaluator

October 5, 2021

Miscellaneous MSR-189H
Crawler Tractor Multi-Shank Rippers

Size Class:
To 260 HP
Weight:
3557 lbs

Configuration for MSR-189H

Number Of Shanks	**3.0**	Ripper Type	**Parallelogram**
Power Mode	**Hydraulic**		

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $2.64/hr	USD $2.50/hr	-5.1%
Cost of Facilities Capital (CFC)	USD $0.10/hr	USD $0.08/hr	-18.5%
Overhead	USD $0.66/hr	USD $0.52/hr	-21.1%
Overhaul Labor	USD $1.18/hr	USD $0.35/hr	-70.2%
Overhaul Parts	USD $0.95/hr	USD $0.75/hr	-21.1%
Total Hourly Ownership Cost:	**USD $5.52/hr**	**USD $4.20/hr**	**-23.9%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (1,285hrs -> 1,629hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $1.96/hr	USD $0.59/hr	-70.2%
Field Parts	USD $1.18/hr	USD $0.93/hr	-21.1%
Ground Engaging Component (GEC)	USD $0.99/hr	USD $0.00/hr	-100%
Tire	USD $0.00/hr	-	-
Electrical/Fuel	USD $0.00/hr	-	-
Lube	USD $0.15/hr	-	-
Total Operating Ownership Cost:	**USD $4.28/hr**	**USD $1.67/hr**	**-61.1%**

User Defined Adjustments: Annual Ground Engaging Component (USD $1,268.17 -> USD $0.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $253.63 -> USD $0.00) Annual Field Repair Parts Cost (USD $1,268.17 -> USD $1,521.81)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $5.52/hr	USD $4.20/hr	-23.9%
Hourly Operating Costs	USD $4.28/hr	USD $1.67/hr	-61.1%
Total Hourly Cost	**USD $9.81**	**USD $5.87/hr**	**-40.1%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $3.40/hr	USD $3.10/hr	-8.6%
Idle	USD $5.52/hr	USD $4.20/hr	-23.9%

Revised Date: 4th quarter 2021

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All prices shown in US dollars ($)

Rental Rate Blue Book®

October 5, 2021

Miscellaneous MSR-189H
Crawler Tractor Multi-Shank Rippers

Size Class:
To 260 HP
Weight:
3557 lbs

Configuration for MSR-189H

Number Of Shanks	**3.0**	Ripper Type	**Parallelogram**
Power Mode	**Hydraulic**		

Blue Book Rates

Non-current (i.e. archived) rates: Jan 1, 2019 - Jun 30, 2019
** FHWA Rate is equal to the monthly ownership cost divided by 176 plus the hourly estimated operating cost.

	Ownership Costs				Estimated Operating Costs	FHWA Rate**
	Monthly	**Weekly**	**Daily**	**Hourly**	**Hourly**	**Hourly**
Published Rates	USD $1,010.00	USD $285.00	USD $71.00	USD $11.00	USD $4.15	USD $9.89
Adjustments						
Region (Las Cruces, New Mexico: 89%)	(USD $111.10)	(USD $31.35)	(USD $7.81)	(USD $1.21)		
Model Year (2021: 100%)	-	-	-	-		
Adjusted Hourly Ownership Cost (100%)	-	-	-	-		
Hourly Operating Cost (100%)					-	
Total:	**USD $898.90**	**USD $253.65**	**USD $63.19**	**USD $9.79**	**USD $4.15**	**USD $9.26**

Non-Active Use Rates	**Hourly**
Standby Rate	USD $3.52
Idling Rate	USD $5.11

Rate Element Allocation

Element	**Percentage**	**Value**
Depreciation (ownership)	50%	USD $505.00/mo
Overhaul (ownership)	31%	USD $313.10/mo
CFC (ownership)	7%	USD $70.70/mo
Indirect (ownership)	12%	USD $121.20/mo

Fuel cost data is not available for these rates.

Revised Date: 1st half 2019

These are the most accurate rates for the selected Revision Date(s). However, due to more frequent online updates, these rates may not match Rental Rate Blue Book Print. Visit the Cost Recovery Product Guide on our Help page for more information.

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All prices shown in US dollars ($)

Custom Cost Evaluator

October 5, 2021

Miscellaneous MSR-359H
Crawler Tractor Multi-Shank Rippers

Size Class:
260 HP & Over
Weight:
N/A

Configuration for MSR-359H

Number Of Shanks	**3.0**	Ripper Type	**Parallelogram**
Power Mode	**Hydraulic**		

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $7.23/hr	USD $6.86/hr	-5.1%
Cost of Facilities Capital (CFC)	USD $0.24/hr	USD $0.20/hr	-18.2%
Overhead	USD $1.68/hr	USD $1.33/hr	-20.8%
Overhaul Labor	USD $2.95/hr	USD $0.88/hr	-70%
Overhaul Parts	USD $2.35/hr	USD $1.86/hr	-20.8%
Total Hourly Ownership Cost:	**USD $14.45/hr**	**USD $11.13/hr**	**-23%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (1,285hrs -> 1,623hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $5.40/hr	USD $1.62/hr	-70%
Field Parts	USD $2.37/hr	USD $1.87/hr	-20.8%
Ground Engaging Component (GEC)	USD $1.97/hr	USD $0.00/hr	-100%
Tire	USD $0.00/hr	-	-
Electrical/Fuel	USD $0.00/hr	-	-
Lube	USD $0.37/hr	-	-
Total Operating Ownership Cost:	**USD $10.12/hr**	**USD $3.87/hr**	**-61.8%**

User Defined Adjustments: Annual Ground Engaging Component (USD $2,534.87 -> USD $0.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $506.97 -> USD $0.00) Annual Field Repair Parts Cost (USD $2,534.87 -> USD $3,041.85)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $14.45/hr	USD $11.13/hr	-23%
Hourly Operating Costs	USD $10.12/hr	USD $3.87/hr	-61.8%
Total Hourly Cost	**USD $24.56**	**USD $15.00/hr**	**-38.9%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $9.15/hr	USD $8.39/hr	-8.3%
Idle	USD $14.45/hr	USD $11.13/hr	-23%

Revised Date: 4th quarter 2021

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Rental Rate Blue Book®

October 5, 2021

Miscellaneous MSR-359H
Crawler Tractor Multi-Shank Rippers

Size Class:
260 HP & Over
Weight:
N/A

Configuration for MSR-359H

Number Of Shanks	**3.0**	Ripper Type	**Parallelogram**
Power Mode	**Hydraulic**		

Blue Book Rates

Non-current (i.e. archived) rates: Jan 1, 2019 - Jun 30, 2019
** FHWA Rate is equal to the monthly ownership cost divided by 176 plus the hourly estimated operating cost.

	Ownership Costs				Estimated Operating Costs	FHWA Rate**
	Monthly	**Weekly**	**Daily**	**Hourly**	**Hourly**	**Hourly**
Published Rates	USD $2,635.00	USD $740.00	USD $185.00	USD $28.00	USD $9.75	USD $24.72
Adjustments						
Region (Las Cruces, New Mexico: 89%)	(USD $289.85)	(USD $81.40)	(USD $20.35)	(USD $3.08)		
Model Year (2021: 100%)	-	-	-	-		
Adjusted Hourly Ownership Cost (100%)	-	-	-	-		
Hourly Operating Cost (100%)					-	
Total:	**USD $2,345.15**	**USD $658.60**	**USD $164.65**	**USD $24.92**	**USD $9.75**	**USD $23.07**

Non-Active Use Rates	**Hourly**
Standby Rate	USD $9.19
Idling Rate	USD $13.32

Rate Element Allocation

Element	**Percentage**	**Value**
Depreciation (ownership)	50%	USD $1,317.50/mo
Overhaul (ownership)	31%	USD $816.85/mo
CFC (ownership)	7%	USD $184.45/mo
Indirect (ownership)	12%	USD $316.20/mo

Fuel cost data is not available for these rates.

Revised Date: 1st half 2019

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All prices shown in US dollars ($)

Spec Finder

January 8, 2021

Caterpillar 319D L (disc. 2012)

Crawler Mounted Hydraulic Excavators

Size Class:
19.1 - 21.0 MTons
Weight:
19.9 lbs

Specifications

Boom, Bucket, Loader, Platform, and Stick	
Boom Length	209.0 ft
Boom Type	1-Piece
Bucket Capacity	1.0 cu yd
Bucket Capacity Range	0.59 cu yd
Bucket Digging Force-Standard	18142.0 lbf
Bucket Type	Heavy Duty
Bucket Width	36.0 in
Stick Length	126.0 in
Engine	
Displacement	259.0 cid
Engine	C4.2
Engine Manufacturer	Caterpillar
Gross Horsepower	131.0 hp
Horsepower	125.0 hp
Power Mode	Diesel
Fluid Capacities	
Fuel Tank Capacity	79.3 gal
Hydraulic Tank Capacity	28.0 gal
Hydraulics	
Main Pump - Maximum Flow	100.1 gal/min
Standard Relief Pressure	5076.0 psi
Performance	
Front Lift Capy @ 20' G.L.	13000.0 lbs
Maximum Drawbar Pull	46466.0 lbs
Maximum Swing Speed	11.1 rpm
Side Lift Capy @ 20' G.L.	6700.0 lbs
Stick Digging Force - Standard	18142.0 lbs
Travel Speed - High	3.0 mph
Undercarriage	
Ground Pressure	5.1 psi
No. of Lower/Track Rollers	7.0
No. of Upper/Carrier Rollers	2.0
Track Gauge	87.0 in
Track Length	175.0 in
Track Shoe Width	28.0 in
Weights & Dimensions	
Digging Depth (8' Flat Bottom)	265.0 in
Maximum Digging Depth	271.0 in
Maximum Dumping Height	269.0 in
Maximum Reach at Ground Level	380.0 in
Operating Weight	19.9 lbs
Overall Height	139.0 in
Overall Length	345.0 in
Overall Track Width--Retracted	114.0 in
Overall Width	114.0 in
Tail Swing Radius	98.0 in
Undercarriage Ground Clearance	17.0 in

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Spec Finder

January 8, 2021

Caterpillar 725 (disc. 2014)
Articulated Rear Dumps

Size Class:
20 - 25 MTons
Weight:
N/A

Specifications

Axles & Tires	
Axle Configuration	6 X 6
Front Tire Size	23.5 R25
Rear Tire Size	23.5 R25
Dump Body	
Body Capacity	14.3 cu yd
Body Floor-Plate Thickness	0.55 in
Body Front-Plate Thickness	0.31 in
Body Sidewall Thickness	0.47 in
Dump Angle	70.0 degrees
Dump Cycle (Hoist/Raise)	10.0 sec
Dump Cycle (Power Down)	8.0 sec
Engine	
Displacement	680.0 cid
Emissions Tier	Tier 3
Engine	C11 ACERT
Engine Manufacturer	Caterpillar
Horsepower	301.0 hp
Number of Cylinders	6.0
Power Mode	Diesel
Fluid Capacities	
Fuel Tank Capacity	94.0 gal
Hydraulic System Capacity	49.0 gal
Steering	
Steering Angle	45.0 degrees
Transmission	
Maximum Speed	35.0 mph
Number of Speeds	6F/1R
Transmission	Autoshift
Transmission Manufacturer	Caterpillar
Weights & Dimensions	
Center Axle Weight (GVW)	34440.0 lbs
Front Axle Weight (GVW)	33135.0 lbs
Gross Weight	101085.0 lbs
Ground Clearance	18.0 in
Inside Turning Radius	146.0 in
Load Over Height	108.0 in
Net Weight	49075.0 lbs
Outside Turning Radius	286.0 in
Overall Machine Height	135.0 in
Overall Machine Length	389.0 in
Overall Machine Width	109.0 in
Rated Payload	23.6 mt
Rear Axle Weight (GVW)	33510.0 lbs
Wheelbase	215.0 in

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Spec Finder

January 8, 2021

Caterpillar 777F (disc. 2012)
Mechanical Drive Rear Dumps

Size Class:
90 - 104 MTons
Weight:
N/A

Specifications

Axles & Tires	
Front Tire Size	27.00 R49
Rear Tire Size	27.00 R49
Brakes	
Parking Brake	SAHR
Dump Body	
Body Capacity	54.8 cu yd
Dump Angle	49.4 degrees
Dump Cycle (Hoist/Raise)	15.0 sec
Dump Cycle (Power Down)	13.0 sec
Engine	
Displacement	1959.0 cid
Engine	CAT C32 ACERT
Engine Manufacturer	Caterpillar
Engine Torque @ RPM	4716Nm@-- ft-lb
Gross Horsepower	1016.0 hp
Horsepower	938.0 hp
Number of Cylinders	12.0
Power Mode	Diesel
Rated RPM	1750.0 rpm
Fluid Capacities	
Fuel Tank Capacity	300.0 gal
Hydraulic System Capacity	50.0 gal
Transmission	
Maximum Speed	40.1 mph
Number of Speeds	7F/1R
Transmission	Powershift
Transmission Manufacturer	Caterpillar
Weights & Dimensions	
Gross Weight	360000.0 lbs
Ground Clearance	35.0 in
Inside Turning Diameter	996.0 in
Load Over Height	172.0 in
Maximum Payload	90.7 mt
Overall Machine Height	204.0 in
Overall Machine Length	415.0 in
Overall Machine Width	238.0 in
Rated Payload	90.7 mt
Wheelbase	180.0 in

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Spec Finder

January 8, 2021

Hitachi EX3600-5 (disc. 2009)
Hydraulic Shovels

Size Class:
150.1 MTons & Over
Weight:
350.0 lbs

Specifications

Boom, Bucket, Loader, Platform, and Stick	
Boom Length	311.0 ft
Bucket Capacity	27.4 cu yd
Bucket Digging Force-Standard	254000.0 lbf
Bucket Type	Bottom Dump
Bucket Width	155.0 in
Engine	
Displacement	3990.0 cid
Engine	S16R-TAA
Engine Manufacturer	Hitachi
Gross Horsepower	1880.0 hp
Horsepower	1880.0 hp
Number of Cylinders	16.0
Power Mode	Diesel
Rated RPM	1600.0 rpm
Fluid Capacities	
Fuel Tank Capacity	1900.0 gal
Hydraulics	
Hydraulic Pumps - Type	Piston
Main Pump - Maximum Flow	1056.0 gal/min
Standard Relief Pressure	4270.0 psi
Performance	
Maximum Drawbar Pull	395700.0 lbs
Maximum Swing Speed	3.2 rpm
Stick Digging Force - Standard	269000.0 lbs
Travel Speed - High	1.4 mph
Undercarriage	
Ground Pressure	26.3 psi
Track Gauge	217.0 in
Track Shoe Width	50.0 in
Weights & Dimensions	
Component Weight-Counterweight	88600.0 lbs
Height to Top of Cab	305.0 in
Length of Track on Ground	262.0 in
Maximum Digging Depth	154.0 in
Maximum Dumping Height	433.0 in
Maximum Reach at Ground Level	599.0 in
Operating Weight	350.0 lbs
Overall Track Width--Retracted	267.0 in
Tail Swing Radius	262.0 in
Track Length	342.0 in
Undercarriage Ground Clearance	36.0 in
Upperstructure Width	355.0 in

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Spec Finder

January 8, 2021

Komatsu 730E

Electric Drive Rear Dumps

Size Class:
170 - 199 MTons
Weight:
N/A

Specifications

Axles & Tires	
Front Tire Size	37.00R57
Rear Tire Size	37.00R57
Brakes	
Elec. Dynamic Retarding (Max.)	3700.0 hp
Parking Brake	SAHR
Service Brakes - Front	Wheel Spd Disc
Service Brakes - Rear	Dual Disc
Dump Body	
Body Capacity	101.0 cu yd
Body Floor-Plate Thickness	0.75 in
Body Front-Plate Thickness	0.47 in
Body Sidewall Thickness	0.35 in
Dump Angle	45.0 degrees
Dump Cycle (Hoist/Raise)	21.0 sec
Dump Cycle (Power Down)	15.0 sec
Electric Drive	
Alternator/Generator Mfr	General Electric
Alternator/Generator Model	GTA-22
Maximum Travel Speed	34.6 mph
System Current	AC/DC
Wheel Motor Manufacturer	General Electric
Wheel Motor Model	GE788
Wheel Motor Planetary Ratio	26.825:1
Engine	
Engine	SSA16V159
Engine Manufacturer	Komatsu
Gross Horsepower	2000.0 hp
Horsepower	1860.0 hp
Number of Cylinders	16.0
Power Mode	Diesel
Rated RPM	1900.0 rpm
Fluid Capacities	
Fuel Tank Capacity	850.0 gal
Hydraulic System Capacity	193.0 gal
Weights & Dimensions	
Clearance Circle	1104.0 in
Gross Weight	715000.0 lbs
Ground Clearance	45.0 in
Height of Rear Body (Empty)	221.0 in
Height to Cab Guard - Loading	246.0 in
Maximum Payload	186.0 mt
Net Weight	309950.0 lbs
Overall Machine Length	505.0 in
Overall Machine Width	297.0 in
Rated Payload	183.7 mt
Wheelbase	232.0 in

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Spec Finder

January 8, 2021

Komatsu HD1500-5 (disc. 2008)
Mechanical Drive Rear Dumps

Size Class:
105 - 139 MTons
Weight:
N/A

Specifications

Axles & Tires	
Front Tire Size	33.00 R51
Rear Tire Size	33.00 R51 Dual
Dump Body	
Body Capacity	71.0 cu yd
Dump Cycle (Hoist/Raise)	15.0 sec
Dump Cycle (Power Down)	15.0 sec
Engine	
Displacement	2746.0 cid
Engine	SDA12V160
Engine Manufacturer	Komatsu
Engine Torque @ RPM	4285.0 ft-lb
Gross Horsepower	1486.0 hp
Horsepower	1406.0 hp
Number of Cylinders	12.0
Power Mode	Diesel
Rated RPM	1900.0 rpm
Fluid Capacities	
Fuel Tank Capacity	560.0 gal
Hydraulic System Capacity	238.0 gal
Transmission	
Maximum Speed	36.0 mph
Number of Speeds	7F/1R
Transmission	Powershift
Transmission Manufacturer	Komatsu
Weights & Dimensions	
Clearance Circle	960.0 in
Gross Weight	550000.0 lbs
Ground Clearance	35.0 in
Load Over Height	195.0 in
Maximum Payload	149.0 mt
Net Weight	221481.0 lbs
Overall Machine Height	230.0 in
Overall Machine Length	448.0 in
Overall Machine Width	261.0 in
Rated Payload	136.0 mt
Wheelbase	213.0 in

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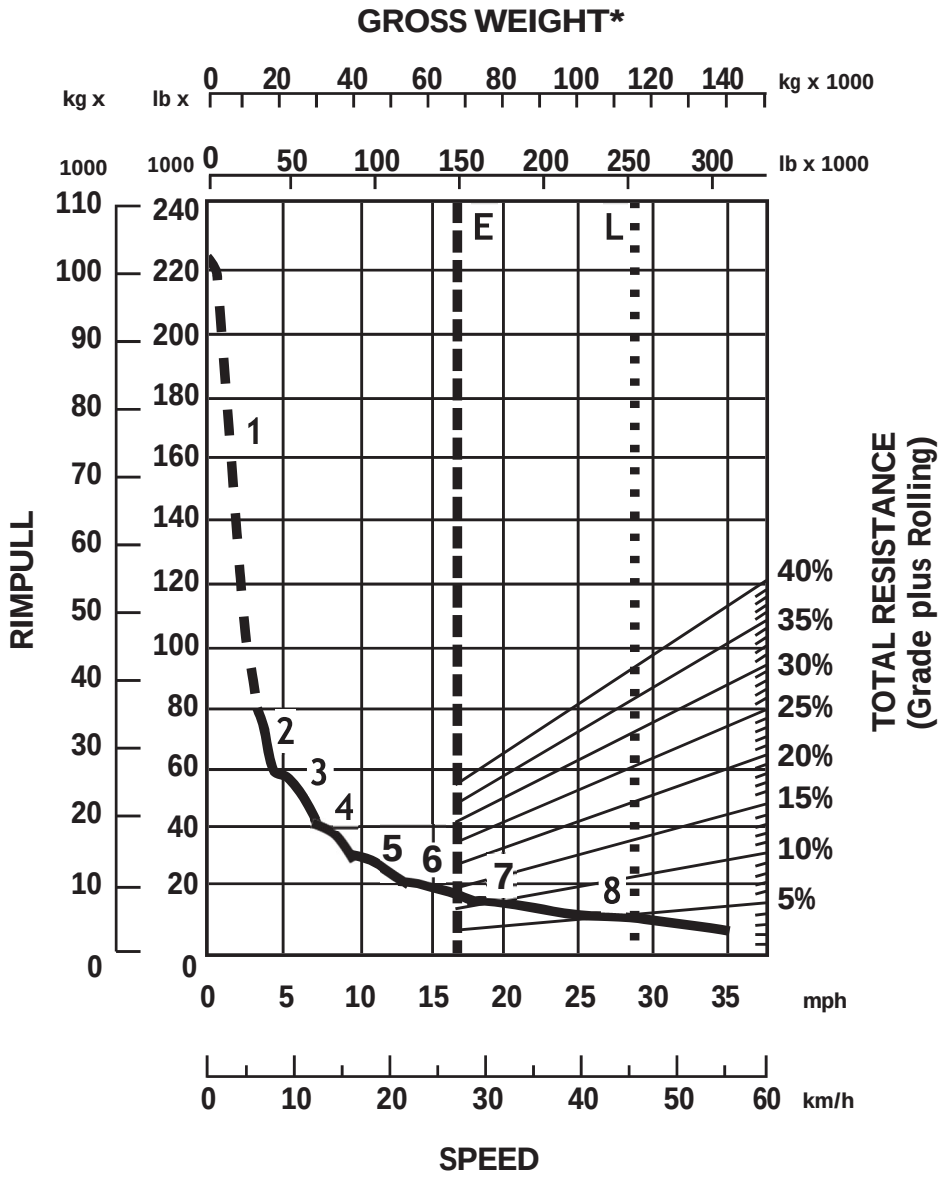
Attachment C.3
Equipment Productivity Curve Fits



*at sea level

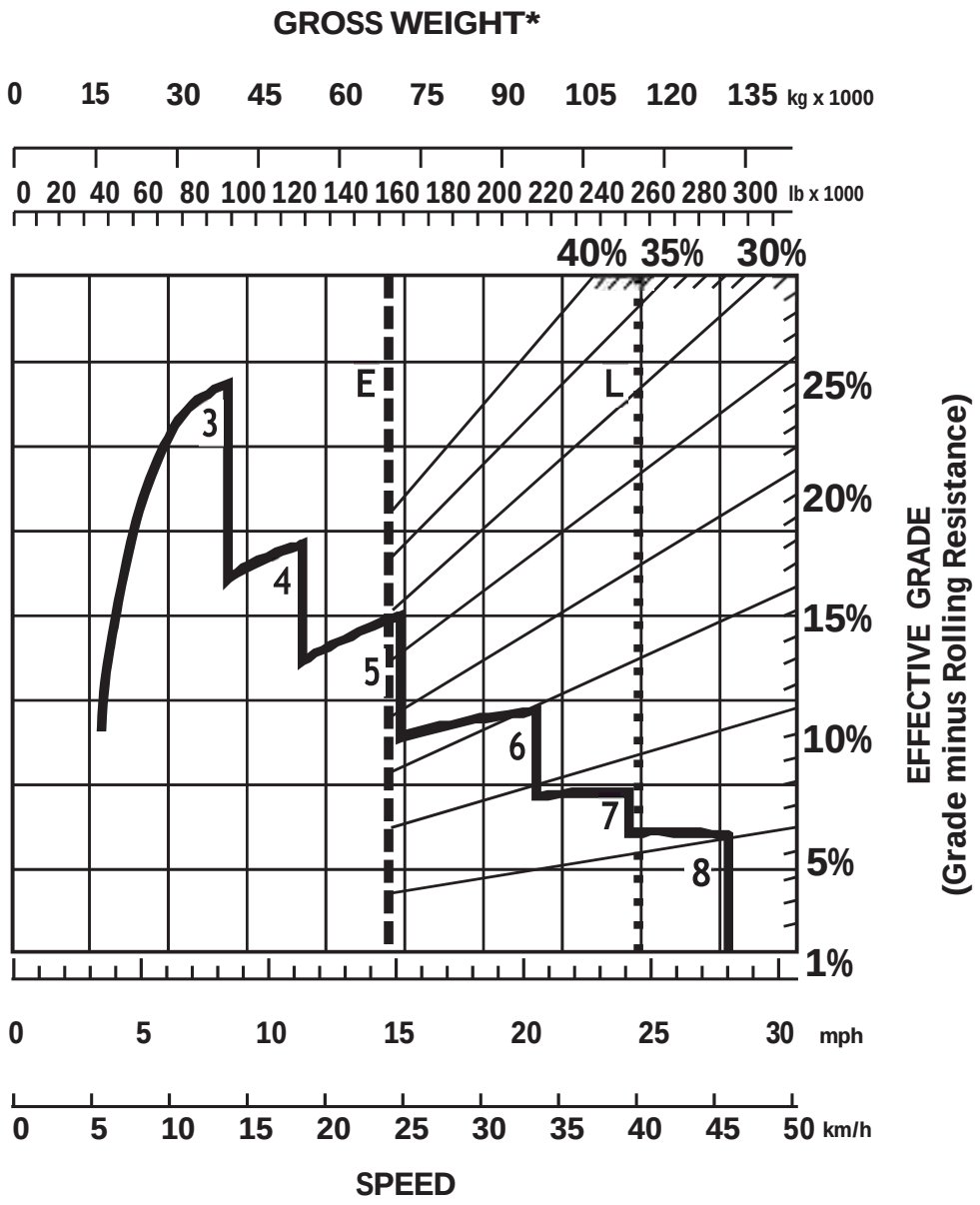
KEY

1 — 1st Gear Torque Converter Drive
2 — 2nd Gear Torque Converter Drive
3 — 3rd Gear Direct Drive
4 — 4th Gear Direct Drive
5 — 5th Gear Direct Drive

KEY

6 — 6th Gear Direct Drive 7 — 7th Gear Direct Drive 8 — 8th Gear Direct Drive

E — Empty 72 804 kg (160,505 lb)
L — Loaded 119 978 kg (264,505 lb)



*at sea level

8 — 8th Gear Direct Drive

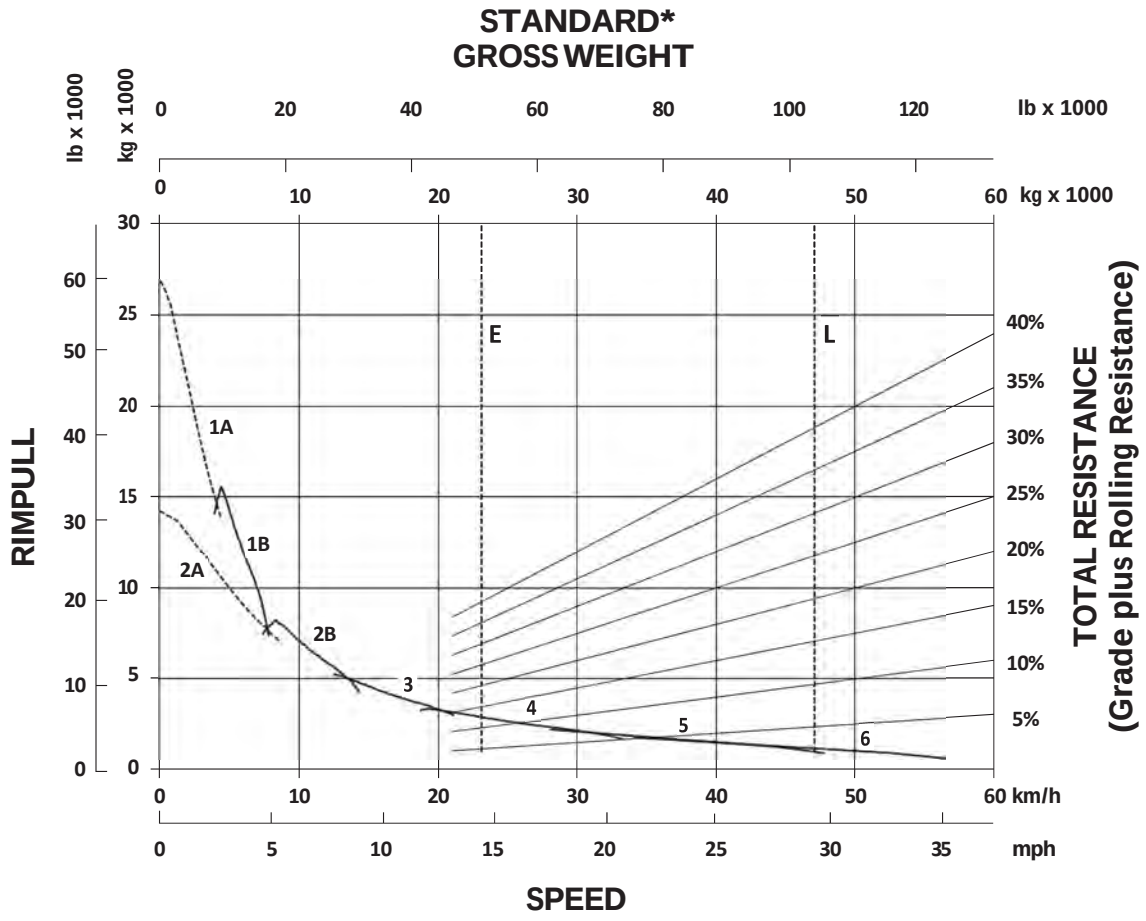
KEY

3 — 3rd Gear Direct Drive
4 — 4th Gear Direct Drive
5 — 5th Gear Direct Drive
6 — 6th Gear Direct Drive
7 — 7th Gear Direct Drive

E — Empty 72 804 kg (160,505 lb)
L — Loaded 119 978 kg (264,505 lb)

KEY

725C2 Rimpull-Speed-Gradeability
• 23.5R25 Tires
• Tier 4 Final/Stage IV/Japan 2014 (Tier 4 Final)



KEY

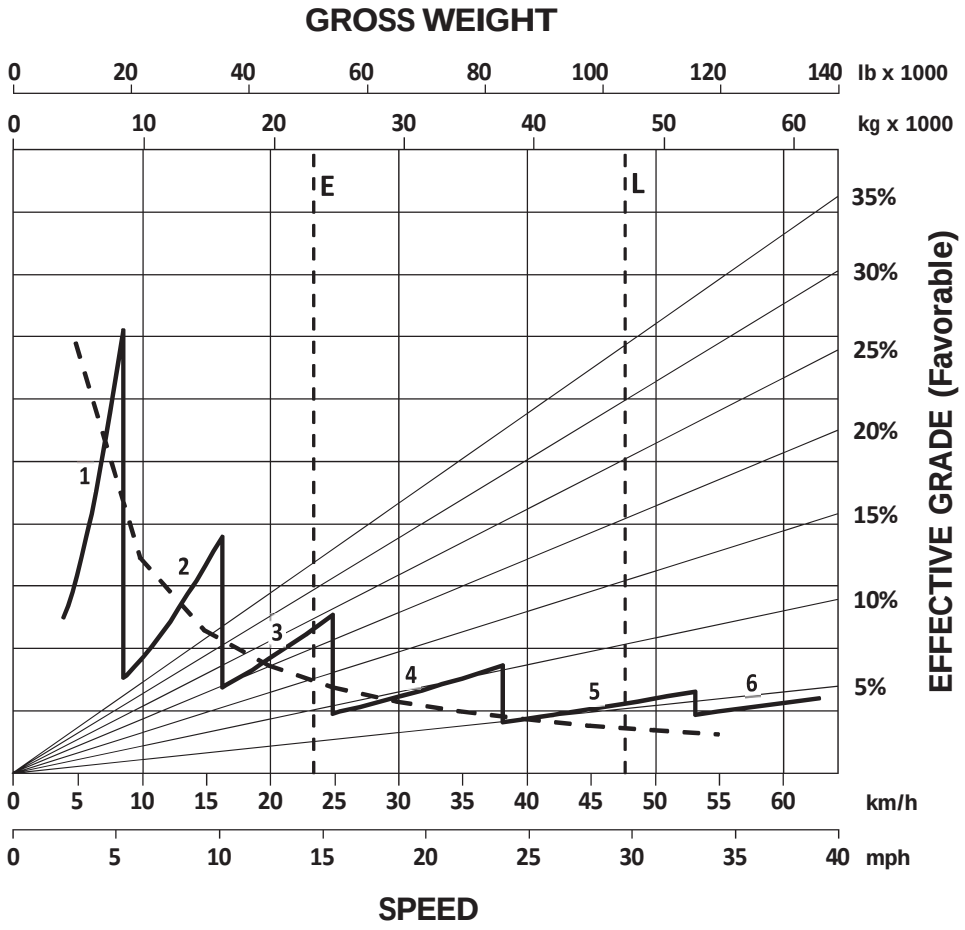
1A — 1st Gear (Converter Drive)
1B — 1st Gear (Direct Drive)
2A — 2nd Gear (Converter Drive
2B — 2nd Gear (Direct Drive)
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear

KEY

E — Empty 23 040 kg (50,795 lb)
L — Loaded 47 040 kg (103,707 lb)

*At sea level.

725C2 Brake/Retarder Performance Curve
- 23.5R25 Tires
- Tier 4 Final/Stage IV/Japan 2014 (Tier 4 Final)

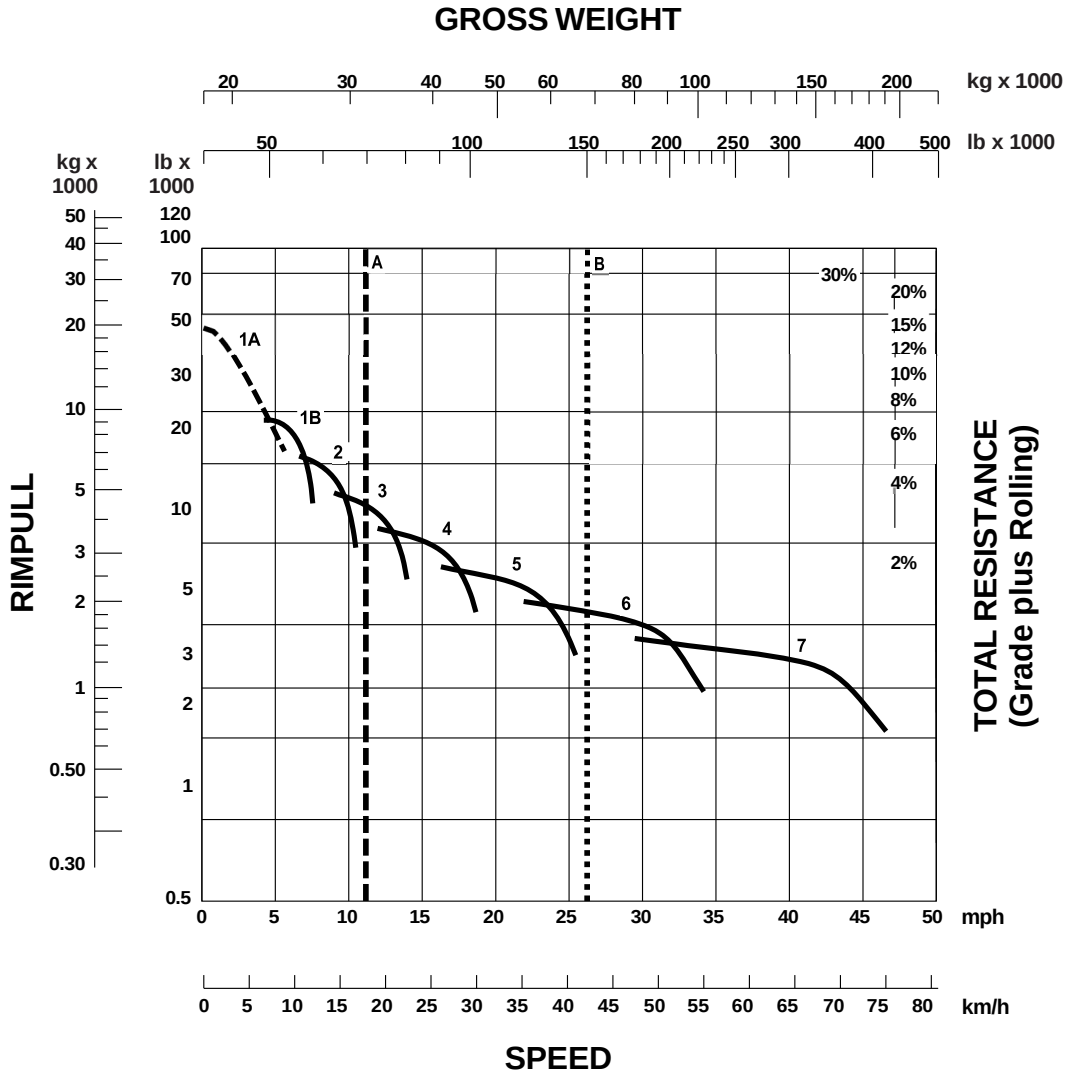


KEY

1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear

KEY

E — Empty 23 040 kg (50,795 lb)
L — Loaded 47 040 kg (103,707 lb)

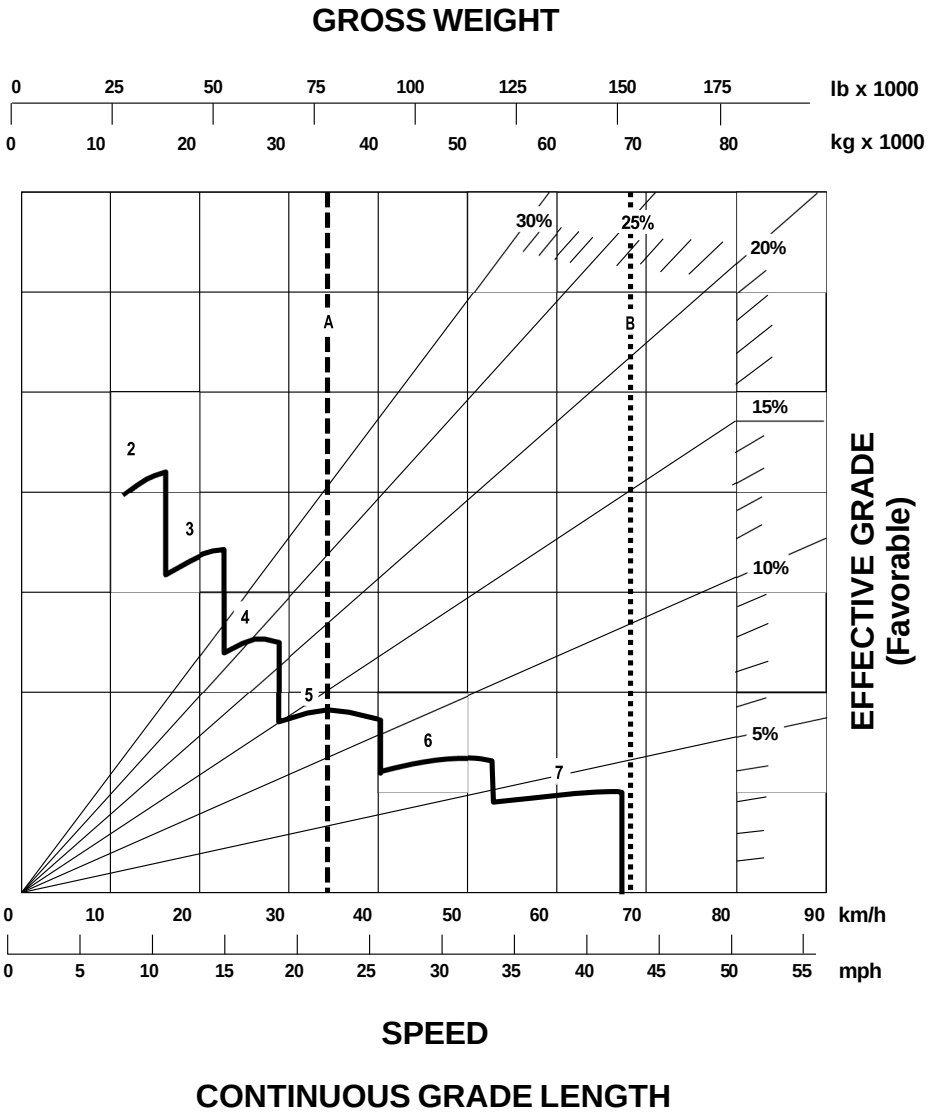


KEY

1A — 1st Gear (Torque Converter)
1B — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear
7 — 7th Gear

KEY

A — Empty 31 250 kg (68,900 lb)
B — Max GMW 68 182 kg (150,000 lb)



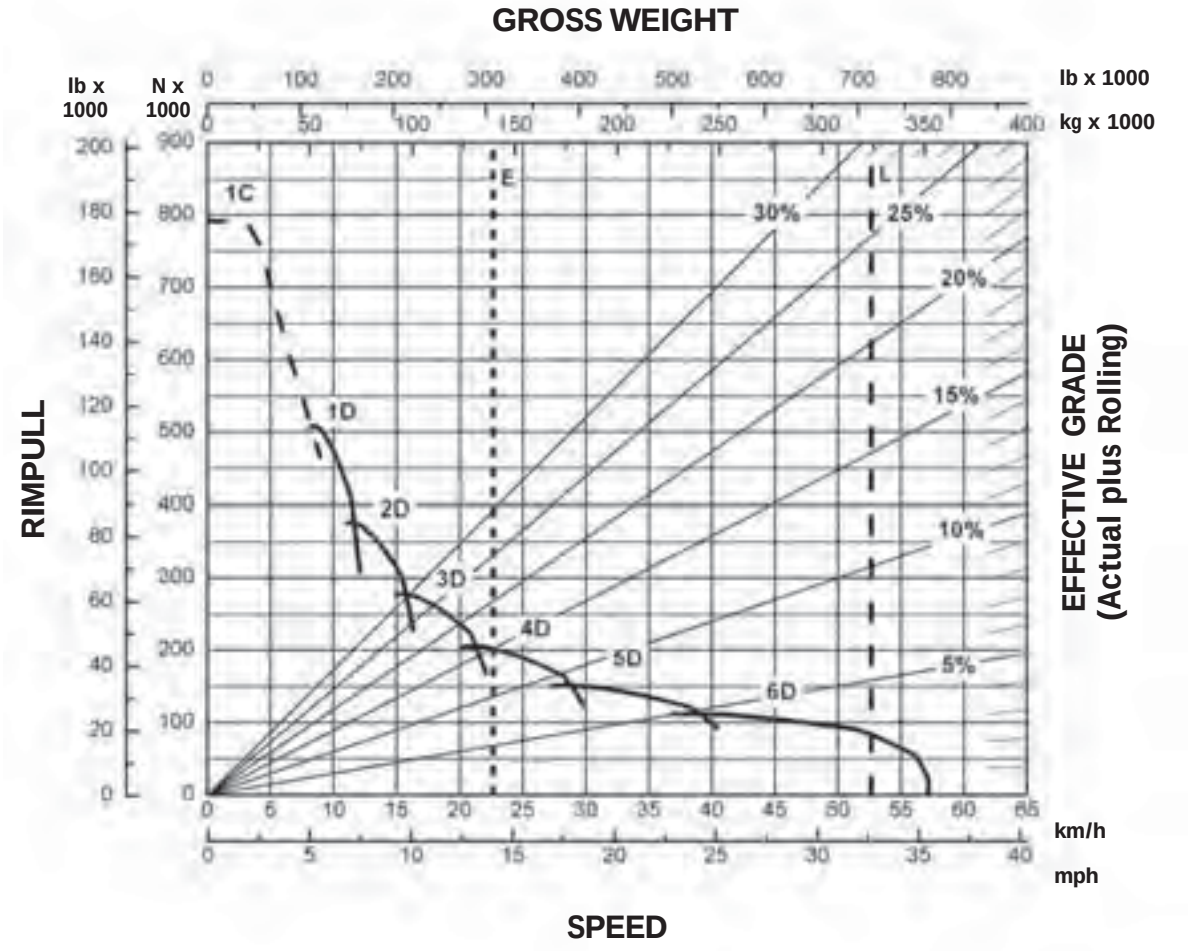
KEY

2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear
7 — 7th Gear

KEY

A — Empty 31 250 kg (68,900 lb)
B — Max GMW 68 182 kg (150,000 lb)

789D 2100 HP Rimpull-Speed-Gradeability
- 37.00R57 Tires**
- 1593 mm **(5'2.7")** Tire Radius



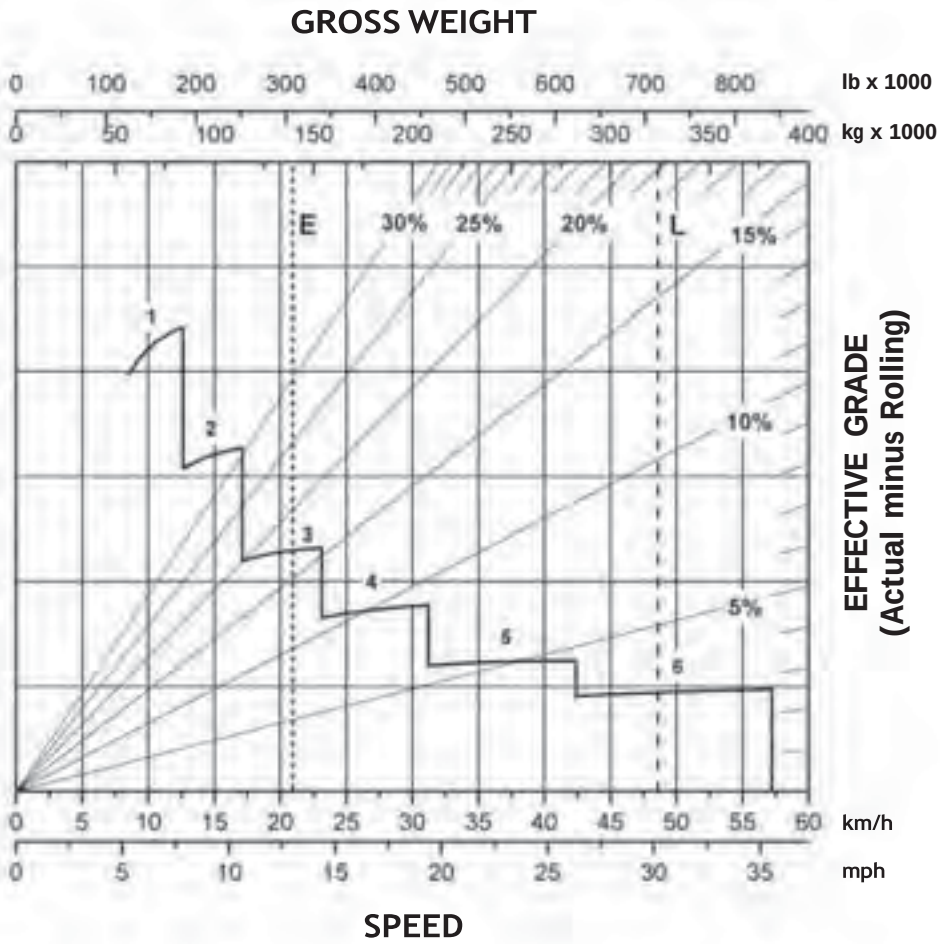
KEY

1C — 1st Gear (Torque Converter)
1D— 1st Gear
2D— 2nd Gear
3D— 3rd Gear
4D— 4th Gear
5D— 5th Gear
6D— 6th Gear

KEY

E — Empty Operating Weight 141 214 kg (311,324 lb)*
L —Target GMW 324 319 kg (715,000 lb)

*Truck equipped with sideboards and liners.
**At Sea Level.

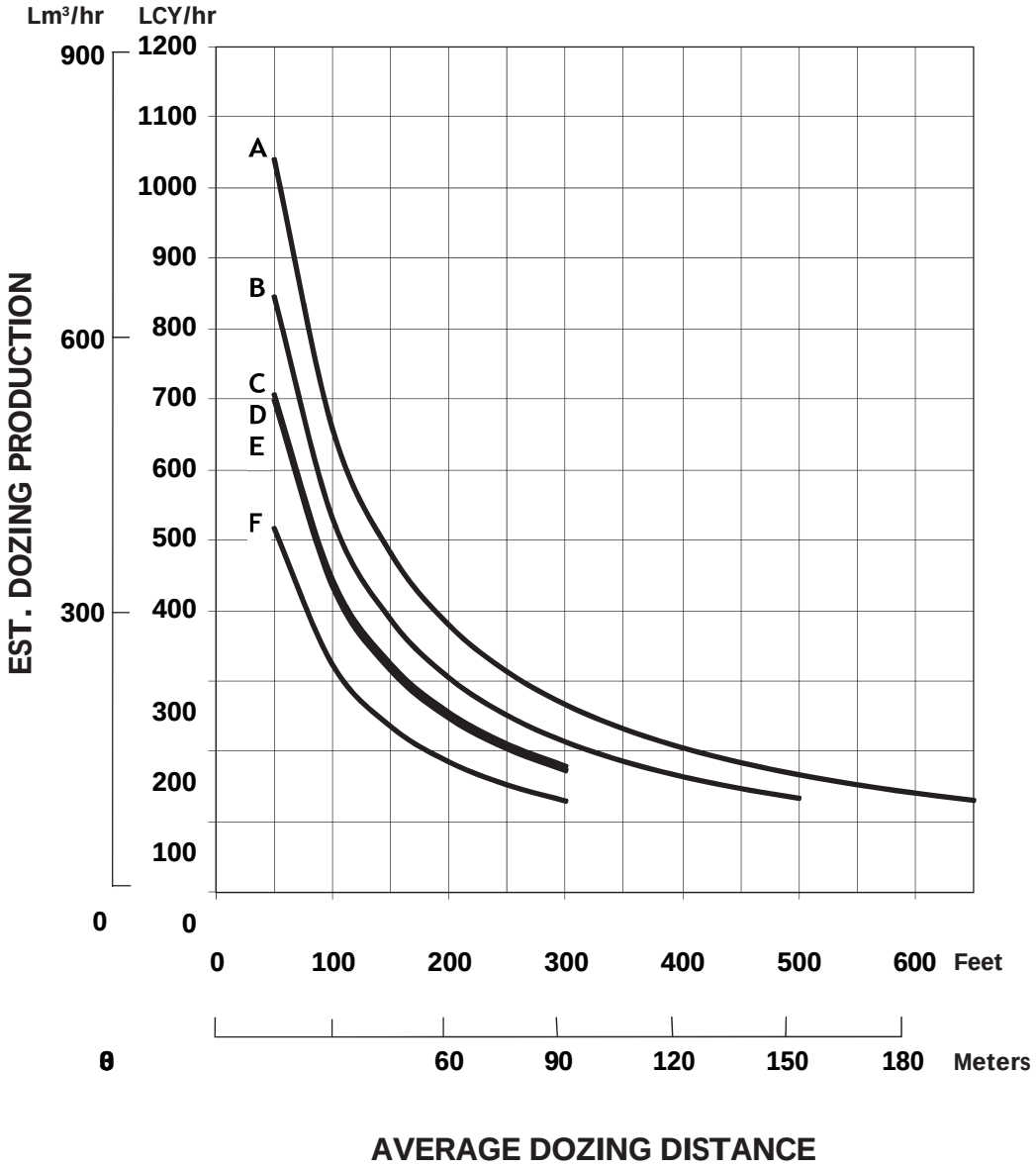


KEY
1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear

KEY
E — Empty Operating Weight 141 214 kg (311,324 lb)*
L — Target GMW 324 319 kg (715,000 lb)

*Truck equipped with sideboards and liners.
**At Sea Level.

ESTIMATED DOZING PRODUCTION • Semi-Universal Blades • D6N through D8R

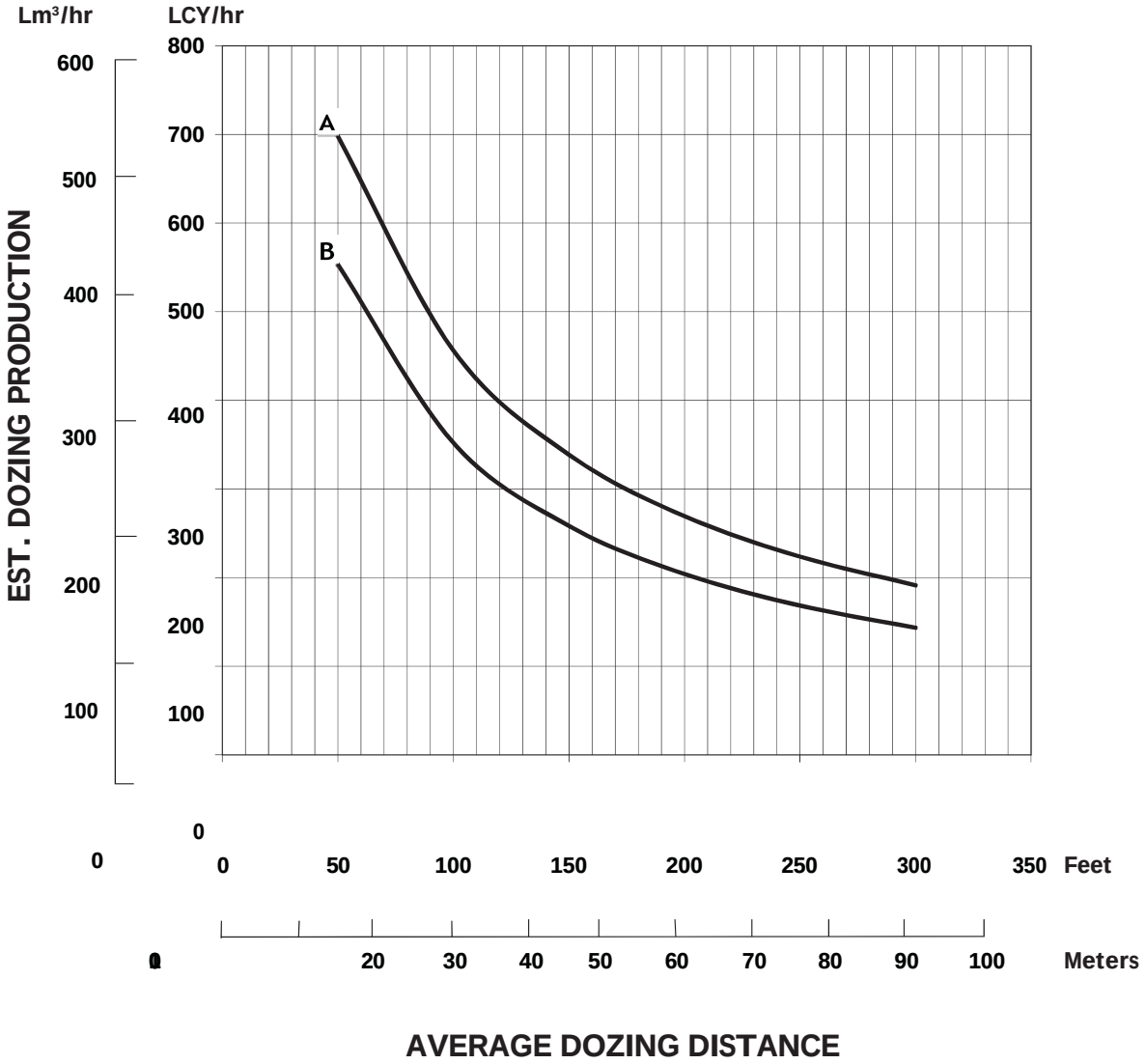


KEY

A — D8R
B — D7R
C — D6T Tier 4 Interim/Stage IIIB/Japan 2011 (Tier 4 Interim)
D — D6T
E
—
D
6
R

NOTE: This chart is based on numerous field studies made under varying job conditions. Refer to correction factors following these charts.

ESTIMATED DOZING PRODUCTION • Straight Blades • D6T through D7E

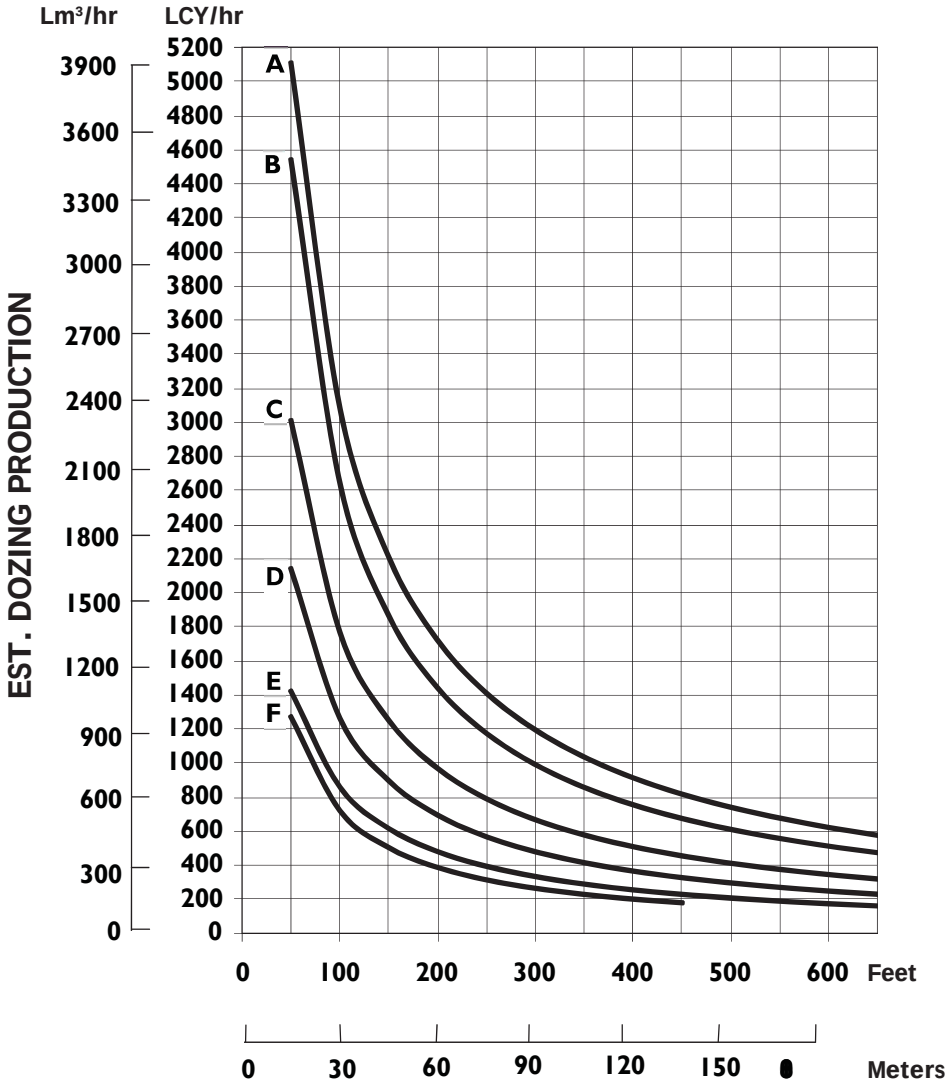


KEY

A — D7E
B — D6T

NOTE: This chart is based on numerous field studies made under varying job conditions. Refer to correction factors following these charts.

ESTIMATED DOZING PRODUCTION • Universal Blades • D7E through D11T CD



AVERAGE DOZING DISTANCE

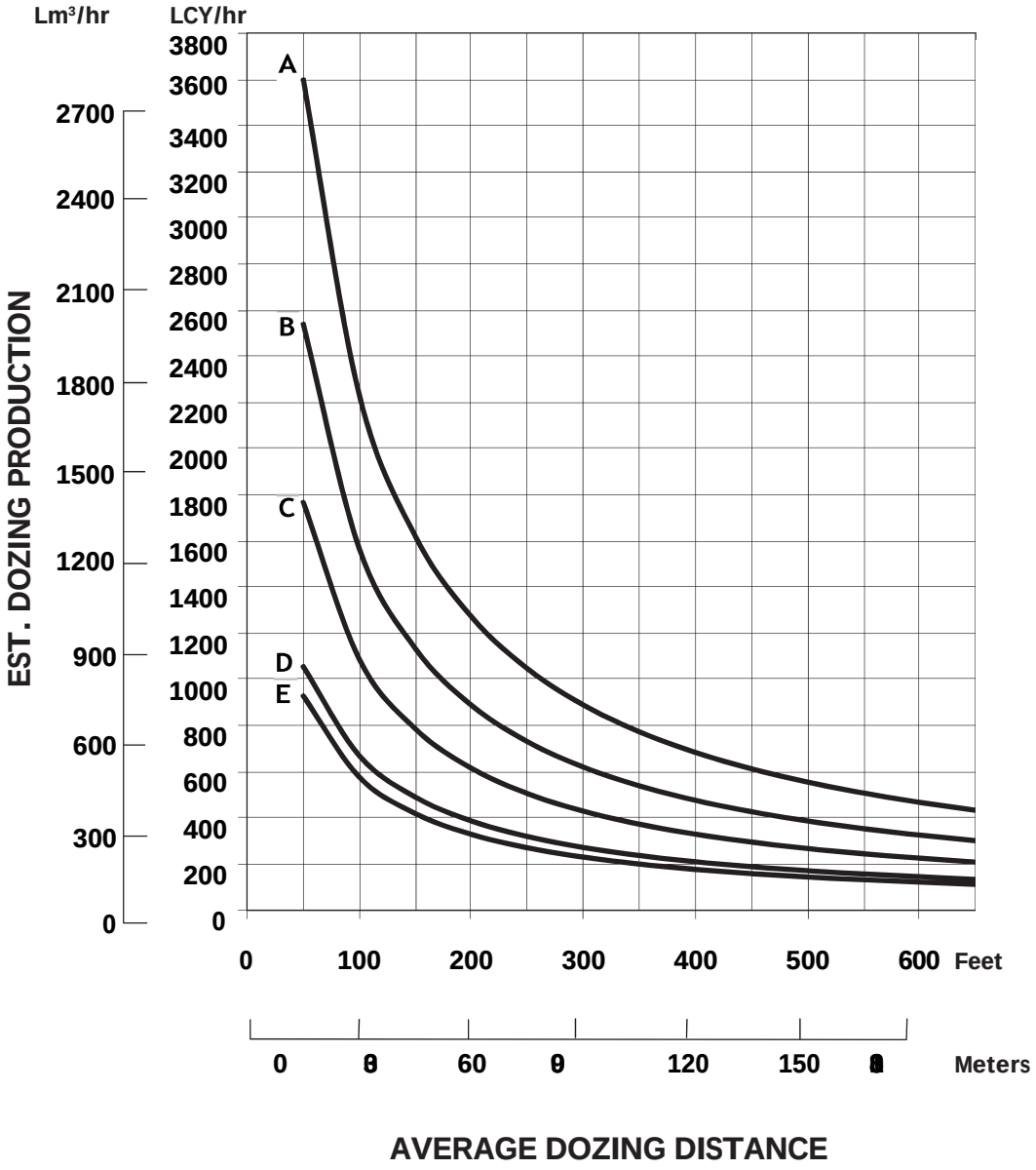
KEY

A — D11T CD
B — D11T
C — D10T2
D — D9T
E — D8T
F — D7E

NOTE: This chart is based on numerous field studies made under varying job conditions. Refer to correction factors

following
these
charts.

ESTIMATED DOZING PRODUCTION • Semi-Universal Blades • D7E through D11T

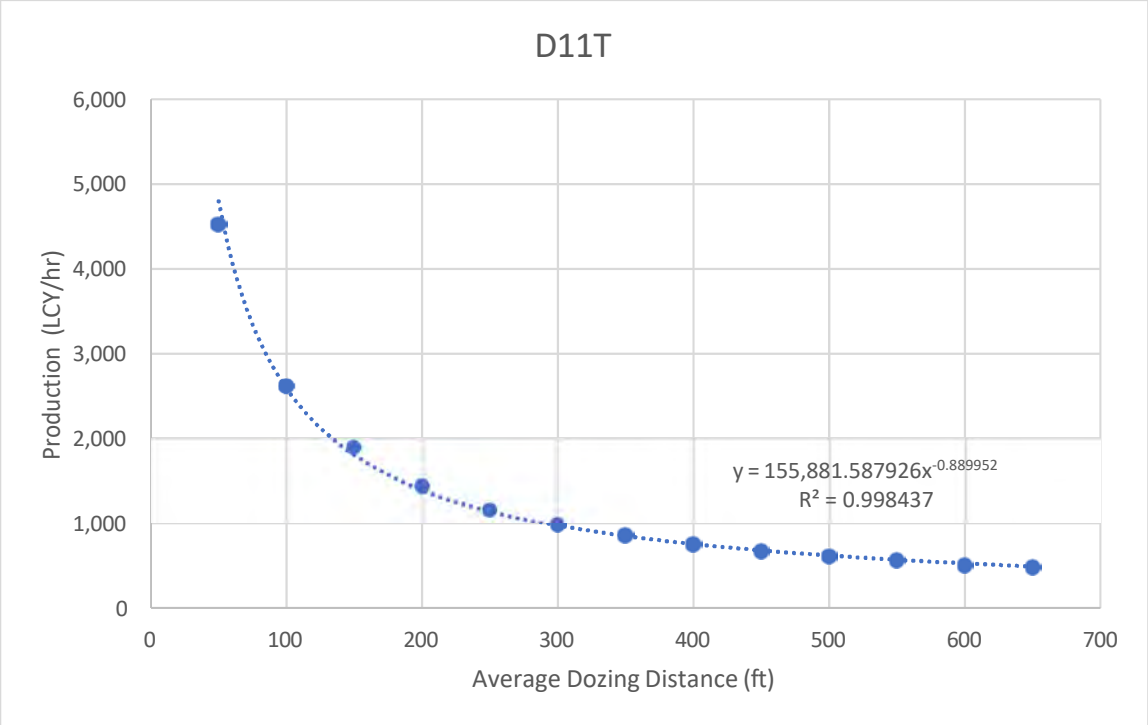


KEY

A — D11T
B — D10T2
C — D9T
D — D8T
E — D7E

NOTE: This chart is based on numerous field studies made under varying job conditions. Refer to correction factors following these charts.

Dozing Production



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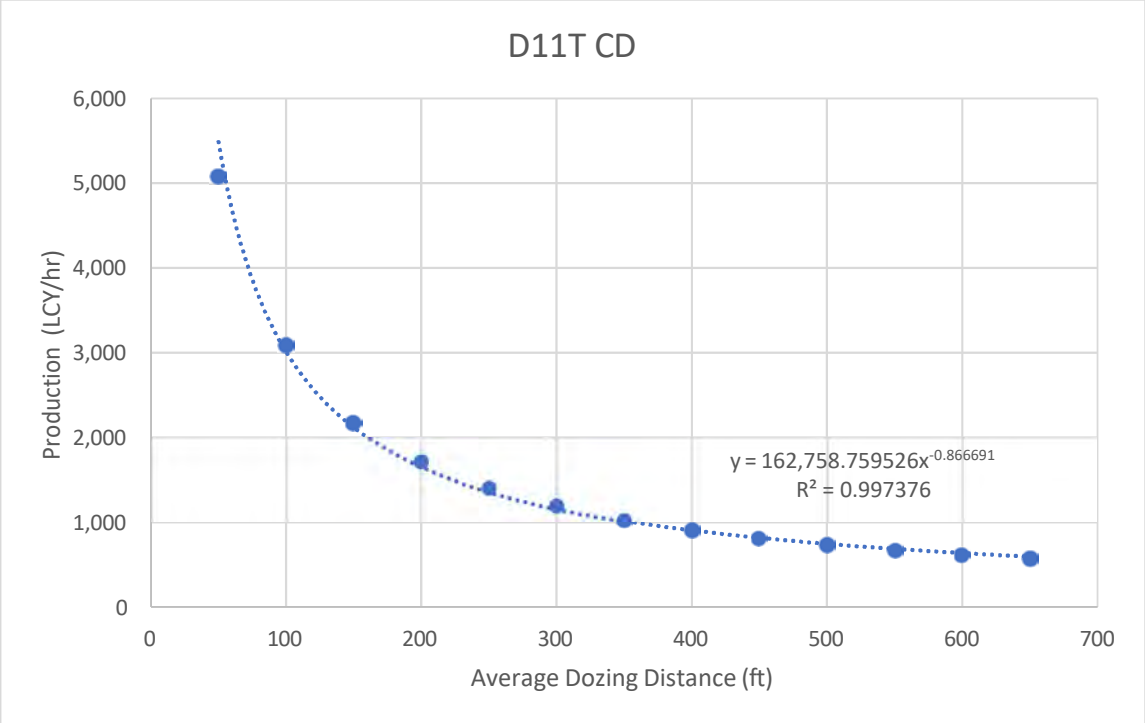
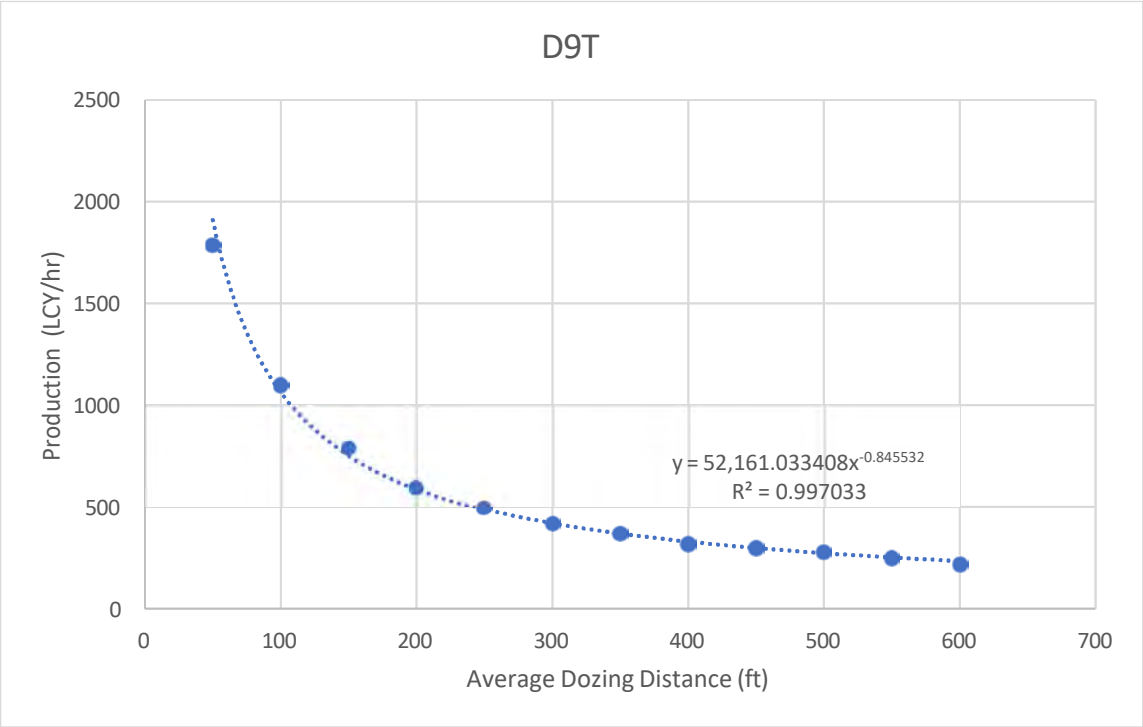


Caterpillar Performance Handbook Edition 47, 19-51



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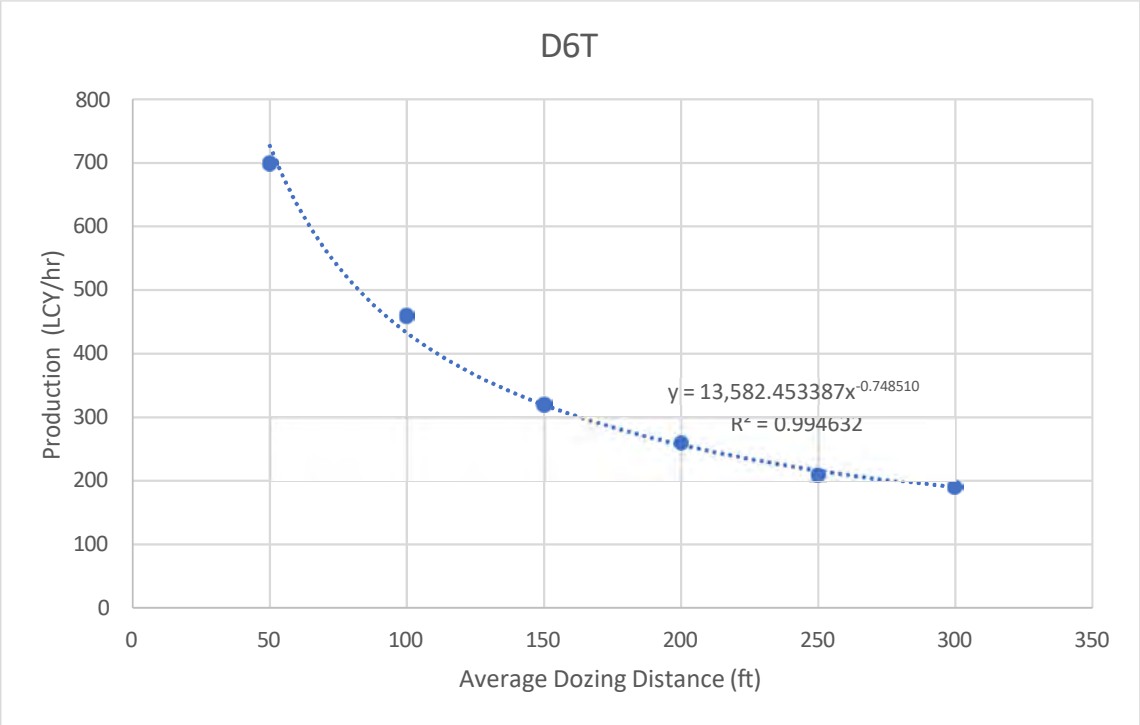

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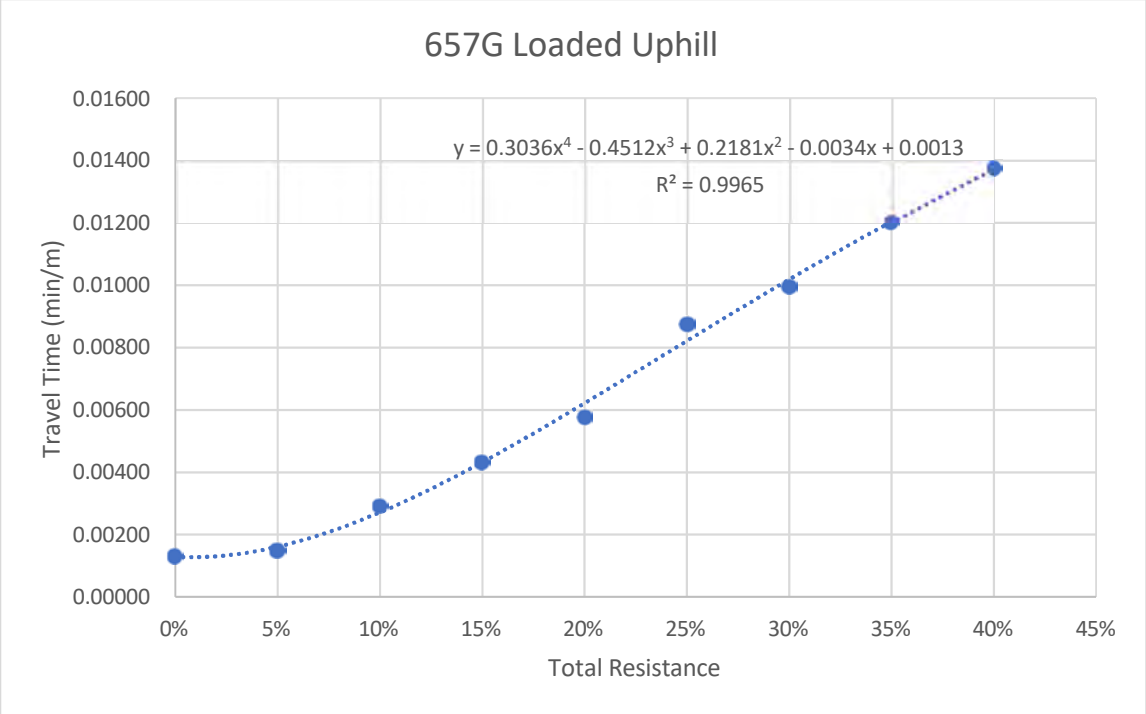
Scraper Haul Travel Time



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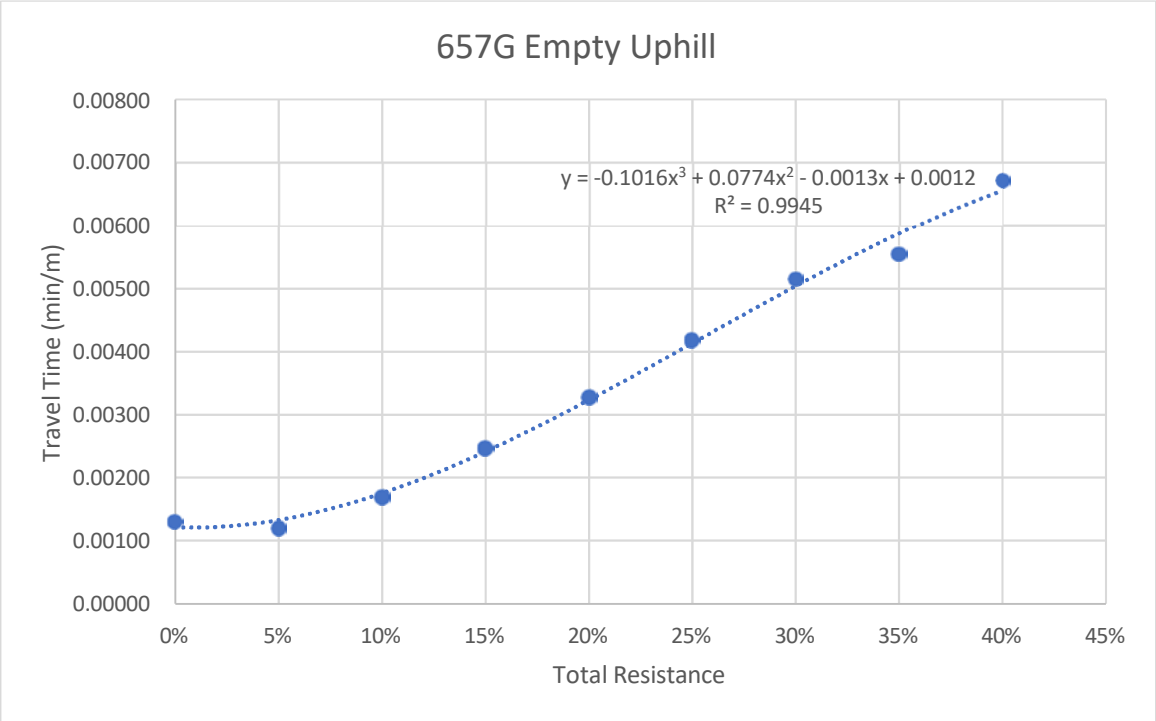

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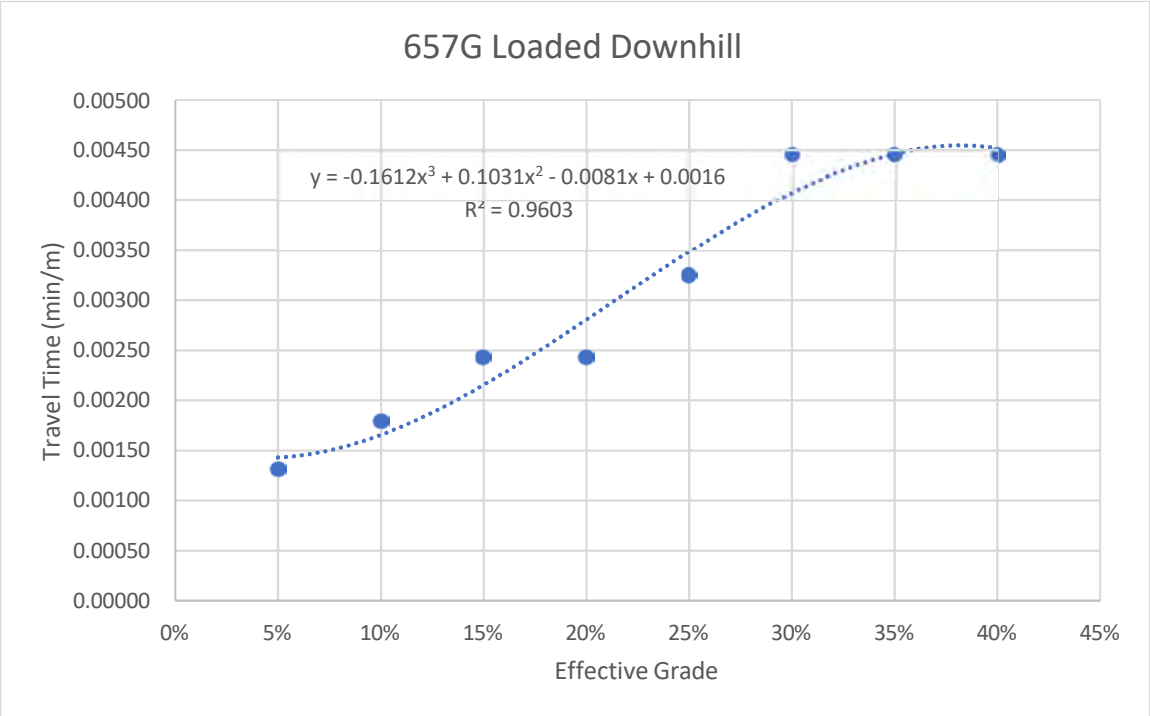

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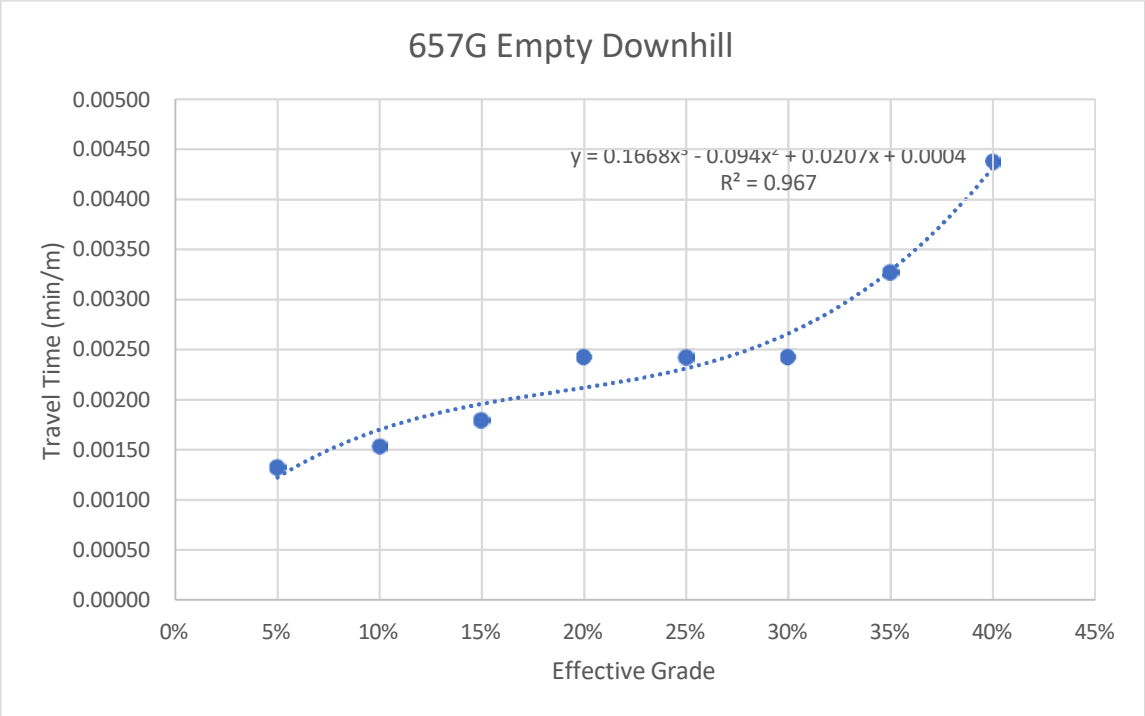
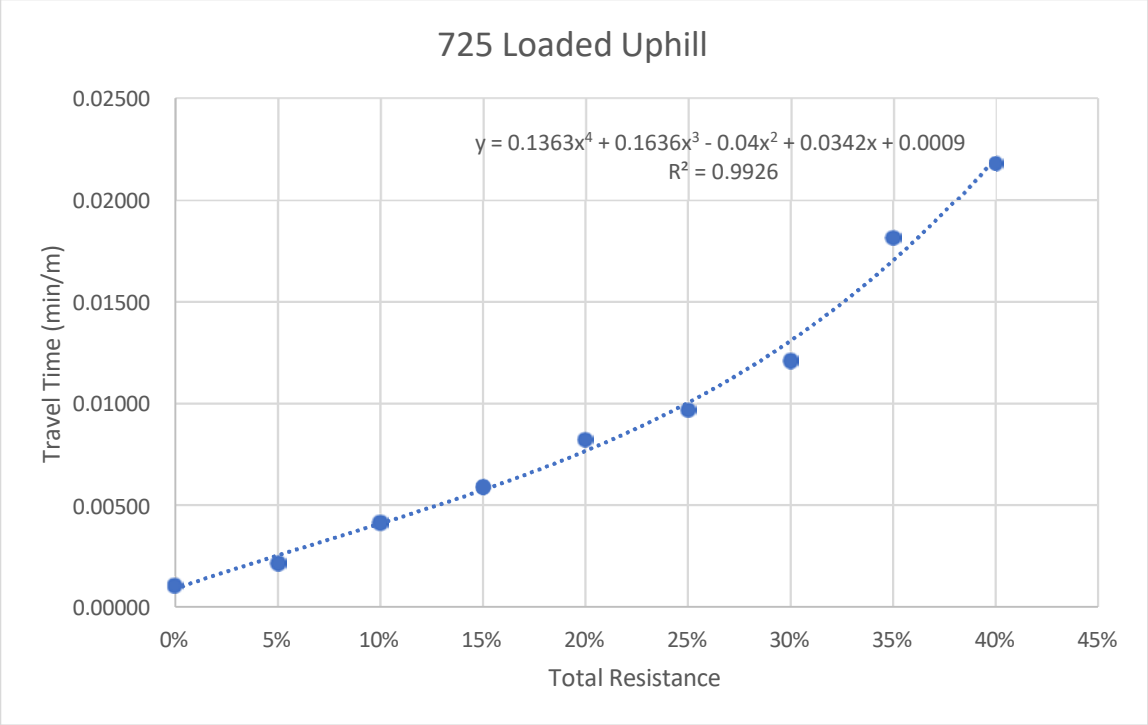
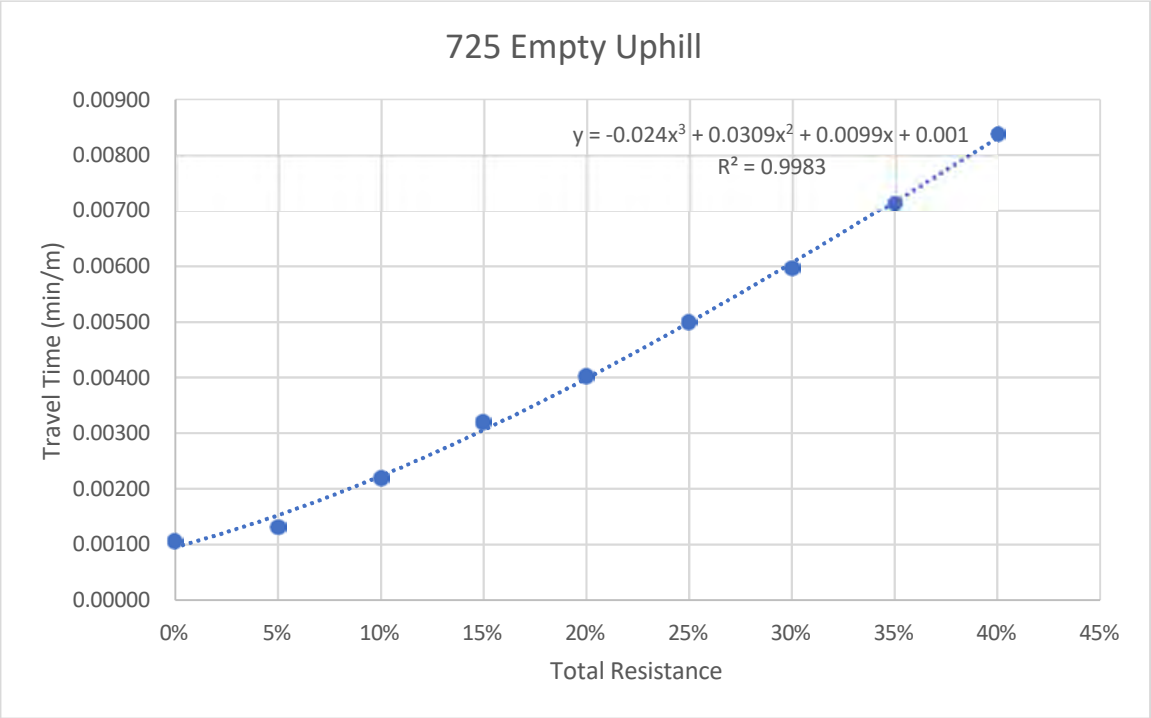


Caterpillar Performance Handbook Edition 47, 24-30

Truck Haul Travel Time



Caterpillar Performance Handbook Edition 47, 1-9



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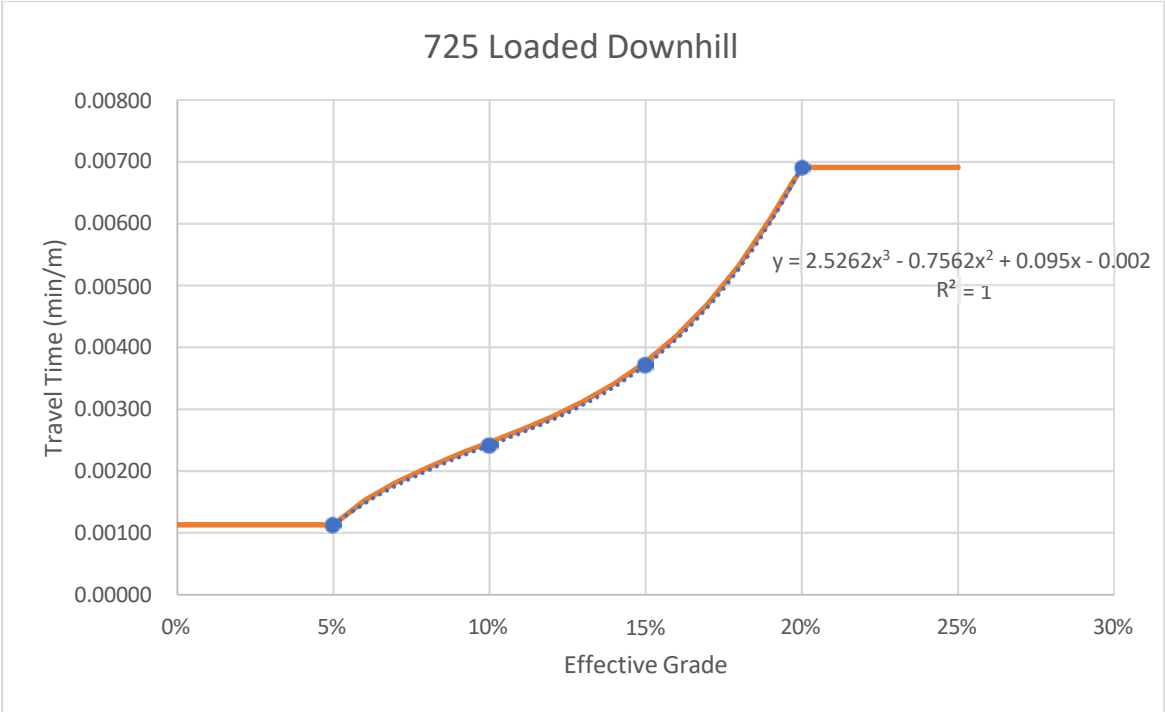

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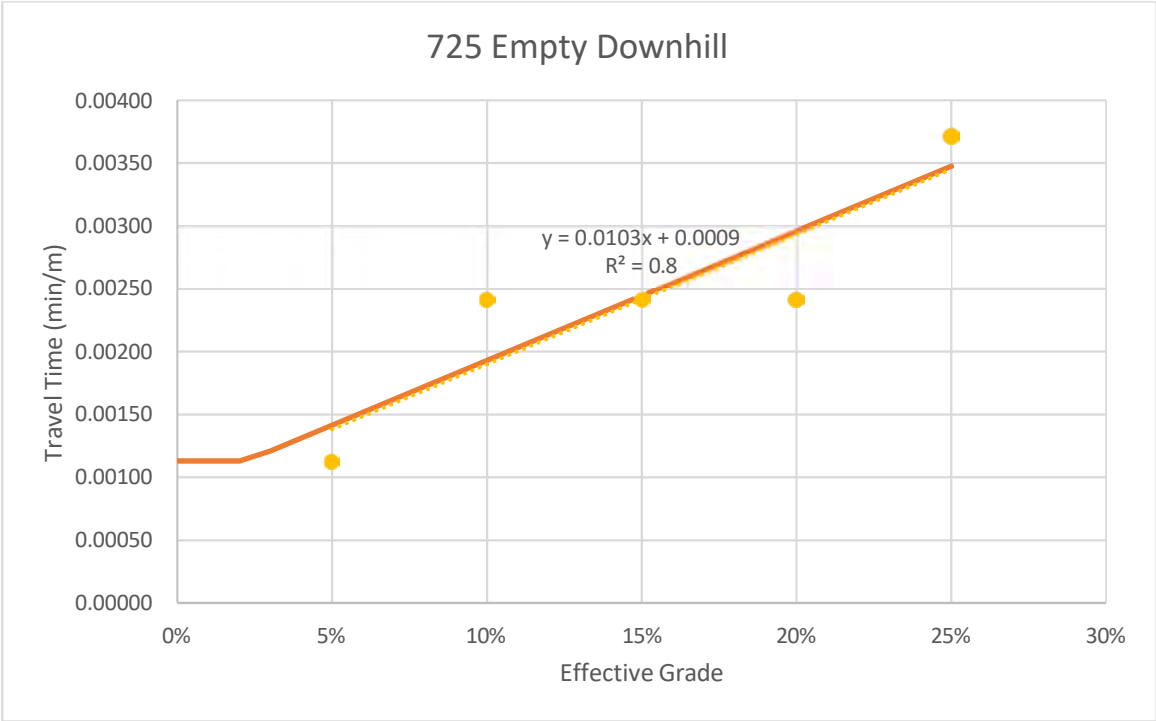

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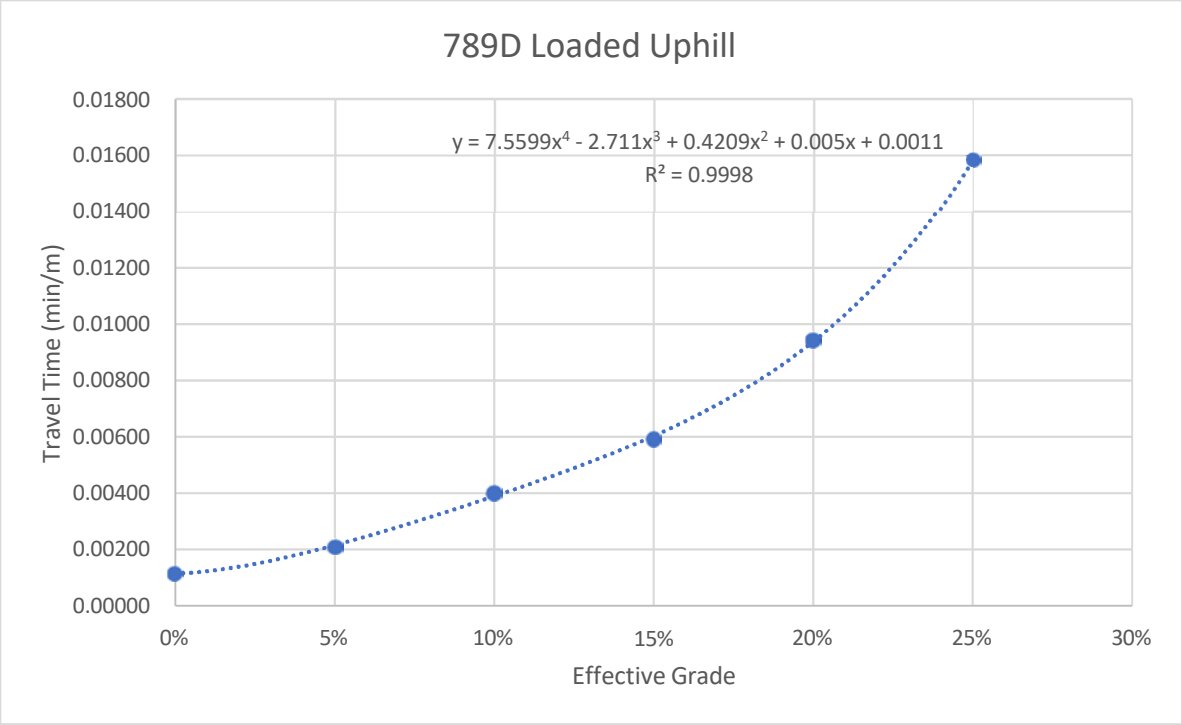
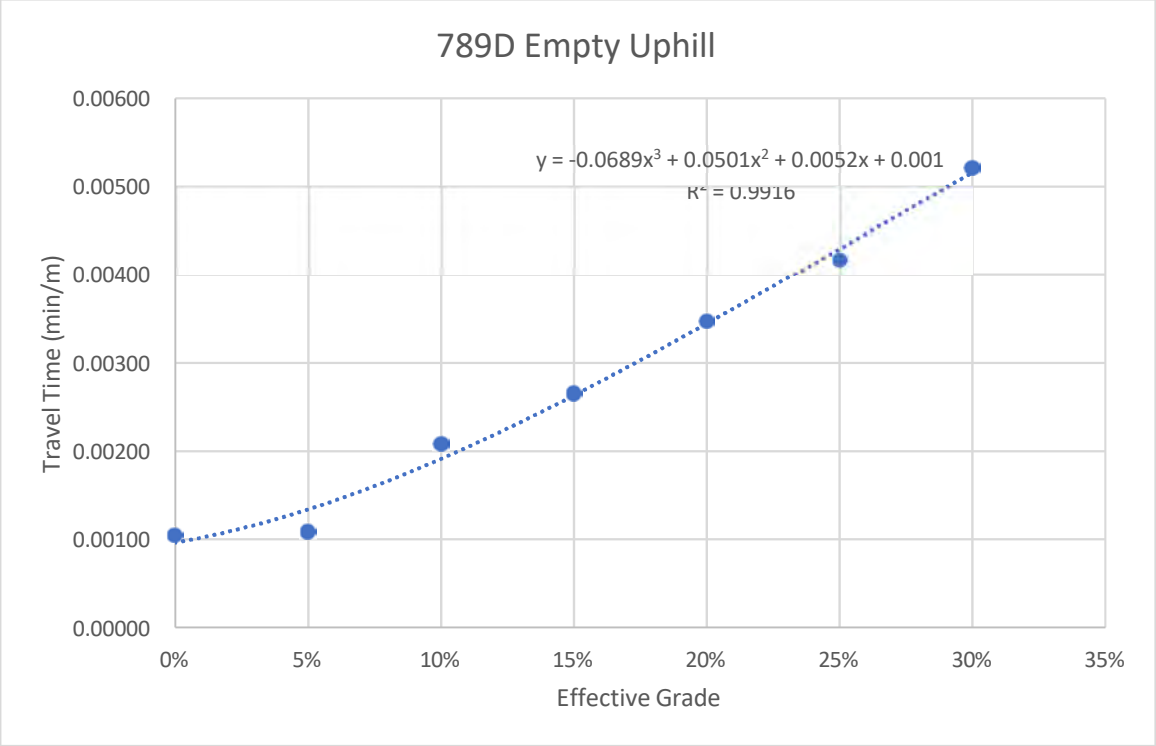
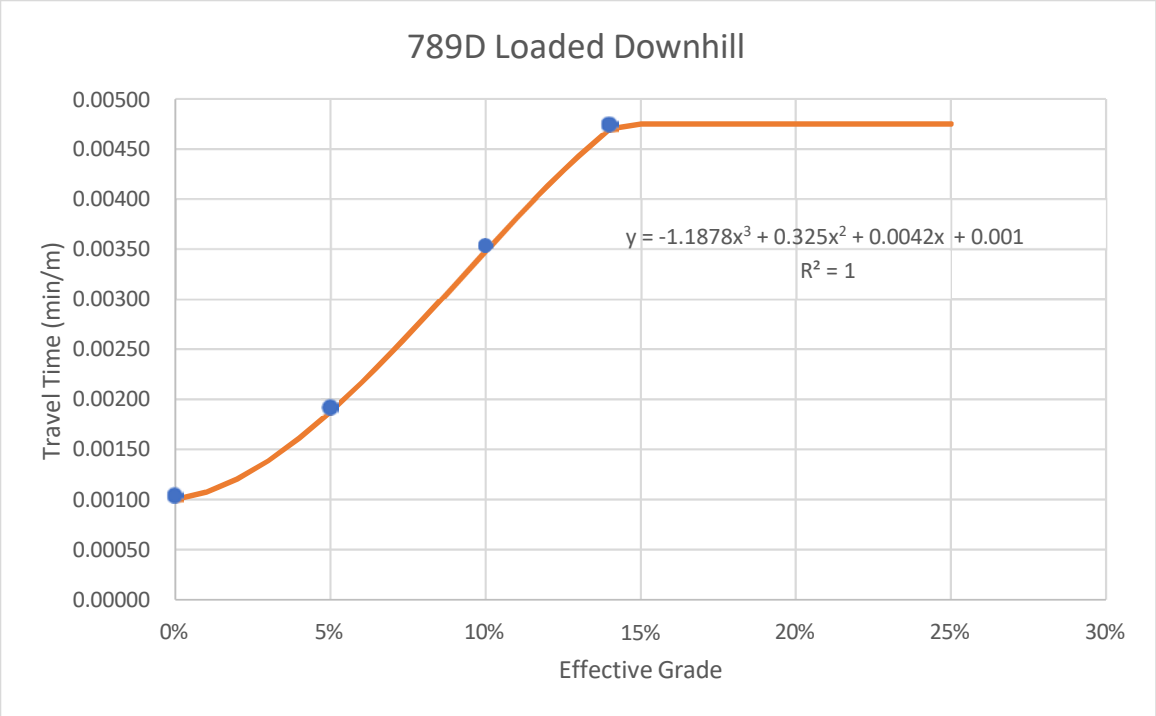


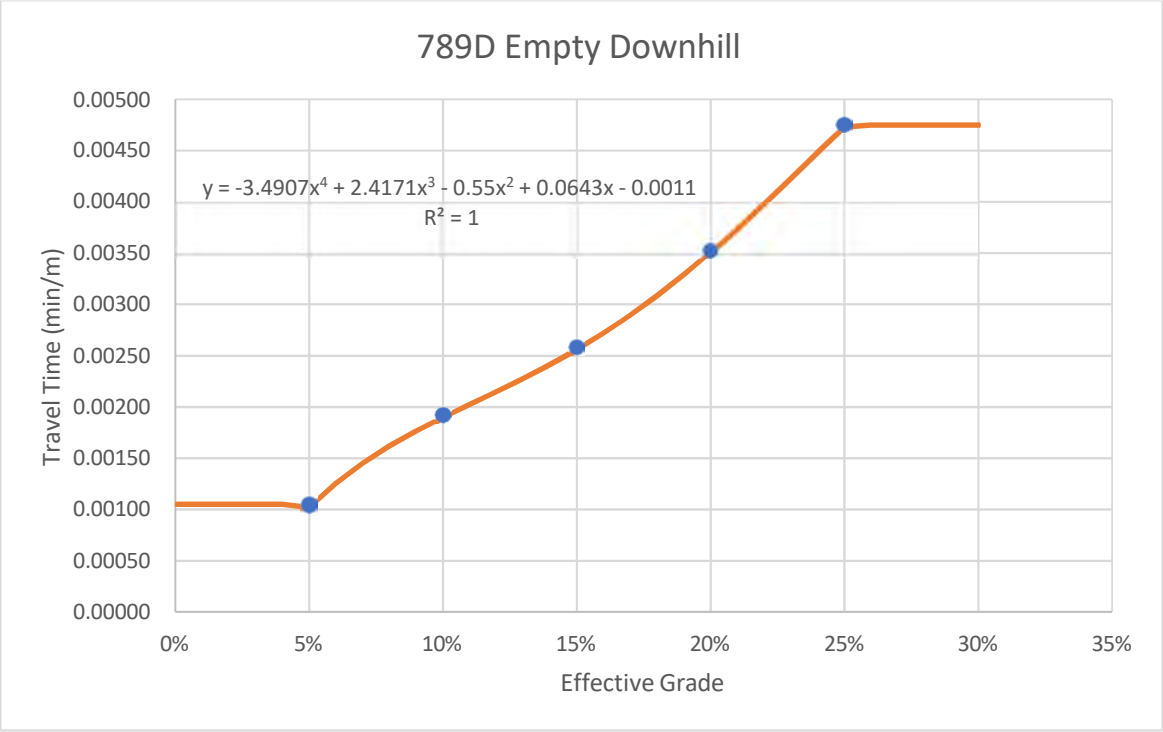
Caterpillar Performance Handbook Edition 47, 10-64



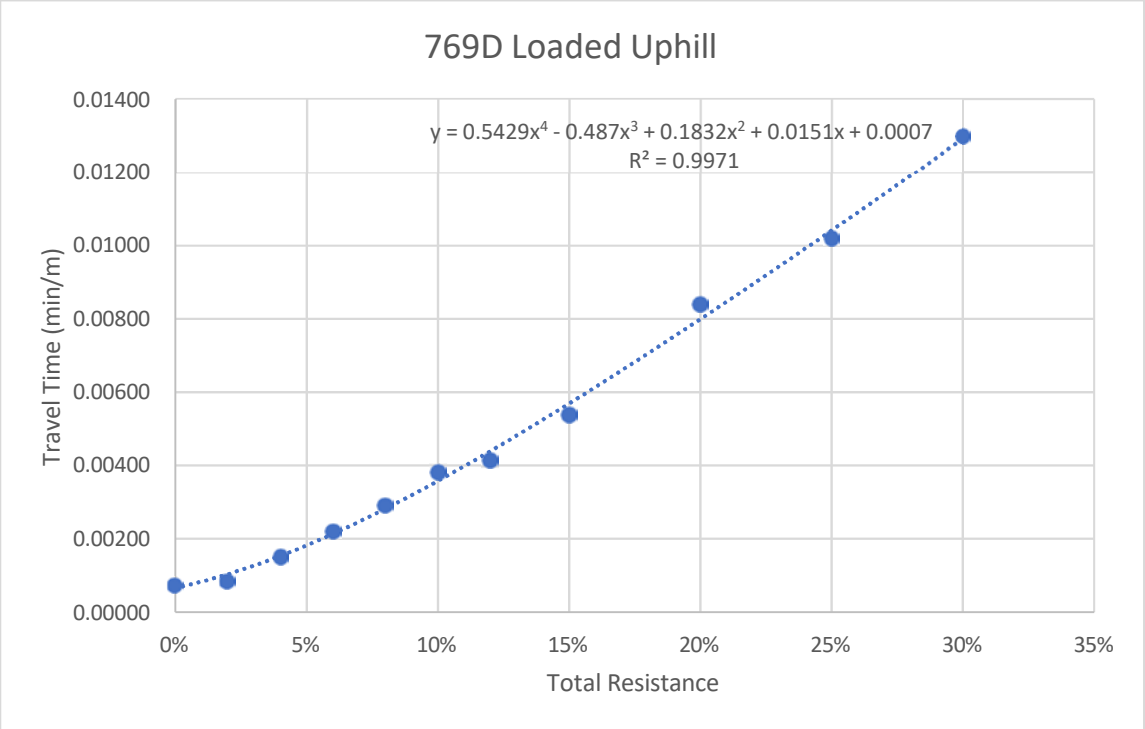
Caterpillar Performance Handbook Edition 47, 10-64



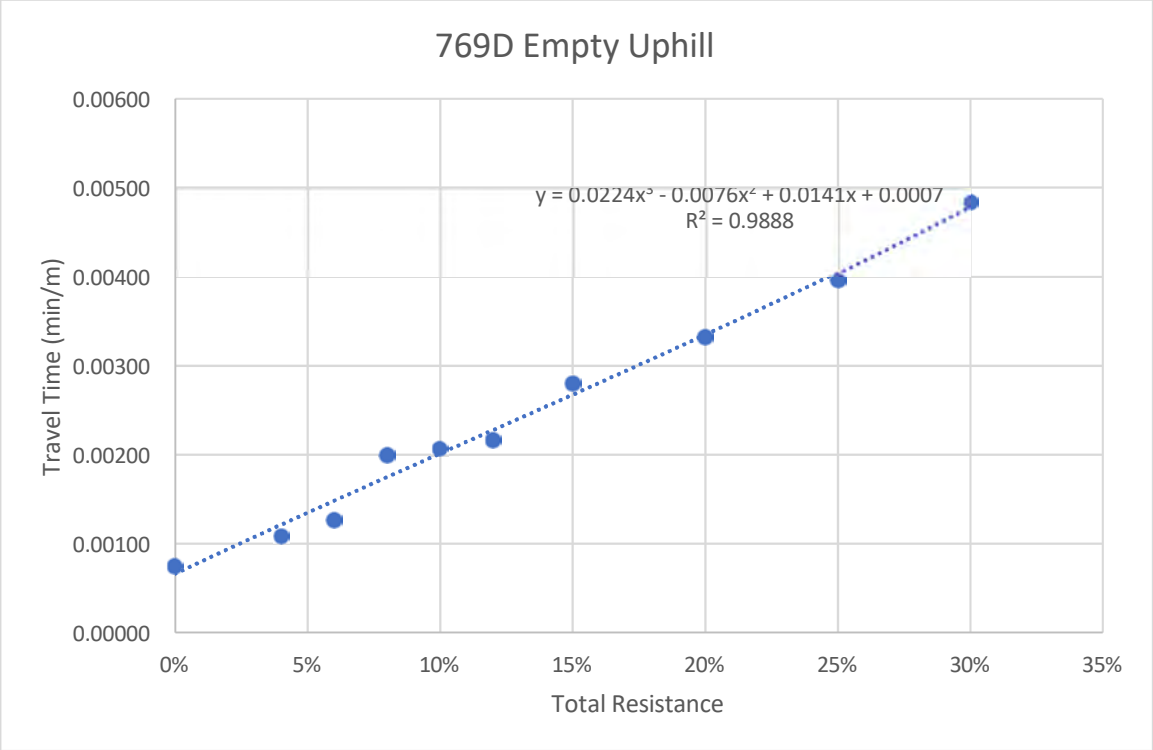
Caterpillar Performance Handbook Edition 47, 10-65



Caterpillar Performance Handbook Edition 47, 10-65



Caterpillar Performance Handbook Edition 29, 9-10



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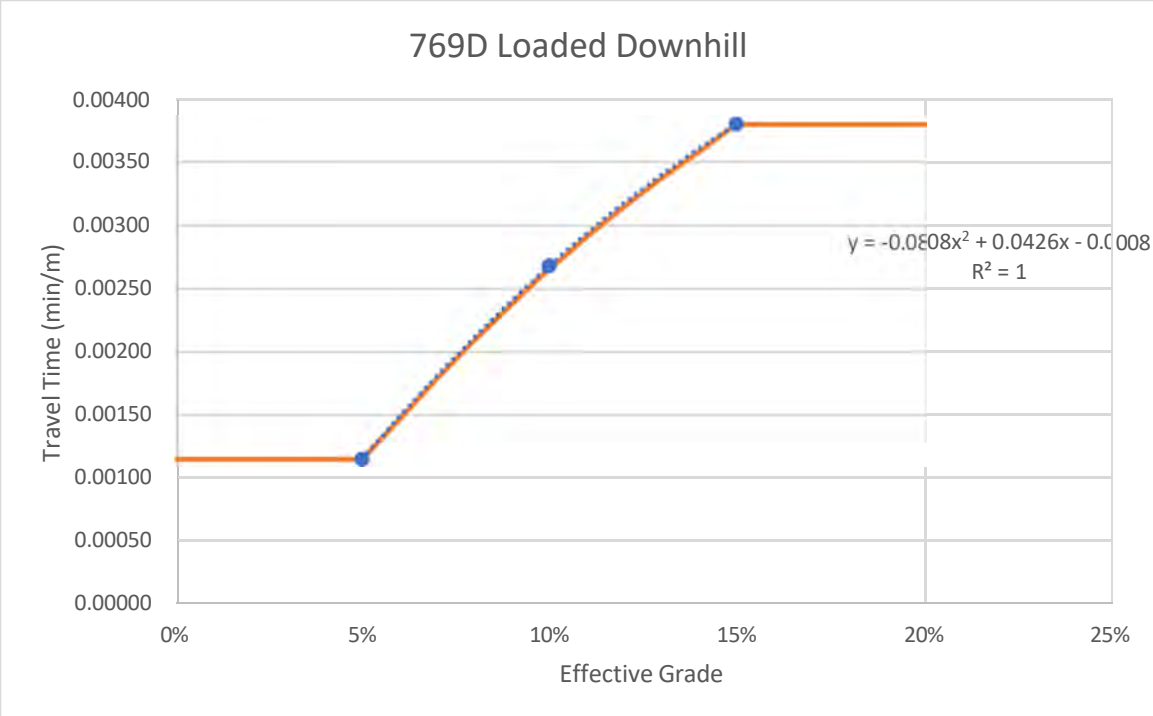
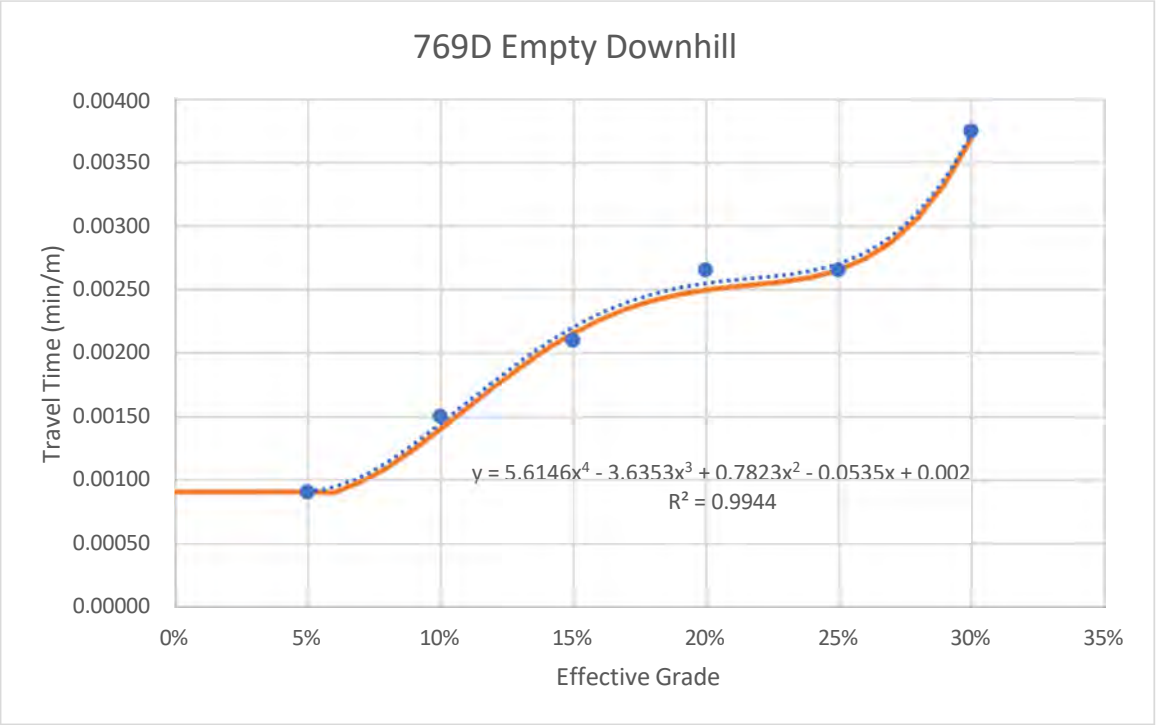


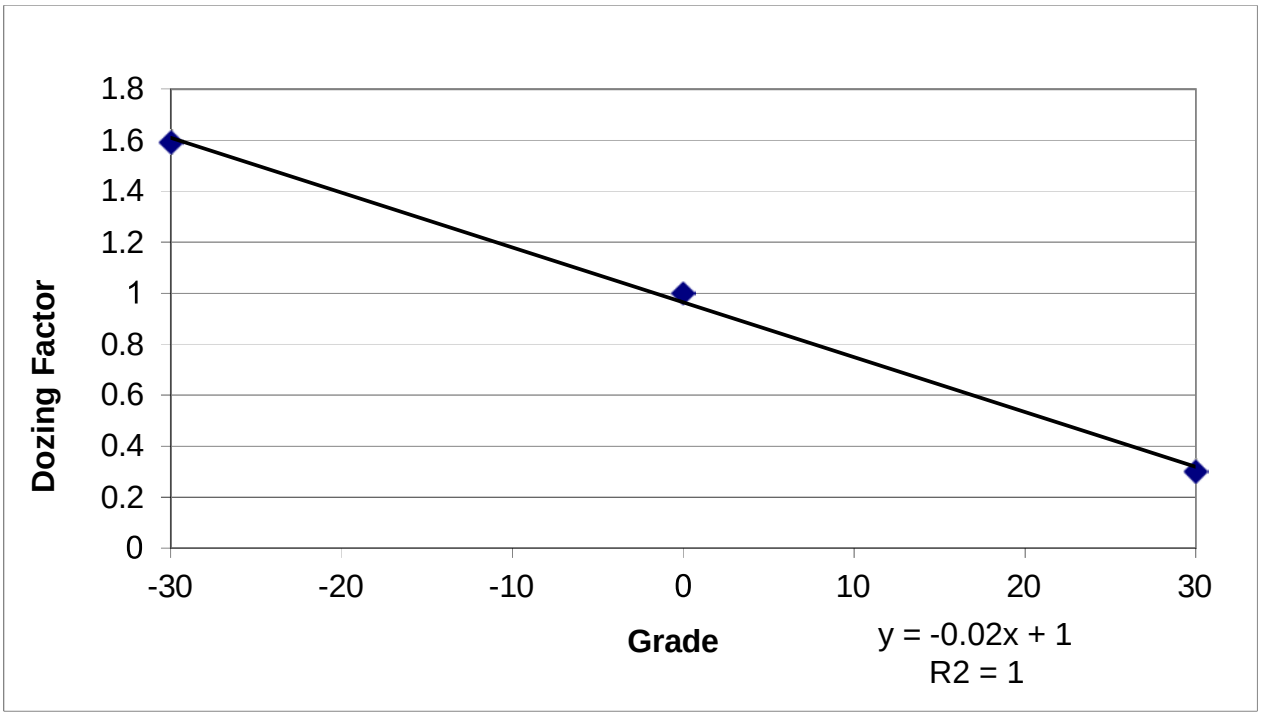
Caterpillar Performance Handbook Edition 29, 9-11



Caterpillar Performance Handbook Edition 29, 9-11

Grade vs. Dozing Factor

Grade %	Dozing Factor
0	1
-30	1.59
30	0.3



Attachment C.4
R.S. Means Data

RS Means Online Data

Demolition - accessed September 21, 2021

Line Number	Description	Unit	Material	Labor	Equipment	Total	Data Release	CCI Location
024113400190	Selective demolition, metal drainage piping, CMP, steel, 48"-60", diameter, excludes excavation	L.F.	$ -	$ 10.08	$ 2.38	$ 12.46	Year 2021	NEW MEXICO / LAS CRUCES (880)

Revegetation - accessed September 21, 2021

Line Number	Description	Unit	Material	Labor	Equipment	Total	Data Release	CCI Location
015433201500	Rent disc harrow attchment for tractor, Excl. Hourly Oper. Cost.	Month	$ -	$ -	$ 670.65	$ 670.65	Year 2021	NEW MEXICO / LAS CRUCES (880)
329343100560	Planting, trees, shrubs, and ground cover, medium soil, bare root seedlings, 3" to 5", includes planting only	Clab	$ -	$ 0.37	$ -	$ 0.37	Year 2021	NEW MEXICO / LAS CRUCES (880)

Concrete cutoff wall (dissipater [dissipation basin]) & Grade Control Wall - accessed September 21, 2021

Line Number	Description	Unit	Material	Labor	Equipment	Total	Data Release	CCI Location
033053406200	Structural concrete, in place, gravity retaining wall (3000 psi), 4' high, includes forms(4 uses), Grade 60 rebar, concrete (Portland cement Type I), placing and finishing	C.Y.	$ 155.23	$ 101.84	$ 5.51	$ 262.58	Year 2021	NEW MEXICO / LAS CRUCES (880)
033053403945	Structural concrete, in place, continuous strip footing (3000 psi), 36" wide x 12" deep, unreinforced, includes forms(4 uses), concrete (Portland cement Type I), placing and finishing, excludes reinforcing	C.Y.	$ 127.01	$ 43.47	$ 0.31	$ 170.79	Year 2021	NEW MEXICO / LAS CRUCES (880)

Perimeter Items - accessed September 21, 2021

Line Number	Description	Unit	Material	Labor	Equipment	Total	Data Release	CCI Location
323113200800	Fence, chain link industrial, galvanized steel, 6 ga. wire, 2" posts @ 10' OC, 6' high, includes excavation, & concrete, excludes barbed wire	L.F.	$ 20.63	$ 3.20	$ 0.82	$ 24.65	Year 2021	NEW MEXICO / LAS CRUCES (880)
323113205070	Fence, chain link industrial, double swing gates, 6' high, 20' opening, includes excavation, posts & hardware in concrete	Opng.	$ 568.54	$ 309.40	$ 79.07	$ 957.01	Year 2021	NEW MEXICO / LAS CRUCES (880)
101453200600	Signs, guide and directional signs, reflectorized, 12" x 18", excludes posts	Ea.	$ 42.50	$ 18.92	$ 12.21	$ 73.63	Year 2021	NEW MEXICO / LAS CRUCES (880)

Excavation- accessed September 21, 2021

Line Number	Description	Unit	Material	Labor	Equipment	Total	Data Release	CCI Location
312316466070	Excavating, bulk, dozer, open site, bank measure, common earth, 700 HP dozer, 300' haul	B.C.Y.	$ -	$ 0.54	$ 4.66	$ 5.20	Year 2021	NEW MEXICO / LAS CRUCES (880)
312316466010	Excavating, bulk, dozer, open site, bank measure, common earth, 700 HP dozer, 50' haul	B.C.Y.	$ -	$ 0.16	$ 1.39	$ 1.55	Year 2021	NEW MEXICO / LAS CRUCES (880)
312323205040	Cycle hauling (wait, load, travel, unload or dump & return) time per cycle, excavated or borrow, loose cubic yards, 15 min load/wait/unload, 22 C.Y. truck, cycle 1 mile, 5 MPH, excludes loading equipment	L.C.Y.	$ -	$ 0.82	$ 2.05	$ 2.87	Year 2021	NEW MEXICO / LAS CRUCES (880)

Crews - Standard

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew A-1	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Building Laborer	$44.40	$355.20	$66.25	$530.00	$44.40	$66.25
1 Concrete Saw, Gas Manual		113.70		125.07	14.21	15.63
8 L.H., Daily Totals		$468.90		$655.07	$58.61	$81.88
Crew A-1A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Skilled Worker	$57.10	$456.80	$85.90	$687.20	$57.10	$85.90
1 Shot Blaster, 20		208.70		229.57	26.09	28.70
8 L.H., Daily Totals		$665.50		$916.77	$83.19	$114.60
Crew A-1B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Building Laborer	$44.40	$355.20	$66.25	$530.00	$44.40	$66.25
1 Concrete Saw		112.85		124.14	14.11	15.52
8 L.H., Daily Totals		$468.05		$654.13	$58.51	$81.77
Crew A-1C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Building Laborer	$44.40	$355.20	$66.25	$530.00	$44.40	$66.25
1 Chain Saw, Gas, 18		52.20		57.42	6.53	7.18
8 L.H., Daily Totals		$407.40		$587.42	$50.92	$73.43
Crew A-1D	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Building Laborer	$44.40	$355.20	$66.25	$530.00	$44.40	$66.25
1 Vibrating Plate, Gas, 18		31.90		35.09	3.99	4.39
8 L.H., Daily Totals		$387.10		$565.09	$48.39	$70.64
Crew A-1E	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Building Laborer	$44.40	$355.20	$66.25	$530.00	$44.40	$66.25
1 Vibrating Plate, Gas, 21		165.60		182.16	20.70	22.77
8 L.H., Daily Totals		$520.80		$712.16	$65.10	$89.02
Crew A-1F	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Building Laborer	$44.40	$355.20	$66.25	$530.00	$44.40	$66.25
1 Rammer/Tamper, Gas, 8		47.00		51.70	5.88	6.46
8 L.H., Daily Totals		$402.20		$581.70	$50.27	$72.71
Crew A-1G	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Building Laborer	$44.40	$355.20	$66.25	$530.00	$44.40	$66.25
1 Rammer/Tamper, Gas, 15		54.65		60.12	6.83	7.51
8 L.H., Daily Totals		$409.85		$590.12	$51.23	$73.76
Crew A-1H	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Building Laborer	$44.40	$355.20	$66.25	$530.00	$44.40	$66.25
1 Exterior Steam Cleaner		77.20		84.92	9.65	10.62
8 L.H., Daily Totals		$432.40		$614.92	$54.05	$76.86
Crew A-1J	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Building Laborer	$44.40	$355.20	$66.25	$530.00	$44.40	$66.25
1 Cultivator, Walk-Behind, 5 H.P.		53.25		58.58	6.66	7.32
8 L.H., Daily Totals		$408.45		$588.58	$51.06	$73.57
Crew A-1K	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Building Laborer	$44.40	$355.20	$66.25	$530.00	$44.40	$66.25
1 Cultivator, Walk-Behind, 8 H.P.		92.20		101.42	11.53	12.68
8 L.H., Daily Totals		$447.40		$631.42	$55.92	$78.93
Crew A-1M	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Building Laborer	$44.40	$355.20	$66.25	$530.00	$44.40	$66.25
1 Snow Blower, Walk-Behind		68.30		75.13	8.54	9.39
8 L.H., Daily Totals		$423.50		$605.13	$52.94	$75.64

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew A-2	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$45.87	$68.50
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Flatbed Truck, Gas, 1.5 Ton		198.50		218.35	8.27	9.10
24 L.H., Daily Totals		$1299.30		$1862.35	$54.14	$77.60
Crew A-2A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$45.87	$68.50
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Flatbed Truck, Gas, 1.5 Ton		198.50		218.35		
1 Concrete Saw		112.85		124.14	12.97	14.27
24 L.H., Daily Totals		$1412.15		$1986.48	$58.84	$82.77
Crew A-2B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Truck Driver (light)	$48.80	$390.40	$73.00	$584.00	$48.80	$73.00
1 Flatbed Truck, Gas, 1.5 Ton		198.50		218.35	24.81	27.29
8 L.H., Daily Totals		$588.90		$802.35	$73.61	$100.29
Crew A-3A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (light)	$55.50	$444.00	$82.70	$661.60	$55.50	$82.70
1 Pickup Truck, 4x4, 3/4 Ton		176.75		194.43	22.09	24.30
8 L.H., Daily Totals		$620.75		$856.02	$77.59	$107.00
Crew A-3B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$55.15	$82.30
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Dump Truck, 12 C.Y., 400 H.P.		579.35		637.28		
1 F.E. Loader, W.M., 2.5 C.Y.		638.30		702.13	76.10	83.71
16 L.H., Daily Totals		$2100.05		$2656.22	$131.25	$166.01
Crew A-3C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (light)	$55.50	$444.00	$82.70	$661.60	$55.50	$82.70
1 Loader, Skid Steer, 78 H.P.		446.30		490.93	55.79	61.37
8 L.H., Daily Totals		$890.30		$1152.53	$111.29	$144.07
Crew A-3D	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Truck Driver (light)	$48.80	$390.40	$73.00	$584.00	$48.80	$73.00
1 Pickup Truck, 4x4, 3/4 Ton		176.75		194.43		
1 Flatbed Trailer, 25 Ton		137.20		150.92	39.24	43.17
8 L.H., Daily Totals		$704.35		$929.35	$88.04	$116.17
Crew A-3E	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$56.38	$84.13
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Pickup Truck, 4x4, 3/4 Ton		176.75		194.43	11.05	12.15
16 L.H., Daily Totals		$1078.75		$1540.43	$67.42	$96.28
Crew A-3F	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$56.38	$84.13
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Pickup Truck, 4x4, 3/4 Ton		176.75		194.43		
1 Truck Tractor, 6x4, 380 H.P.		499.15		549.07		
1 Lowbed Trailer, 75 Ton		258.10		283.91	58.38	64.21
16 L.H., Daily Totals		$1836.00		$2373.40	$114.75	$148.34

Crews - Standard

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew A-3G	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$56.38	$84.13
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Pickup Truck, 4x4, 3/4 Ton		176.75		194.43		
1 Truck Tractor, 6x4, 450 H.P.		608.95		669.85		
1 Lowbed Trailer, 75 Ton		258.10		283.91	65.24	71.76
16 L.H., Daily Totals		$1945.80		$2494.18	$121.61	$155.89
Crew A-3H	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$61.45	$91.55
1 Hyd. Crane, 12 Ton (Daily)		733.15		806.47	91.64	100.81
8 L.H., Daily Totals		$1224.75		$1538.87	$153.09	$192.36
Crew A-3I	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$61.45	$91.55
1 Hyd. Crane, 25 Ton (Daily)		810.50		891.55	101.31	111.44
8 L.H., Daily Totals		$1302.10		$1623.95	$162.76	$202.99
Crew A-3J	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$61.45	$91.55
1 Hyd. Crane, 40 Ton (Daily)		1287.00		1415.70	160.88	176.96
8 L.H., Daily Totals		$1778.60		$2148.10	$222.32	$268.51
Crew A-3K	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$56.98	$84.90
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Hyd. Crane, 55 Ton (Daily)		1377.00		1514.70		
1 P/U Truck, 3/4 Ton (Daily)		143.85		158.24	95.05	104.56
16 L.H., Daily Totals		$2432.45		$3031.34	$152.03	$189.46
Crew A-3L	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$56.98	$84.90
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Hyd. Crane, 80 Ton (Daily)		2058.00		2263.80		
1 P/U Truck, 3/4 Ton (Daily)		143.85		158.24	137.62	151.38
16 L.H., Daily Totals		$3113.45		$3780.43	$194.59	$236.28
Crew A-3M	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$56.98	$84.90
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Hyd. Crane, 100 Ton (Daily)		2253.00		2478.30		
1 P/U Truck, 3/4 Ton (Daily)		143.85		158.24	149.80	164.78
16 L.H., Daily Totals		$3308.45		$3994.93	$206.78	$249.68
Crew A-3N	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$61.45	$91.55
1 Tower Crane (monthly)		1737.00		1910.70	217.13	238.84
8 L.H., Daily Totals		$2228.60		$2643.10	$278.57	$330.39
Crew A-3P	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (light)	$55.50	$444.00	$82.70	$661.60	$55.50	$82.70
1 A.T. Forklift, 31' reach, 45' lift		346.45		381.10	43.31	47.64
8 L.H., Daily Totals		$790.45		$1042.69	$98.81	$130.34
Crew A-3Q	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (light)	$55.50	$444.00	$82.70	$661.60	$55.50	$82.70
1 Pickup Truck, 4x4, 3/4 Ton		176.75		194.43		
1 Flatbed Trailer, 3 Ton		71.15		78.27	30.99	34.09
8 L.H., Daily Totals		$691.90		$934.29	$86.49	$116.79

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew A-3R	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (light)	$55.50	$444.00	$82.70	$661.60	$55.50	$82.70
1 Forklift, Smooth Floor, 8,000 Lb.		283.25		311.57	35.41	38.95
8 L.H., Daily Totals		$727.25		$973.17	$90.91	$121.65
Crew A-4	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Carpenters	$54.70	$875.20	$81.65	$1306.40	$51.95	$77.40
1 Painter, Ordinary	46.45	371.60	68.90	551.20		
24 L.H., Daily Totals		$1246.80		$1857.60	$51.95	$77.40
Crew A-5	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$44.89	$67.00
.25 Truck Driver (light)	48.80	97.60	73.00	146.00		
.25 Flatbed Truck, Gas, 1.5 Ton		49.63		54.59	2.76	3.03
18 L.H., Daily Totals		$857.63		$1260.59	$47.65	$70.03
Crew A-6	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Instrument Man	$57.10	$456.80	$85.90	$687.20	$54.88	$82.15
1 Rodman/Chainman	52.65	421.20	78.40	627.20		
1 Level, Electronic		34.40		37.84	2.15	2.37
16 L.H., Daily Totals		$912.40		$1352.24	$57.02	$84.52
Crew A-7	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Chief of Party	$68.50	$548.00	$102.35	$818.80	$59.42	$88.88
1 Instrument Man	57.10	456.80	85.90	687.20		
1 Rodman/Chainman	52.65	421.20	78.40	627.20		
1 Level, Electronic		34.40		37.84	1.43	1.58
24 L.H., Daily Totals		$1460.40		$2171.04	$60.85	$90.46
Crew A-8	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Chief of Party	$68.50	$548.00	$102.35	$818.80	$57.73	$86.26
1 Instrument Man	57.10	456.80	85.90	687.20		
2 Rodmen/Chainmen	52.65	842.40	78.40	1254.40		
1 Level, Electronic		34.40		37.84	1.08	1.18
32 L.H., Daily Totals		$1881.60		$2798.24	$58.80	$87.44
Crew A-9	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Asbestos Foreman	$61.45	$491.60	$94.00	$752.00	$61.01	$93.34
7 Asbestos Workers	60.95	3413.20	93.25	5222.00		
64 L.H., Daily Totals		$3904.80		$5974.00	$61.01	$93.34
Crew A-10A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Asbestos Foreman	$61.45	$491.60	$94.00	$752.00	$61.12	$93.50
2 Asbestos Workers	60.95	975.20	93.25	1492.00		
24 L.H., Daily Totals		$1466.80		$2244.00	$61.12	$93.50
Crew A-10B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Asbestos Foreman	$61.45	$491.60	$94.00	$752.00	$61.08	$93.44
3 Asbestos Workers	60.95	1462.80	93.25	2238.00		
32 L.H., Daily Totals		$1954.40		$2990.00	$61.08	$93.44
Crew A-10C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
3 Asbestos Workers	$60.95	$1462.80	$93.25	$2238.00	$60.95	$93.25
1 Flatbed Truck, Gas, 1.5 Ton		198.50		218.35	8.27	9.10
24 L.H., Daily Totals		$1661.30		$2456.35	$69.22	$102.35

Crews - Standard

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew A-10D	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Asbestos Workers	$60.95	$975.20	$93.25	$1492.00	$58.96	$89.08
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Hydraulic Crane, 33 Ton		983.15		1081.46	30.72	33.80
32 L.H., Daily Totals		$2869.95		$3931.86	$89.69	$122.87
Crew A-11	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Asbestos Foreman	$61.45	$491.60	$94.00	$752.00	$61.01	$93.34
7 Asbestos Workers	60.95	3413.20	93.25	5222.00		
2 Chip. Hammers, 12 Lb., Elec.		65.70		72.27	1.03	1.13
64 L.H., Daily Totals		$3970.50		$6046.27	$62.04	$94.47
Crew A-12	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Asbestos Foreman	$61.45	$491.60	$94.00	$752.00	$61.01	$93.34
7 Asbestos Workers	60.95	3413.20	93.25	5222.00		
1 Trk-Mtd Vac, 14 CY, 1500 Gal.		542.60		596.86		
1 Flatbed Truck, 20,000 GVW		204.05		224.46	11.67	12.83
64 L.H., Daily Totals		$4651.45		$6795.31	$72.68	$106.18
Crew A-13	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (light)	$55.50	$444.00	$82.70	$661.60	$55.50	$82.70
1 Trk-Mtd Vac, 14 CY, 1500 Gal.		542.60		596.86		
1 Flatbed Truck, 20,000 GVW		204.05		224.46	93.33	102.66
8 L.H., Daily Totals		$1190.65		$1482.92	$148.83	$185.36
Crew B-1	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$45.07	$67.25
2 Laborers	44.40	710.40	66.25	1060.00		
24 L.H., Daily Totals		$1081.60		$1614.00	$45.07	$67.25
Crew B-1A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$45.07	$67.25
2 Laborers	44.40	710.40	66.25	1060.00		
2 Cutting Torches		25.90		28.49		
2 Sets of Gases		347.20		381.92	15.55	17.10
24 L.H., Daily Totals		$1454.70		$2024.41	$60.61	$84.35
Crew B-1B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.16	$73.33
2 Laborers	44.40	710.40	66.25	1060.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
2 Cutting Torches		25.90		28.49		
2 Sets of Gases		347.20		381.92		
1 Hyd. Crane, 12 Ton		475.80		523.38	26.53	29.18
32 L.H., Daily Totals		$2422.10		$3280.19	$75.69	$102.51
Crew B-1C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$45.07	$67.25
2 Laborers	44.40	710.40	66.25	1060.00		
1 Telescoping Boom Lift, to 60'		292.45		321.69	12.19	13.40
24 L.H., Daily Totals		$1374.05		$1935.69	$57.25	$80.65
Crew B-1D	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$44.40	$66.25
1 Small Work Boat, Gas, 50 H.P.		120.85		132.94		
1 Pressure Washer, 7 GPM		93.95		103.35	13.43	14.77
16 L.H., Daily Totals		$925.20		$1296.28	$57.83	$81.02

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-1E	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$44.90	$67.00
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Work Boat, Diesel, 200 H.P.		1436.00		1579.60		
2 Pressure Washers, 7 GPM		187.90		206.69	50.75	55.82
32 L.H., Daily Totals		$3060.70		$3930.29	$95.65	$122.82
Crew B-1F	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Skilled Workers	$57.10	$913.60	$85.90	$1374.40	$52.87	$79.35
1 Laborer	44.40	355.20	66.25	530.00		
1 Small Work Boat, Gas, 50 H.P.		120.85		132.94		
1 Pressure Washer, 7 GPM		93.95		103.35	8.95	9.85
24 L.H., Daily Totals		$1483.60		$2140.68	$61.82	$89.19
Crew B-1G	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$44.40	$66.25
1 Small Work Boat, Gas, 50 H.P.		120.85		132.94	7.55	8.31
16 L.H., Daily Totals		$831.25		$1192.93	$51.95	$74.56
Crew B-1H	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Skilled Workers	$57.10	$913.60	$85.90	$1374.40	$52.87	$79.35
1 Laborer	44.40	355.20	66.25	530.00		
1 Small Work Boat, Gas, 50 H.P.		120.85		132.94	5.04	5.54
24 L.H., Daily Totals		$1389.65		$2037.34	$57.90	$84.89
Crew B-1J	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (inside)	$44.90	$359.20	$67.00	$536.00	$44.65	$66.63
1 Laborer	44.40	355.20	66.25	530.00		
16 L.H., Daily Totals		$714.40		$1066.00	$44.65	$66.63
Crew B-1K	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Carpenter Foreman (inside)	$55.20	$441.60	$82.40	$659.20	$54.95	$82.03
1 Carpenter	54.70	437.60	81.65	653.20		
16 L.H., Daily Totals		$879.20		$1312.40	$54.95	$82.03
Crew B-2	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$44.80	$66.85
4 Laborers	44.40	1420.80	66.25	2120.00		
40 L.H., Daily Totals		$1792.00		$2674.00	$44.80	$66.85
Crew B-2A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$45.07	$67.25
2 Laborers	44.40	710.40	66.25	1060.00		
1 Telescoping Boom Lift, to 60'		292.45		321.69	12.19	13.40
24 L.H., Daily Totals		$1374.05		$1935.69	$57.25	$80.65
Crew B-3	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.47	$73.84
2 Laborers	44.40	710.40	66.25	1060.00		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
2 Truck Drivers (heavy)	51.30	820.80	76.70	1227.20		
1 Crawler Loader, 3 C.Y.		1146.00		1260.60		
2 Dump Trucks, 12 C.Y., 400 H.P.		1158.70		1274.57	48.01	52.82
48 L.H., Daily Totals		$4679.10		$6079.57	$97.48	$126.66
Crew B-3A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
4 Laborers	$44.40	$1420.80	$66.25	$2120.00	$47.32	$70.58
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Hyd. Excavator, 1.5 C.Y.		695.80		765.38	17.40	19.13
40 L.H., Daily Totals		$2588.60		$3588.58	$64.72	$89.71

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-3B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$49.77	$74.28
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Backhoe Loader, 80 H.P.		235.05		258.56		
1 Dump Truck, 12 C.Y., 400 H.P.		579.35		637.28	25.45	28.00
32 L.H., Daily Totals		$2407.20		$3272.64	$75.22	$102.27
Crew B-3C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
3 Laborers	$44.40	$1065.60	$66.25	$1590.00	$48.05	$71.66
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Crawler Loader, 4 C.Y.		1456.00		1601.60	45.50	50.05
32 L.H., Daily Totals		$2993.60		$3894.80	$93.55	$121.71
Crew B-4	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$45.88	$68.49
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Truck Tractor, 220 H.P.		310.80		341.88		
1 Flatbed Trailer, 40 Ton		188.45		207.29	10.40	11.44
48 L.H., Daily Totals		$2701.65		$3836.78	$56.28	$79.93
Crew B-5	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.86	$72.86
4 Laborers	44.40	1420.80	66.25	2120.00		
2 Equip. Oper. (medium)	59.00	944.00	87.90	1406.40		
1 Air Compressor, 250 cfm		202.85		223.13		
2 Breakers, Pavement, 60 lb.		107.20		117.92		
2 -50' Air Hoses, 1.5		45.60		50.16		
1 Crawler Loader, 3 C.Y.		1146.00		1260.60	26.82	29.50
56 L.H., Daily Totals		$4237.65		$5732.22	$75.67	$102.36
Crew B-5A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.08	$73.22
6 Laborers	44.40	2131.20	66.25	3180.00		
2 Equip. Oper. (medium)	59.00	944.00	87.90	1406.40		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
2 Truck Drivers (heavy)	51.30	820.80	76.70	1227.20		
1 Air Compressor, 365 cfm		343.55		377.90		
2 Breakers, Pavement, 60 lb.		107.20		117.92		
8 -50' Air Hoses, 1		64.40		70.84		
2 Dump Trucks, 8 C.Y., 220 H.P.		815.20		896.72	13.86	15.24
96 L.H., Daily Totals		$6041.55		$8492.58	$62.93	$88.46
Crew B-5B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Powderman	$57.10	$456.80	$85.90	$687.20	$54.83	$81.97
2 Equip. Oper. (medium)	59.00	944.00	87.90	1406.40		
3 Truck Drivers (heavy)	51.30	1231.20	76.70	1840.80		
1 F.E. Loader, W.M., 2.5 C.Y.		638.30		702.13		
3 Dump Trucks, 12 C.Y., 400 H.P.		1738.05		1911.86		
1 Air Compressor, 365 cfm		343.55		377.90	56.66	62.33
48 L.H., Daily Totals		$5351.90		$6926.29	$111.50	$144.30

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-5C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
3 Laborers	$44.40	$1065.60	$66.25	$1590.00	$51.09	$76.23
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
2 Truck Drivers (heavy)	51.30	820.80	76.70	1227.20		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
2 Dump Trucks, 12 C.Y., 400 H.P.		1158.70		1274.57		
1 Crawler Loader, 4 C.Y.		1456.00		1601.60		
1 S.P. Crane, 4x4, 25 Ton		1155.00		1270.50	58.90	64.79
64 L.H., Daily Totals		$7039.70		$9025.47	$110.00	$141.02
Crew B-5D	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.16	$73.34
4 Laborers	44.40	1420.80	66.25	2120.00		
2 Equip. Oper. (medium)	59.00	944.00	87.90	1406.40		
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Air Compressor, 250 cfm		202.85		223.13		
2 Breakers, Pavement, 60 lb.		107.20		117.92		
2 -50' Air Hoses, 1.5		45.60		50.16		
1 Crawler Loader, 3 C.Y.		1146.00		1260.60		
1 Dump Truck, 12 C.Y., 400 H.P.		579.35		637.28	32.52	35.77
64 L.H., Daily Totals		$5227.40		$6983.10	$81.68	$109.11
Crew B-5E	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.16	$73.34
4 Laborers	44.40	1420.80	66.25	2120.00		
2 Equip. Oper. (medium)	59.00	944.00	87.90	1406.40		
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Water Tank Trailer, 5000 Gal.		154.10		169.51		
1 High Pressure Water Jet 40 KSI		820.75		902.83		
2 -50' Air Hoses, 1.5		45.60		50.16		
1 Crawler Loader, 3 C.Y.		1146.00		1260.60		
1 Dump Truck, 12 C.Y., 400 H.P.		579.35		637.28	42.90	47.19
64 L.H., Daily Totals		$5892.20		$7714.38	$92.07	$120.54
Crew B-6	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$48.10	$71.73
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Backhoe Loader, 48 H.P.		216.20		237.82	9.01	9.91
24 L.H., Daily Totals		$1370.60		$1959.42	$57.11	$81.64
Crew B-6A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
.5 Labor Foreman (outside)	$46.40	$185.60	$69.25	$277.00	$50.64	$75.51
1 Laborer	44.40	355.20	66.25	530.00		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Vacuum Truck, 5000 Gal.		371.95		409.14	18.60	20.46
20 L.H., Daily Totals		$1384.75		$1919.35	$69.24	$95.97
Crew B-6B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Labor Foremen (outside)	$46.40	$742.40	$69.25	$1108.00	$45.07	$67.25
4 Laborers	44.40	1420.80	66.25	2120.00		
1 S.P. Crane, 4x4, 5 Ton		381.95		420.14		
1 Flatbed Truck, Gas, 1.5 Ton		198.50		218.35		
1 Butt Fusion Mach., 4 -12 diam.		420.75		462.82	20.86	22.94
48 L.H., Daily Totals		$3164.40		$4329.32	$65.92	$90.19

Crews - Standard

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-6C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Labor Foremen (outside)	$46.40	$742.40	$69.25	$1108.00	$45.07	$67.25
4 Laborers	44.40	1420.80	66.25	2120.00		
1 S.P. Crane, 4x4, 12 Ton		432.65		475.92		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05		
1 Butt Fusion Mach., 8 -24 diam.		1086.00		1194.60	49.35	54.28
48 L.H., Daily Totals		$4531.90		$5833.57	$94.41	$121.53
Crew B-6D	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
.5 Labor Foreman (outside)	$46.40	$185.60	$69.25	$277.00	$50.64	$75.51
1 Laborer	44.40	355.20	66.25	530.00		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Hydro Excavator, 12 C.Y.		1277.00		1404.70	63.85	70.23
20 L.H., Daily Totals		$2289.80		$2914.90	$114.49	$145.75
Crew B-7	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$47.17	$70.36
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Brush Chipper, 12 , 130 H.P.		366.05		402.65		
1 Crawler Loader, 3 C.Y.		1146.00		1260.60		
2 Chain Saws, Gas, 36 Long		83.30		91.63	33.24	36.56
48 L.H., Daily Totals		$3859.35		$5132.09	$80.40	$106.92
Crew B-7A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$48.10	$71.73
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Rake w/Tractor		343.50		377.85		
2 Chain Saws, Gas, 18		104.40		114.84	18.66	20.53
24 L.H., Daily Totals		$1602.30		$2214.29	$66.76	$92.26
Crew B-7B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$47.76	$71.26
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Brush Chipper, 12 , 130 H.P.		366.05		402.65		
1 Crawler Loader, 3 C.Y.		1146.00		1260.60		
2 Chain Saws, Gas, 36 Long		83.30		91.63		
1 Dump Truck, 8 C.Y., 220 H.P.		407.60		448.36	35.77	39.34
56 L.H., Daily Totals		$4677.35		$6194.05	$83.52	$110.61
Crew B-7C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$47.76	$71.26
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Brush Chipper, 12 , 130 H.P.		366.05		402.65		
1 Crawler Loader, 3 C.Y.		1146.00		1260.60		
2 Chain Saws, Gas, 36 Long		83.30		91.63		
1 Dump Truck, 12 C.Y., 400 H.P.		579.35		637.28	38.83	42.72
56 L.H., Daily Totals		$4849.10		$6382.97	$86.59	$113.98

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-8	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$51.04	$76.15
2 Laborers	44.40	710.40	66.25	1060.00		
2 Equip. Oper. (medium)	59.00	944.00	87.90	1406.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
2 Truck Drivers (heavy)	51.30	820.80	76.70	1227.20		
1 Hyd. Crane, 25 Ton		586.70		645.37		
1 Crawler Loader, 3 C.Y.		1146.00		1260.60		
2 Dump Trucks, 12 C.Y., 400 H.P.		1158.70		1274.57	45.18	49.70
64 L.H., Daily Totals		$6157.80		$8054.14	$96.22	$125.85
Crew B-9	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$44.80	$66.85
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Air Compressor, 250 cfm		202.85		223.13		
2 Breakers, Pavement, 60 lb.		107.20		117.92		
2 -50' Air Hoses, 1.5		45.60		50.16	8.89	9.78
40 L.H., Daily Totals		$2147.65		$3065.22	$53.69	$76.63
Crew B-9A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$46.70	$69.73
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Water Tank Trailer, 5000 Gal.		154.10		169.51		
1 Truck Tractor, 220 H.P.		310.80		341.88		
2 -50' Discharge Hoses, 3		9.00		9.90	19.75	21.72
24 L.H., Daily Totals		$1594.70		$2194.89	$66.45	$91.45
Crew B-9B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$46.70	$69.73
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
2 -50' Discharge Hoses, 3		9.00		9.90		
1 Water Tank Trailer, 5000 Gal.		154.10		169.51		
1 Truck Tractor, 220 H.P.		310.80		341.88		
1 Pressure Washer		97.35		107.08	23.80	26.18
24 L.H., Daily Totals		$1692.05		$2301.97	$70.50	$95.92
Crew B-9D	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$44.80	$66.85
4 Common Laborers	44.40	1420.80	66.25	2120.00		
1 Air Compressor, 250 cfm		202.85		223.13		
2 -50' Air Hoses, 1.5		45.60		50.16		
2 Air Powered Tampers		79.50		87.45	8.20	9.02
40 L.H., Daily Totals		$2119.95		$3034.74	$53.00	$75.87
Crew B-9E	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Cement Finisher	$51.80	$414.40	$75.90	$607.20	$48.10	$71.08
1 Laborer	44.40	355.20	66.25	530.00		
1 Chip. Hammers, 12 Lb., Elec.		32.85		36.13	2.05	2.26
16 L.H., Daily Totals		$802.45		$1173.34	$50.15	$73.33
Crew B-10	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
12 L.H., Daily Totals		$649.60		$968.20	$54.13	$80.68
Crew B-10A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Roller, 2-Drum, W.B., 7.5 H.P.		166.75		183.43	13.90	15.29
12 L.H., Daily Totals		$816.35		$1151.63	$68.03	$95.97

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-10B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Dozer, 200 H.P.		1520.00		1672.00	126.67	139.33
12 L.H., Daily Totals		$2169.60		$2640.20	$180.80	$220.02
Crew B-10C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Dozer, 200 H.P.		1520.00		1672.00		
1 Vibratory Roller, Towed, 23 Ton		520.35		572.38	170.03	187.03
12 L.H., Daily Totals		$2689.95		$3212.59	$224.16	$267.72
Crew B-10D	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Dozer, 200 H.P.		1520.00		1672.00		
1 Sheepsft. Roller, Towed		426.95		469.64	162.25	178.47
12 L.H., Daily Totals		$2596.55		$3109.84	$216.38	$259.15
Crew B-10E	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Tandem Roller, 5 Ton		258.75		284.63	21.56	23.72
12 L.H., Daily Totals		$908.35		$1252.83	$75.70	$104.40
Crew B-10F	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Tandem Roller, 10 Ton		246.80		271.48	20.57	22.62
12 L.H., Daily Totals		$896.40		$1239.68	$74.70	$103.31
Crew B-10G	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Sheepsfoot Roller, 240 H.P.		1363.00		1499.30	113.58	124.94
12 L.H., Daily Totals		$2012.60		$2467.50	$167.72	$205.63
Crew B-10H	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Diaphragm Water Pump, 2		87.70		96.47		
1 -20' Suction Hose, 2		3.55		3.90		
2 -50' Discharge Hoses, 2		8.00		8.80	8.27	9.10
12 L.H., Daily Totals		$748.85		$1077.38	$62.40	$89.78
Crew B-10I	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Diaphragm Water Pump, 4		106.35		116.99		
1 -20' Suction Hose, 4		17.25		18.98		
2 -50' Discharge Hoses, 4		25.60		28.16	12.43	13.68
12 L.H., Daily Totals		$798.80		$1132.32	$66.57	$94.36
Crew B-10J	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Centrifugal Water Pump, 3		74.40		81.84		
1 -20' Suction Hose, 3		8.75		9.63		
2 -50' Discharge Hoses, 3		9.00		9.90	7.68	8.45
12 L.H., Daily Totals		$741.75		$1069.57	$61.81	$89.13

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-10K	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Centr. Water Pump, 6		235.25		258.77		
1 -20' Suction Hose, 6		25.50		28.05		
2 -50' Discharge Hoses, 6		36.20		39.82	24.75	27.22
12 L.H., Daily Totals		$946.55		$1294.85	$78.88	$107.90
Crew B-10L	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Dozer, 80 H.P.		405.85		446.44	33.82	37.20
12 L.H., Daily Totals		$1055.45		$1414.64	$87.95	$117.89
Crew B-10M	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Dozer, 300 H.P.		1785.00		1963.50	148.75	163.63
12 L.H., Daily Totals		$2434.60		$2931.70	$202.88	$244.31
Crew B-10N	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 F.E. Loader, T.M., 1.5 C.Y.		572.00		629.20	47.67	52.43
12 L.H., Daily Totals		$1221.60		$1597.40	$101.80	$133.12
Crew B-10O	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 F.E. Loader, T.M., 2.25 C.Y.		925.50		1018.05	77.13	84.84
12 L.H., Daily Totals		$1575.10		$1986.25	$131.26	$165.52
Crew B-10P	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Crawler Loader, 3 C.Y.		1146.00		1260.60	95.50	105.05
12 L.H., Daily Totals		$1795.60		$2228.80	$149.63	$185.73
Crew B-10Q	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Crawler Loader, 4 C.Y.		1456.00		1601.60	121.33	133.47
12 L.H., Daily Totals		$2105.60		$2569.80	$175.47	$214.15
Crew B-10R	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 F.E. Loader, W.M., 1 C.Y.		305.60		336.16	25.47	28.01
12 L.H., Daily Totals		$955.20		$1304.36	$79.60	$108.70
Crew B-10S	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 F.E. Loader, W.M., 1.5 C.Y.		441.40		485.54	36.78	40.46
12 L.H., Daily Totals		$1091.00		$1453.74	$90.92	$121.15
Crew B-10T	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 F.E. Loader, W.M., 2.5 C.Y.		638.30		702.13	53.19	58.51
12 L.H., Daily Totals		$1287.90		$1670.33	$107.33	$139.19

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-10U	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 F.E. Loader, W.M., 5.5 C.Y.		967.95		1064.74	80.66	88.73
12 L.H., Daily Totals		$1617.55		$2032.94	$134.80	$169.41
Crew B-10V	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Dozer, 700 H.P.		5175.00		5692.50	431.25	474.38
12 L.H., Daily Totals		$5824.60		$6660.70	$485.38	$555.06
Crew B-10W	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Dozer, 105 H.P.		640.80		704.88	53.40	58.74
12 L.H., Daily Totals		$1290.40		$1673.08	$107.53	$139.42
Crew B-10X	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Dozer, 410 H.P.		2807.00		3087.70	233.92	257.31
12 L.H., Daily Totals		$3456.60		$4055.90	$288.05	$337.99
Crew B-10Y	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Vibr. Roller, Towed, 12 Ton		584.80		643.28	48.73	53.61
12 L.H., Daily Totals		$1234.40		$1611.48	$102.87	$134.29
Crew B-11A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equipment Oper. (med.)	$59.00	$472.00	$87.90	$703.20	$51.70	$77.08
1 Laborer	44.40	355.20	66.25	530.00		
1 Dozer, 200 H.P.		1520.00		1672.00	95.00	104.50
16 L.H., Daily Totals		$2347.20		$2905.20	$146.70	$181.57
Crew B-11B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equipment Oper. (light)	$55.50	$444.00	$82.70	$661.60	$49.95	$74.47
1 Laborer	44.40	355.20	66.25	530.00		
1 Air Powered Tamper		39.75		43.73		
1 Air Compressor, 365 cfm		343.55		377.90		
2 -50' Air Hoses, 1.5		45.60		50.16	26.81	29.49
16 L.H., Daily Totals		$1228.10		$1663.39	$76.76	$103.96
Crew B-11C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equipment Oper. (med.)	$59.00	$472.00	$87.90	$703.20	$51.70	$77.08
1 Laborer	44.40	355.20	66.25	530.00		
1 Backhoe Loader, 48 H.P.		216.20		237.82	13.51	14.86
16 L.H., Daily Totals		$1043.40		$1471.02	$65.21	$91.94
Crew B-11J	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equipment Oper. (med.)	$59.00	$472.00	$87.90	$703.20	$51.70	$77.08
1 Laborer	44.40	355.20	66.25	530.00		
1 Grader, 30,000 Lbs.		1073.00		1180.30		
1 Ripper, Beam & 1 Shank		91.60		100.76	72.79	80.07
16 L.H., Daily Totals		$1991.80		$2514.26	$124.49	$157.14

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-11K	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equipment Oper. (med.)	$59.00	$472.00	$87.90	$703.20	$51.70	$77.08
1 Laborer	44.40	355.20	66.25	530.00		
1 Trencher, Chain Type, 8' D		1894.00		2083.40	118.38	130.21
16 L.H., Daily Totals		$2721.20		$3316.60	$170.07	$207.29
Crew B-11L	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equipment Oper. (med.)	$59.00	$472.00	$87.90	$703.20	$51.70	$77.08
1 Laborer	44.40	355.20	66.25	530.00		
1 Grader, 30,000 Lbs.		1073.00		1180.30	67.06	73.77
16 L.H., Daily Totals		$1900.20		$2413.50	$118.76	$150.84
Crew B-11M	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equipment Oper. (med.)	$59.00	$472.00	$87.90	$703.20	$51.70	$77.08
1 Laborer	44.40	355.20	66.25	530.00		
1 Backhoe Loader, 80 H.P.		235.05		258.56	14.69	16.16
16 L.H., Daily Totals		$1062.25		$1491.76	$66.39	$93.23
Crew B-11N	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$52.47	$78.36
2 Equipment Operators (med.)	59.00	944.00	87.90	1406.40		
6 Truck Drivers (heavy)	51.30	2462.40	76.70	3681.60		
1 F.E. Loader, W.M., 5.5 C.Y.		967.95		1064.74		
1 Dozer, 410 H.P.		2807.00		3087.70		
6 Dump Trucks, Off Hwy., 50 Ton		11874.00		13061.40	217.35	239.08
72 L.H., Daily Totals		$19426.55		$22855.85	$269.81	$317.44
Crew B-11Q	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equipment Operator (med.)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Dozer, 140 H.P.		729.15		802.07	60.76	66.84
12 L.H., Daily Totals		$1378.75		$1770.27	$114.90	$147.52
Crew B-11R	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equipment Operator (med.)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Dozer, 200 H.P.		1520.00		1672.00	126.67	139.33
12 L.H., Daily Totals		$2169.60		$2640.20	$180.80	$220.02
Crew B-11S	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equipment Operator (med.)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Dozer, 300 H.P.		1785.00		1963.50		
1 Ripper, Beam & 1 Shank		91.60		100.76	156.38	172.02
12 L.H., Daily Totals		$2526.20		$3032.46	$210.52	$252.71
Crew B-11T	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equipment Operator (med.)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Dozer, 410 H.P.		2807.00		3087.70		
1 Ripper, Beam & 2 Shanks		140.40		154.44	245.62	270.18
12 L.H., Daily Totals		$3597.00		$4210.34	$299.75	$350.86
Crew B-11U	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equipment Operator (med.)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Dozer, 520 H.P.		3434.00		3777.40	286.17	314.78
12 L.H., Daily Totals		$4083.60		$4745.60	$340.30	$395.47

Crews - Standard

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-11V	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
3 Laborers	$44.40	$1065.60	$66.25	$1590.00	$44.40	$66.25
1 Roller, 2-Drum, W.B., 7.5 H.P.		166.75		183.43	6.95	7.64
24 L.H., Daily Totals		$1232.35		$1773.43	$51.35	$73.89
Crew B-11W	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equipment Operator (med.)	$59.00	$472.00	$87.90	$703.20	$51.37	$76.76
1 Common Laborer	44.40	355.20	66.25	530.00		
10 Truck Drivers (heavy)	51.30	4104.00	76.70	6136.00		
1 Dozer, 200 H.P.		1520.00		1672.00		
1 Vibratory Roller, Towed, 23 Ton		520.35		572.38		
10 Dump Trucks, 8 C.Y., 220 H.P.		4076.00		4483.60	63.71	70.08
96 L.H., Daily Totals		$11047.55		$14097.18	$115.08	$146.85
Crew B-11Y	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.49	$73.80
5 Common Laborers	44.40	1776.00	66.25	2650.00		
3 Equipment Operators (med.)	59.00	1416.00	87.90	2109.60		
1 Dozer, 80 H.P.		405.85		446.44		
2 Rollers, 2-Drum, W.B., 7.5 H.P.		333.50		366.85		
4 Vibrating Plates, Gas, 21		662.40		728.64	19.47	21.42
72 L.H., Daily Totals		$4964.95		$6855.52	$68.96	$95.22
Crew B-12A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$52.92	$78.90
1 Laborer	44.40	355.20	66.25	530.00		
1 Hyd. Excavator, 1 C.Y.		832.65		915.91	52.04	57.24
16 L.H., Daily Totals		$1679.45		$2178.32	$104.97	$136.14
Crew B-12B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$52.92	$78.90
1 Laborer	44.40	355.20	66.25	530.00		
1 Hyd. Excavator, 1.5 C.Y.		695.80		765.38	43.49	47.84
16 L.H., Daily Totals		$1542.60		$2027.78	$96.41	$126.74
Crew B-12C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$52.92	$78.90
1 Laborer	44.40	355.20	66.25	530.00		
1 Hyd. Excavator, 2 C.Y.		942.70		1036.97	58.92	64.81
16 L.H., Daily Totals		$1789.50		$2299.37	$111.84	$143.71
Crew B-12D	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$52.92	$78.90
1 Laborer	44.40	355.20	66.25	530.00		
1 Hyd. Excavator, 3.5 C.Y.		2184.00		2402.40	136.50	150.15
16 L.H., Daily Totals		$3030.80		$3664.80	$189.43	$229.05
Crew B-12E	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$52.92	$78.90
1 Laborer	44.40	355.20	66.25	530.00		
1 Hyd. Excavator, .5 C.Y.		457.00		502.70	28.56	31.42
16 L.H., Daily Totals		$1303.80		$1765.10	$81.49	$110.32
Crew B-12F	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$52.92	$78.90
1 Laborer	44.40	355.20	66.25	530.00		
1 Hyd. Excavator, .75 C.Y.		701.80		771.98	43.86	48.25
16 L.H., Daily Totals		$1548.60		$2034.38	$96.79	$127.15

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-12G	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$52.92	$78.90
1 Laborer	44.40	355.20	66.25	530.00		
1 Crawler Crane, 15 Ton		810.30		891.33		
1 Clamshell Bucket, .5 C.Y.		67.80		74.58	54.88	60.37
16 L.H., Daily Totals		$1724.90		$2228.31	$107.81	$139.27
Crew B-12H	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$52.92	$78.90
1 Laborer	44.40	355.20	66.25	530.00		
1 Crawler Crane, 25 Ton		1152.00		1267.20		
1 Clamshell Bucket, 1 C.Y.		69.25		76.17	76.33	83.96
16 L.H., Daily Totals		$2068.05		$2605.78	$129.25	$162.86
Crew B-12I	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$52.92	$78.90
1 Laborer	44.40	355.20	66.25	530.00		
1 Crawler Crane, 20 Ton		1013.00		1114.30		
1 Dragline Bucket, .75 C.Y.		61.85		68.03	67.18	73.90
16 L.H., Daily Totals		$1921.65		$2444.74	$120.10	$152.80
Crew B-12J	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$52.92	$78.90
1 Laborer	44.40	355.20	66.25	530.00		
1 Gradall, 5/8 C.Y.		850.65		935.72	53.17	58.48
16 L.H., Daily Totals		$1697.45		$2198.11	$106.09	$137.38
Crew B-12K	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$52.92	$78.90
1 Laborer	44.40	355.20	66.25	530.00		
1 Gradall, 3 Ton, 1 C.Y.		984.55		1083.01	61.53	67.69
16 L.H., Daily Totals		$1831.35		$2345.41	$114.46	$146.59
Crew B-12L	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$52.92	$78.90
1 Laborer	44.40	355.20	66.25	530.00		
1 Crawler Crane, 15 Ton		810.30		891.33		
1 F.E. Attachment, .5 C.Y.		66.05		72.66	54.77	60.25
16 L.H., Daily Totals		$1723.15		$2226.39	$107.70	$139.15
Crew B-12M	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$52.92	$78.90
1 Laborer	44.40	355.20	66.25	530.00		
1 Crawler Crane, 20 Ton		1013.00		1114.30		
1 F.E. Attachment, .75 C.Y.		71.25		78.38	67.77	74.54
16 L.H., Daily Totals		$1931.05		$2455.07	$120.69	$153.44
Crew B-12N	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$52.92	$78.90
1 Laborer	44.40	355.20	66.25	530.00		
1 Crawler Crane, 25 Ton		1152.00		1267.20		
1 F.E. Attachment, 1 C.Y.		77.35		85.08	76.83	84.52
16 L.H., Daily Totals		$2076.15		$2614.68	$129.76	$163.42
Crew B-12O	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$52.92	$78.90
1 Laborer	44.40	355.20	66.25	530.00		
1 Crawler Crane, 40 Ton		1231.00		1354.10		
1 F.E. Attachment, 1.5 C.Y.		88.65		97.52	82.48	90.73
16 L.H., Daily Totals		$2166.45		$2714.01	$135.40	$169.63

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-12P	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$52.92	$78.90
1 Laborer	44.40	355.20	66.25	530.00		
1 Crawler Crane, 40 Ton		1231.00		1354.10		
1 Dragline Bucket, 1.5 C.Y.		65.70		72.27	81.04	89.15
16 L.H., Daily Totals		$2143.50		$2688.77	$133.97	$168.05
Crew B-12Q	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$52.92	$78.90
1 Laborer	44.40	355.20	66.25	530.00		
1 Hyd. Excavator, 5/8 C.Y.		604.75		665.23	37.80	41.58
16 L.H., Daily Totals		$1451.55		$1927.63	$90.72	$120.48
Crew B-12S	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$52.92	$78.90
1 Laborer	44.40	355.20	66.25	530.00		
1 Hyd. Excavator, 2.5 C.Y.		1567.00		1723.70	97.94	107.73
16 L.H., Daily Totals		$2413.80		$2986.10	$150.86	$186.63
Crew B-12T	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$52.92	$78.90
1 Laborer	44.40	355.20	66.25	530.00		
1 Crawler Crane, 75 Ton		1967.00		2163.70		
1 F.E. Attachment, 3 C.Y.		115.55		127.11	130.16	143.18
16 L.H., Daily Totals		$2929.35		$3553.20	$183.08	$222.08
Crew B-12V	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$52.92	$78.90
1 Laborer	44.40	355.20	66.25	530.00		
1 Crawler Crane, 75 Ton		1967.00		2163.70		
1 Dragline Bucket, 3 C.Y.		72.30		79.53	127.46	140.20
16 L.H., Daily Totals		$2886.10		$3505.63	$180.38	$219.10
Crew B-12Y	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$50.08	$74.68
2 Laborers	44.40	710.40	66.25	1060.00		
1 Hyd. Excavator, 3.5 C.Y.		2184.00		2402.40	91.00	100.10
24 L.H., Daily Totals		$3386.00		$4194.80	$141.08	$174.78
Crew B-12Z	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$50.08	$74.68
2 Laborers	44.40	710.40	66.25	1060.00		
1 Hyd. Excavator, 2.5 C.Y.		1567.00		1723.70	65.29	71.82
24 L.H., Daily Totals		$2769.00		$3516.10	$115.38	$146.50
Crew B-13	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.28	$72.01
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Hyd. Crane, 25 Ton		586.70		645.37	10.48	11.52
56 L.H., Daily Totals		$3290.30		$4677.77	$58.76	$83.53

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-13A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$50.83	$75.85
2 Laborers	44.40	710.40	66.25	1060.00		
2 Equipment Operators (med.)	59.00	944.00	87.90	1406.40		
2 Truck Drivers (heavy)	51.30	820.80	76.70	1227.20		
1 Crawler Crane, 75 Ton		1967.00		2163.70		
1 Crawler Loader, 4 C.Y.		1456.00		1601.60		
2 Dump Trucks, 8 C.Y., 220 H.P.		815.20		896.72	75.68	83.25
56 L.H., Daily Totals		$7084.60		$8909.62	$126.51	$159.10
Crew B-13B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.28	$72.01
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Hyd. Crane, 55 Ton		990.15		1089.17	17.68	19.45
56 L.H., Daily Totals		$3693.75		$5121.56	$65.96	$91.46
Crew B-13C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.28	$72.01
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Crawler Crane, 100 Ton		2310.00		2541.00	41.25	45.38
56 L.H., Daily Totals		$5013.60		$6573.40	$89.53	$117.38
Crew B-13D	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$52.92	$78.90
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Hyd. Excavator, 1 C.Y.		832.65		915.91		
1 Trench Box		119.15		131.07	59.49	65.44
16 L.H., Daily Totals		$1798.60		$2309.38	$112.41	$144.34
Crew B-13E	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$52.92	$78.90
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Hyd. Excavator, 1.5 C.Y.		695.80		765.38		
1 Trench Box		119.15		131.07	50.93	56.03
16 L.H., Daily Totals		$1661.75		$2158.84	$103.86	$134.93
Crew B-13F	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$52.92	$78.90
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Hyd. Excavator, 3.5 C.Y.		2184.00		2402.40		
1 Trench Box		119.15		131.07	143.95	158.34
16 L.H., Daily Totals		$3149.95		$3795.86	$196.87	$237.24
Crew B-13G	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$52.92	$78.90
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Hyd. Excavator, .75 C.Y.		701.80		771.98		
1 Trench Box		119.15		131.07	51.31	56.44
16 L.H., Daily Totals		$1667.75		$2165.45	$104.23	$135.34
Crew B-13H	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$52.92	$78.90
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Gradall, 5/8 C.Y.		850.65		935.72		
1 Trench Box		119.15		131.07	60.61	66.67
16 L.H., Daily Totals		$1816.60		$2329.18	$113.54	$145.57

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-13I	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$52.92	$78.90
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Gradall, 3 Ton, 1 C.Y.		984.55		1083.01		
1 Trench Box		119.15		131.07	68.98	75.88
16 L.H., Daily Totals		$1950.50		$2476.47	$121.91	$154.78
Crew B-13J	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$52.92	$78.90
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Hyd. Excavator, 2.5 C.Y.		1567.00		1723.70		
1 Trench Box		119.15		131.07	105.38	115.92
16 L.H., Daily Totals		$2532.95		$3117.17	$158.31	$194.82
Crew B-13K	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Equip. Opers. (crane)	$61.45	$983.20	$91.55	$1464.80	$61.45	$91.55
1 Hyd. Excavator, .75 C.Y.		701.80		771.98		
1 Hyd. Hammer, 4000 ft-lb		649.20		714.12		
1 Hyd. Excavator, .75 C.Y.		701.80		771.98	128.30	141.13
16 L.H., Daily Totals		$3036.00		$3722.88	$189.75	$232.68
Crew B-13L	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Equip. Opers. (crane)	$61.45	$983.20	$91.55	$1464.80	$61.45	$91.55
1 Hyd. Excavator, 1.5 C.Y.		695.80		765.38		
1 Hyd. Hammer, 5000 ft-lb		705.60		776.16		
1 Hyd. Excavator, .75 C.Y.		701.80		771.98	131.45	144.60
16 L.H., Daily Totals		$3086.40		$3778.32	$192.90	$236.15
Crew B-13M	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Equip. Opers. (crane)	$61.45	$983.20	$91.55	$1464.80	$61.45	$91.55
1 Hyd. Excavator, 2.5 C.Y.		1567.00		1723.70		
1 Hyd. Hammer, 8000 ft-lb		918.65		1010.52		
1 Hyd. Excavator, 1.5 C.Y.		695.80		765.38	198.84	218.72
16 L.H., Daily Totals		$4164.65		$4964.40	$260.29	$310.27
Crew B-13N	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Equip. Opers. (crane)	$61.45	$983.20	$91.55	$1464.80	$61.45	$91.55
1 Hyd. Excavator, 3.5 C.Y.		2184.00		2402.40		
1 Hyd. Hammer, 12,000 ft-lb		882.20		970.42		
1 Hyd. Excavator, 1.5 C.Y.		695.80		765.38	235.13	258.64
16 L.H., Daily Totals		$4745.20		$5603.00	$296.57	$350.19
Crew B-14	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$46.58	$69.49
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Backhoe Loader, 48 H.P.		216.20		237.82	4.50	4.95
48 L.H., Daily Totals		$2452.20		$3573.42	$51.09	$74.45
Crew B-14A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$55.77	$83.12
.5 Laborer	44.40	177.60	66.25	265.00		
1 Hyd. Excavator, 4.5 C.Y.		3450.00		3795.00	287.50	316.25
12 L.H., Daily Totals		$4119.20		$4792.40	$343.27	$399.37
Crew B-14B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$55.77	$83.12
.5 Laborer	44.40	177.60	66.25	265.00		
1 Hyd. Excavator, 6 C.Y.		3506.00		3856.60	292.17	321.38
12 L.H., Daily Totals		$4175.20		$4854.00	$347.93	$404.50

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-14C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$55.77	$83.12
.5 Laborer	44.40	177.60	66.25	265.00		
1 Hyd. Excavator, 7 C.Y.		3475.00		3822.50	289.58	318.54
12 L.H., Daily Totals		$4144.20		$4819.90	$345.35	$401.66
Crew B-14F	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$55.77	$83.12
.5 Laborer	44.40	177.60	66.25	265.00		
1 Hyd. Shovel, 7 C.Y.		4148.00		4562.80	345.67	380.23
12 L.H., Daily Totals		$4817.20		$5560.20	$401.43	$463.35
Crew B-14G	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$55.77	$83.12
.5 Laborer	44.40	177.60	66.25	265.00		
1 Hyd. Shovel, 12 C.Y.		6022.00		6624.20	501.83	552.02
12 L.H., Daily Totals		$6691.20		$7621.60	$557.60	$635.13
Crew B-14J	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 F.E. Loader, 8 C.Y.		2285.00		2513.50	190.42	209.46
12 L.H., Daily Totals		$2934.60		$3481.70	$244.55	$290.14
Crew B-14K	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 F.E. Loader, 10 C.Y.		2706.00		2976.60	225.50	248.05
12 L.H., Daily Totals		$3355.60		$3944.80	$279.63	$328.73
Crew B-15	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equipment Oper. (med.)	$59.00	$472.00	$87.90	$703.20	$52.51	$78.41
.5 Laborer	44.40	177.60	66.25	265.00		
2 Truck Drivers (heavy)	51.30	820.80	76.70	1227.20		
2 Dump Trucks, 12 C.Y., 400 H.P.		1158.70		1274.57		
1 Dozer, 200 H.P.		1520.00		1672.00	95.67	105.23
28 L.H., Daily Totals		$4149.10		$5141.97	$148.18	$183.64
Crew B-16	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$46.63	$69.61
2 Laborers	44.40	710.40	66.25	1060.00		
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Dump Truck, 12 C.Y., 400 H.P.		579.35		637.28	18.10	19.92
32 L.H., Daily Totals		$2071.35		$2864.89	$64.73	$89.53
Crew B-17	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$48.90	$72.97
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Backhoe Loader, 48 H.P.		216.20		237.82		
1 Dump Truck, 8 C.Y., 220 H.P.		407.60		448.36	19.49	21.44
32 L.H., Daily Totals		$2188.60		$3021.38	$68.39	$94.42
Crew B-17A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Labor Foremen (outside)	$46.40	$742.40	$69.25	$1108.00	$47.54	$71.08
6 Laborers	44.40	2131.20	66.25	3180.00		
1 Skilled Worker Foreman (out)	59.10	472.80	88.90	711.20		
1 Skilled Worker	57.10	456.80	85.90	687.20		
80 L.H., Daily Totals		$3803.20		$5686.40	$47.54	$71.08

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-17B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$48.90	$72.97
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Backhoe Loader, 48 H.P.		216.20		237.82		
1 Dump Truck, 12 C.Y., 400 H.P.		579.35		637.28	24.86	27.35
32 L.H., Daily Totals		$2360.35		$3210.30	$73.76	$100.32
Crew B-18	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$45.07	$67.25
2 Laborers	44.40	710.40	66.25	1060.00		
1 Vibrating Plate, Gas, 21		165.60		182.16	6.90	7.59
24 L.H., Daily Totals		$1247.20		$1796.16	$51.97	$74.84
Crew B-19	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Pile Driver Foreman (outside)	$57.90	$463.20	$89.50	$716.00	$57.11	$87.06
4 Pile Drivers	55.90	1788.80	86.40	2764.80		
2 Equip. Oper. (crane)	61.45	983.20	91.55	1464.80		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Crawler Crane, 40 Ton		1231.00		1354.10		
1 Lead, 90' High		371.85		409.04		
1 Hammer, Diesel, 22k ft-lb		441.70		485.87	31.95	35.14
64 L.H., Daily Totals		$5699.75		$7820.60	$89.06	$122.20
Crew B-19A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Pile Driver Foreman (outside)	$57.90	$463.20	$89.50	$716.00	$57.11	$87.06
4 Pile Drivers	55.90	1788.80	86.40	2764.80		
2 Equip. Oper. (crane)	61.45	983.20	91.55	1464.80		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Crawler Crane, 75 Ton		1967.00		2163.70		
1 Lead, 90' High		371.85		409.04		
1 Hammer, Diesel, 41k ft-lb		583.55		641.90	45.66	50.23
64 L.H., Daily Totals		$6577.60		$8786.24	$102.78	$137.29
Crew B-19B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Pile Driver Foreman (outside)	$57.90	$463.20	$89.50	$716.00	$57.11	$87.06
4 Pile Drivers	55.90	1788.80	86.40	2764.80		
2 Equip. Oper. (crane)	61.45	983.20	91.55	1464.80		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Crawler Crane, 40 Ton		1231.00		1354.10		
1 Lead, 90' High		371.85		409.04		
1 Hammer, Diesel, 22k ft-lb		441.70		485.87		
1 Barge, 400 Ton		869.15		956.07	45.53	50.08
64 L.H., Daily Totals		$6568.90		$8776.67	$102.64	$137.14
Crew B-19C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Pile Driver Foreman (outside)	$57.90	$463.20	$89.50	$716.00	$57.11	$87.06
4 Pile Drivers	55.90	1788.80	86.40	2764.80		
2 Equip. Oper. (crane)	61.45	983.20	91.55	1464.80		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Crawler Crane, 75 Ton		1967.00		2163.70		
1 Lead, 90' High		371.85		409.04		
1 Hammer, Diesel, 41k ft-lb		583.55		641.90		
1 Barge, 400 Ton		869.15		956.07	59.24	65.17
64 L.H., Daily Totals		$7446.75		$9742.31	$116.36	$152.22
Crew B-20	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.30	$73.80
1 Skilled Worker	57.10	456.80	85.90	687.20		
1 Laborer	44.40	355.20	66.25	530.00		
24 L.H., Daily Totals		$1183.20		$1771.20	$49.30	$73.80

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-20A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$53.16	$79.34
1 Laborer	44.40	355.20	66.25	530.00		
1 Plumber	67.70	541.60	101.05	808.40		
1 Plumber Apprentice	54.15	433.20	80.80	646.40		
32 L.H., Daily Totals		$1701.20		$2538.80	$53.16	$79.34
Crew B-21	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$51.04	$76.34
1 Skilled Worker	57.10	456.80	85.90	687.20		
1 Laborer	44.40	355.20	66.25	530.00		
.5 Equip. Oper. (crane)	61.45	245.80	91.55	366.20		
.5 S.P. Crane, 4x4, 5 Ton		190.97		210.07	6.82	7.50
28 L.H., Daily Totals		$1619.97		$2347.47	$57.86	$83.84
Crew B-21A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$54.82	$81.78
1 Laborer	44.40	355.20	66.25	530.00		
1 Plumber	67.70	541.60	101.05	808.40		
1 Plumber Apprentice	54.15	433.20	80.80	646.40		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 S.P. Crane, 4x4, 12 Ton		432.65		475.92	10.82	11.90
40 L.H., Daily Totals		$2625.45		$3747.11	$65.64	$93.68
Crew B-21B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.21	$71.91
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Hyd. Crane, 12 Ton		475.80		523.38	11.90	13.08
40 L.H., Daily Totals		$2404.20		$3399.78	$60.10	$84.99
Crew B-21C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.28	$72.01
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
2 Cutting Torches		25.90		28.49		
2 Sets of Gases		347.20		381.92		
1 Lattice Boom Crane, 90 Ton		1713.00		1884.30	37.25	40.98
56 L.H., Daily Totals		$4789.70		$6327.11	$85.53	$112.98
Crew B-22	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$51.73	$77.35
1 Skilled Worker	57.10	456.80	85.90	687.20		
1 Laborer	44.40	355.20	66.25	530.00		
.75 Equip. Oper. (crane)	61.45	368.70	91.55	549.30		
.75 S.P. Crane, 4x4, 5 Ton		286.46		315.11	9.55	10.50
30 L.H., Daily Totals		$1838.36		$2635.61	$61.28	$87.85
Crew B-22A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$50.75	$75.84
1 Skilled Worker	57.10	456.80	85.90	687.20		
2 Laborers	44.40	710.40	66.25	1060.00		
1 Equipment Operator, Crane	61.45	491.60	91.55	732.40		
1 S.P. Crane, 4x4, 5 Ton		381.95		420.14		
1 Butt Fusion Mach., 4 -12 diam.		420.75		462.82	20.07	22.07
40 L.H., Daily Totals		$2832.70		$3916.57	$70.82	$97.91

Crews - Standard

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-22B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$50.75	$75.84
1 Skilled Worker	57.10	456.80	85.90	687.20		
2 Laborers	44.40	710.40	66.25	1060.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 S.P. Crane, 4x4, 5 Ton		381.95		420.14		
1 Butt Fusion Mach., 8 -24 diam.		1086.00		1194.60	36.70	40.37
40 L.H., Daily Totals		$3497.95		$4648.35	$87.45	$116.21
Crew B-22C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Skilled Worker	$57.10	$456.80	$85.90	$687.20	$50.75	$76.08
1 Laborer	44.40	355.20	66.25	530.00		
1 Butt Fusion Mach., 2 -8 diam.		134.95		148.44	8.43	9.28
16 L.H., Daily Totals		$946.95		$1365.65	$59.18	$85.35
Crew B-23	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$44.80	$66.85
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Drill Rig, Truck-Mounted		768.40		845.24		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05	40.46	44.51
40 L.H., Daily Totals		$3410.45		$4454.30	$85.26	$111.36
Crew B-23A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.93	$74.47
1 Laborer	44.40	355.20	66.25	530.00		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Drill Rig, Truck-Mounted		768.40		845.24		
1 Pickup Truck, 3/4 Ton		112.20		123.42	36.69	40.36
24 L.H., Daily Totals		$2079.00		$2755.86	$86.63	$114.83
Crew B-23B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.93	$74.47
1 Laborer	44.40	355.20	66.25	530.00		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Drill Rig, Truck-Mounted		768.40		845.24		
1 Pickup Truck, 3/4 Ton		112.20		123.42		
1 Centr. Water Pump, 6		235.25		258.77	46.49	51.14
24 L.H., Daily Totals		$2314.25		$3014.64	$96.43	$125.61
Crew B-24	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1Cement Finisher	$51.80	$414.40	$75.90	$607.20	$50.30	$74.60
1Laborer	44.40	355.20	66.25	530.00		
1Carpenter	54.70	437.60	81.65	653.20		
24 L.H., Daily Totals		$1207.20		$1790.40	$50.30	$74.60
Crew B-25	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.56	$72.43
7 Laborers	44.40	2486.40	66.25	3710.00		
3 Equip. Oper. (medium)	59.00	1416.00	87.90	2109.60		
1 Asphalt Paver, 130 H.P.		2143.00		2357.30		
1 Tandem Roller, 10 Ton		246.80		271.48		
1 Roller, Pneum. Whl., 12 Ton		349.90		384.89	31.13	34.25
88 L.H., Daily Totals		$7013.30		$9387.27	$79.70	$106.67
Crew B-25B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.43	$73.72
7 Laborers	44.40	2486.40	66.25	3710.00		
4 Equip. Oper. (medium)	59.00	1888.00	87.90	2812.80		
1 Asphalt Paver, 130 H.P.		2143.00		2357.30		
2 Tandem Rollers, 10 Ton		493.60		542.96		
1 Roller, Pneum. Whl., 12 Ton		349.90		384.89	31.11	34.22
96 L.H., Daily Totals		$7732.10		$10361.95	$80.54	$107.94

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-25C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.60	$73.97
3 Laborers	44.40	1065.60	66.25	1590.00		
2 Equip. Oper. (medium)	59.00	944.00	87.90	1406.40		
1 Asphalt Paver, 130 H.P.		2143.00		2357.30		
1 Tandem Roller, 10 Ton		246.80		271.48	49.79	54.77
48 L.H., Daily Totals		$4770.60		$6179.18	$99.39	$128.73
Crew B-25D	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.82	$74.30
3 Laborers	44.40	1065.60	66.25	1590.00		
2.125 Equip. Oper. (medium)	59.00	1003.00	87.90	1494.30		
.125 Truck Driver (heavy)	51.30	51.30	76.70	76.70		
.125 Truck Tractor, 6x4, 380 H.P.		62.39		68.63		
.125 Dist. Tanker, 3000 Gallon		41.76		45.94		
1 Asphalt Paver, 130 H.P.		2143.00		2357.30		
1 Tandem Roller, 10 Ton		246.80		271.48	49.88	54.87
50 L.H., Daily Totals		$4985.06		$6458.35	$99.70	$129.17
Crew B-25E	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$50.03	$74.61
3 Laborers	44.40	1065.60	66.25	1590.00		
2.250 Equip. Oper. (medium)	59.00	1062.00	87.90	1582.20		
.25 Truck Driver (heavy)	51.30	102.60	76.70	153.40		
.25 Truck Tractor, 6x4, 380 H.P.		124.79		137.27		
.25 Dist. Tanker, 3000 Gallon		83.53		91.88		
1 Asphalt Paver, 130 H.P.		2143.00		2357.30		
1 Tandem Roller, 10 Ton		246.80		271.48	49.96	54.96
52 L.H., Daily Totals		$5199.51		$6737.52	$99.99	$129.57
Crew B-26	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.23	$73.32
6 Laborers	44.40	2131.20	66.25	3180.00		
2 Equip. Oper. (medium)	59.00	944.00	87.90	1406.40		
1 Rodman (reinf.)	58.90	471.20	88.05	704.40		
1 Cement Finisher	51.80	414.40	75.90	607.20		
1 Grader, 30,000 Lbs.		1073.00		1180.30		
1 Paving Mach. & Equip.		2503.00		2753.30	40.64	44.70
88 L.H., Daily Totals		$7908.00		$10385.60	$89.86	$118.02
Crew B-26A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.23	$73.32
6 Laborers	44.40	2131.20	66.25	3180.00		
2 Equip. Oper. (medium)	59.00	944.00	87.90	1406.40		
1 Rodman (reinf.)	58.90	471.20	88.05	704.40		
1 Cement Finisher	51.80	414.40	75.90	607.20		
1 Grader, 30,000 Lbs.		1073.00		1180.30		
1 Paving Mach. & Equip.		2503.00		2753.30		
1 Concrete Saw		112.85		124.14	41.92	46.11
88 L.H., Daily Totals		$8020.85		$10509.74	$91.15	$119.43
Crew B-26B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$50.04	$74.53
6 Laborers	44.40	2131.20	66.25	3180.00		
3 Equip. Oper. (medium)	59.00	1416.00	87.90	2109.60		
1 Rodman (reinf.)	58.90	471.20	88.05	704.40		
1 Cement Finisher	51.80	414.40	75.90	607.20		
1 Grader, 30,000 Lbs.		1073.00		1180.30		
1 Paving Mach. & Equip.		2503.00		2753.30		
1 Concrete Pump, 110' Boom		493.65		543.01	42.39	46.63
96 L.H., Daily Totals		$8873.65		$11631.82	$92.43	$121.16

Crews - Standard

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-26C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.25	$71.86
6 Laborers	44.40	2131.20	66.25	3180.00		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Rodman (reinf.)	58.90	471.20	88.05	704.40		
1 Cement Finisher	51.80	414.40	75.90	607.20		
1 Paving Mach. & Equip.		2503.00		2753.30		
1 Concrete Saw		112.85		124.14	32.70	35.97
80 L.H., Daily Totals		$6475.85		$8626.24	$80.95	$107.83
Crew B-27	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$44.90	$67.00
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Berm Machine		253.55		278.90	7.92	8.72
32 L.H., Daily Totals		$1690.35		$2422.91	$52.82	$75.72
Crew B-28	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2Carpenters	$54.70	$875.20	$81.65	$1306.40	$51.27	$76.52
1Laborer	44.40	355.20	66.25	530.00		
24 L.H., Daily Totals		$1230.40		$1836.40	$51.27	$76.52
Crew B-29	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.28	$72.01
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Gradall, 5/8 C.Y.		850.65		935.72	15.19	16.71
56 L.H., Daily Totals		$3554.25		$4968.11	$63.47	$88.72
Crew B-30	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$53.87	$80.43
2 Truck Drivers (heavy)	51.30	820.80	76.70	1227.20		
1 Hyd. Excavator, 1.5 C.Y.		695.80		765.38		
2 Dump Trucks, 12 C.Y., 400 H.P.		1158.70		1274.57	77.27	85.00
24 L.H., Daily Totals		$3147.30		$3970.35	$131.14	$165.43
Crew B-31	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$46.86	$69.93
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Carpenter	54.70	437.60	81.65	653.20		
1 Air Compressor, 250 cfm		202.85		223.13		
1 Sheeting Driver		7.45		8.20		
2 -50' Air Hoses, 1.5		45.60		50.16	6.40	7.04
40 L.H., Daily Totals		$2130.30		$3078.69	$53.26	$76.97
Crew B-32	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1Laborer	$44.40	$355.20	$66.25	$530.00	$55.35	$82.49
3Equip. Oper. (medium)	59.00	1416.00	87.90	2109.60		
1Grader, 30,000 Lbs.		1073.00		1180.30		
1Tandem Roller, 10 Ton		246.80		271.48		
1Dozer, 200 H.P.		1520.00		1672.00	88.74	97.62
32 L.H., Daily Totals		$4611.00		$5763.38	$144.09	$180.11
Crew B-32A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$54.13	$80.68
2 Equip. Oper. (medium)	59.00	944.00	87.90	1406.40		
1 Grader, 30,000 Lbs.		1073.00		1180.30		
1 Roller, Vibratory, 25 Ton		672.35		739.59	72.72	80.00
24 L.H., Daily Totals		$3044.55		$3856.28	$126.86	$160.68

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-32B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$54.13	$80.68
2 Equip. Oper. (medium)	59.00	944.00	87.90	1406.40		
1 Dozer, 200 H.P.		1520.00		1672.00		
1 Roller, Vibratory, 25 Ton		672.35		739.59	91.35	100.48
24 L.H., Daily Totals		$3491.55		$4347.98	$145.48	$181.17
Crew B-32C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$52.03	$77.58
2 Laborers	44.40	710.40	66.25	1060.00		
3 Equip. Oper. (medium)	59.00	1416.00	87.90	2109.60		
1 Grader, 30,000 Lbs.		1073.00		1180.30		
1 Tandem Roller, 10 Ton		246.80		271.48		
1 Dozer, 200 H.P.		1520.00		1672.00	59.16	65.08
48 L.H., Daily Totals		$5337.40		$6847.38	$111.20	$142.65
Crew B-33A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.83	$81.71
.5 Laborer	44.40	177.60	66.25	265.00		
.25 Equip. Oper. (medium)	59.00	118.00	87.90	175.80		
1 Scraper, Towed, 7 C.Y.		129.30		142.23		
1.25 Dozers, 300 H.P.		2231.25		2454.38	168.61	185.47
14 L.H., Daily Totals		$3128.15		$3740.61	$223.44	$267.19
Crew B-33B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.83	$81.71
.5 Laborer	44.40	177.60	66.25	265.00		
.25 Equip. Oper. (medium)	59.00	118.00	87.90	175.80		
1 Scraper, Towed, 10 C.Y.		161.65		177.82		
1.25 Dozers, 300 H.P.		2231.25		2454.38	170.92	188.01
14 L.H., Daily Totals		$3160.50		$3776.19	$225.75	$269.73
Crew B-33C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.83	$81.71
.5 Laborer	44.40	177.60	66.25	265.00		
.25 Equip. Oper. (medium)	59.00	118.00	87.90	175.80		
1 Scraper, Towed, 15 C.Y.		178.85		196.74		
1.25 Dozers, 300 H.P.		2231.25		2454.38	172.15	189.37
14 L.H., Daily Totals		$3177.70		$3795.11	$226.98	$271.08
Crew B-33D	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.83	$81.71
.5 Laborer	44.40	177.60	66.25	265.00		
.25 Equip. Oper. (medium)	59.00	118.00	87.90	175.80		
1 S.P. Scraper, 14 C.Y.		2424.00		2666.40		
.25 Dozer, 300 H.P.		446.25		490.88	205.02	225.52
14 L.H., Daily Totals		$3637.85		$4301.27	$259.85	$307.23
Crew B-33E	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.83	$81.71
.5 Laborer	44.40	177.60	66.25	265.00		
.25 Equip. Oper. (medium)	59.00	118.00	87.90	175.80		
1 S.P. Scraper, 21 C.Y.		2656.00		2921.60		
.25 Dozer, 300 H.P.		446.25		490.88	221.59	243.75
14 L.H., Daily Totals		$3869.85		$4556.48	$276.42	$325.46

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-33F	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.83	$81.71
.5 Laborer	44.40	177.60	66.25	265.00		
.25 Equip. Oper. (medium)	59.00	118.00	87.90	175.80		
1 Elev. Scraper, 11 C.Y.		1059.00		1164.90		
.25 Dozer, 300 H.P.		446.25		490.88	107.52	118.27
14 L.H., Daily Totals		$2272.85		$2799.78	$162.35	$199.98
Crew B-33G	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.83	$81.71
.5 Laborer	44.40	177.60	66.25	265.00		
.25 Equip. Oper. (medium)	59.00	118.00	87.90	175.80		
1 Elev. Scraper, 22 C.Y.		1895.00		2084.50		
.25 Dozer, 300 H.P.		446.25		490.88	167.23	183.96
14 L.H., Daily Totals		$3108.85		$3719.38	$222.06	$265.67
Crew B-33H	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
.5 Laborer	$44.40	$177.60	$66.25	$265.00	$54.83	$81.71
1 Equipment Operator (med.)	59.00	472.00	87.90	703.20		
.25 Equipment Operator (med.)	59.00	118.00	87.90	175.80		
1 S.P. Scraper, 44 C.Y.		4695.00		5164.50		
.25 Dozer, 410 H.P.		701.75		771.92	385.48	424.03
14 L.H., Daily Totals		$6164.35		$7080.43	$440.31	$505.74
Crew B-33J	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equipment Operator (med.)	$59.00	$472.00	$87.90	$703.20	$59.00	$87.90
1 S.P. Scraper, 14 C.Y.		2424.00		2666.40	303.00	333.30
8 L.H., Daily Totals		$2896.00		$3369.60	$362.00	$421.20
Crew B-33K	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equipment Operator (med.)	$59.00	$472.00	$87.90	$703.20	$54.83	$81.71
.25 Equipment Operator (med.)	59.00	118.00	87.90	175.80		
.5 Laborer	44.40	177.60	66.25	265.00		
1 S.P. Scraper, 31 C.Y.		3707.00		4077.70		
.25 Dozer, 410 H.P.		701.75		771.92	314.91	346.40
14 L.H., Daily Totals		$5176.35		$5993.63	$369.74	$428.12
Crew B-34A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Truck Driver (heavy)	$51.30	$410.40	$76.70	$613.60	$51.30	$76.70
1 Dump Truck, 8 C.Y., 220 H.P.		407.60		448.36	50.95	56.05
8 L.H., Daily Totals		$818.00		$1061.96	$102.25	$132.75
Crew B-34B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Truck Driver (heavy)	$51.30	$410.40	$76.70	$613.60	$51.30	$76.70
1 Dump Truck, 12 C.Y., 400 H.P.		579.35		637.28	72.42	79.66
8 L.H., Daily Totals		$989.75		$1250.89	$123.72	$156.36
Crew B-34C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Truck Driver (heavy)	$51.30	$410.40	$76.70	$613.60	$51.30	$76.70
1 Truck Tractor, 6x4, 380 H.P.		499.15		549.07		
1 Dump Trailer, 16.5 C.Y.		138.35		152.19	79.69	87.66
8 L.H., Daily Totals		$1047.90		$1314.85	$130.99	$164.36
Crew B-34D	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Truck Driver (heavy)	$51.30	$410.40	$76.70	$613.60	$51.30	$76.70
1 Truck Tractor, 6x4, 380 H.P.		499.15		549.07		
1 Dump Trailer, 20 C.Y.		153.55		168.91	81.59	89.75
8 L.H., Daily Totals		$1063.10		$1331.57	$132.89	$166.45

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-34E	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Truck Driver (heavy)	$51.30	$410.40	$76.70	$613.60	$51.30	$76.70
1 Dump Truck, Off Hwy., 25 Ton		1427.00		1569.70	178.38	196.21
8 L.H., Daily Totals		$1837.40		$2183.30	$229.68	$272.91
Crew B-34F	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Truck Driver (heavy)	$51.30	$410.40	$76.70	$613.60	$51.30	$76.70
1 Dump Truck, Off Hwy., 35 Ton		945.65		1040.21	118.21	130.03
8 L.H., Daily Totals		$1356.05		$1653.82	$169.51	$206.73
Crew B-34G	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Truck Driver (heavy)	$51.30	$410.40	$76.70	$613.60	$51.30	$76.70
1 Dump Truck, Off Hwy., 50 Ton		1979.00		2176.90	247.38	272.11
8 L.H., Daily Totals		$2389.40		$2790.50	$298.68	$348.81
Crew B-34H	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Truck Driver (heavy)	$51.30	$410.40	$76.70	$613.60	$51.30	$76.70
1 Dump Truck, Off Hwy., 65 Ton		1938.00		2131.80	242.25	266.48
8 L.H., Daily Totals		$2348.40		$2745.40	$293.55	$343.18
Crew B-34I	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Truck Driver (heavy)	$51.30	$410.40	$76.70	$613.60	$51.30	$76.70
1 Dump Truck, 18 C.Y., 450 H.P.		753.60		828.96	94.20	103.62
8 L.H., Daily Totals		$1164.00		$1442.56	$145.50	$180.32
Crew B-34J	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Truck Driver (heavy)	$51.30	$410.40	$76.70	$613.60	$51.30	$76.70
1 Dump Truck, Off Hwy., 100 Ton		2769.00		3045.90	346.13	380.74
8 L.H., Daily Totals		$3179.40		$3659.50	$397.43	$457.44
Crew B-34K	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Truck Driver (heavy)	$51.30	$410.40	$76.70	$613.60	$51.30	$76.70
1 Truck Tractor, 6x4, 450 H.P.		608.95		669.85		
1 Lowbed Trailer, 75 Ton		258.10		283.91	108.38	119.22
8 L.H., Daily Totals		$1277.45		$1567.36	$159.68	$195.92
Crew B-34L	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (light)	$55.50	$444.00	$82.70	$661.60	$55.50	$82.70
1 Flatbed Truck, Gas, 1.5 Ton		198.50		218.35	24.81	27.29
8 L.H., Daily Totals		$642.50		$879.95	$80.31	$109.99
Crew B-34M	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (light)	$55.50	$444.00	$82.70	$661.60	$55.50	$82.70
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05	106.26	116.88
8 L.H., Daily Totals		$1294.05		$1596.66	$161.76	$199.58
Crew B-34N	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Truck Driver (heavy)	$51.30	$410.40	$76.70	$613.60	$55.15	$82.30
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Truck Tractor, 6x4, 380 H.P.		499.15		549.07		
1 Flatbed Trailer, 40 Ton		188.45		207.29	42.98	47.27
16 L.H., Daily Totals		$1570.00		$2073.16	$98.13	$129.57
Crew B-34P	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Pipe Fitter	$68.35	$546.80	$102.00	$816.00	$58.72	$87.63
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05		
1 Backhoe Loader, 48 H.P.		216.20		237.82	44.43	48.87
24 L.H., Daily Totals		$2475.45		$3276.07	$103.14	$136.50

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-34Q	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Pipe Fitter	$68.35	$546.80	$102.00	$816.00	$59.53	$88.85
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Flatbed Trailer, 25 Ton		137.20		150.92		
1 Dump Truck, 8 C.Y., 220 H.P.		407.60		448.36		
1 Hyd. Crane, 25 Ton		586.70		645.37	47.15	51.86
24 L.H., Daily Totals		$2560.30		$3377.05	$106.68	$140.71
Crew B-34R	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Pipe Fitter	$68.35	$546.80	$102.00	$816.00	$59.53	$88.85
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Flatbed Trailer, 25 Ton		137.20		150.92		
1 Dump Truck, 8 C.Y., 220 H.P.		407.60		448.36		
1 Hyd. Crane, 25 Ton		586.70		645.37		
1 Hyd. Excavator, 1 C.Y.		832.65		915.91	81.84	90.02
24 L.H., Daily Totals		$3392.95		$4292.97	$141.37	$178.87
Crew B-34S	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Pipe Fitters	$68.35	$1093.60	$102.00	$1632.00	$62.36	$93.06
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Flatbed Trailer, 40 Ton		188.45		207.29		
1 Truck Tractor, 6x4, 380 H.P.		499.15		549.07		
1 Hyd. Crane, 80 Ton		1458.00		1603.80		
1 Hyd. Excavator, 2 C.Y.		942.70		1036.97	96.51	106.16
32 L.H., Daily Totals		$5083.90		$6375.13	$158.87	$199.22
Crew B-34T	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Pipe Fitters	$68.35	$1093.60	$102.00	$1632.00	$62.36	$93.06
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Flatbed Trailer, 40 Ton		188.45		207.29		
1 Truck Tractor, 6x4, 380 H.P.		499.15		549.07		
1 Hyd. Crane, 80 Ton		1458.00		1603.80	67.05	73.75
32 L.H., Daily Totals		$4141.20		$5338.16	$129.41	$166.82
Crew B-34U	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Truck Driver (heavy)	$51.30	$410.40	$76.70	$613.60	$53.40	$79.70
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Truck Tractor, 220 H.P.		310.80		341.88		
1 Flatbed Trailer, 25 Ton		137.20		150.92	28.00	30.80
16 L.H., Daily Totals		$1302.40		$1768.00	$81.40	$110.50
Crew B-34V	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Truck Driver (heavy)	$51.30	$410.40	$76.70	$613.60	$56.08	$83.65
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Truck Tractor, 6x4, 450 H.P.		608.95		669.85		
1 Equipment Trailer, 50 Ton		207.25		227.97		
1 Pickup Truck, 4x4, 3/4 Ton		176.75		194.43	41.37	45.51
24 L.H., Daily Totals		$2338.95		$3099.84	$97.46	$129.16

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-34W	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
5 Truck Drivers (heavy)	$51.30	$2052.00	$76.70	$3068.00	$53.92	$80.50
2 Equip. Opers. (crane)	61.45	983.20	91.55	1464.80		
1 Equip. Oper. (mechanic)	61.50	492.00	91.65	733.20		
1 Laborer	44.40	355.20	66.25	530.00		
4 Truck Tractors, 6x4, 380 H.P.		1996.60		2196.26		
2 Equipment Trailers, 50 Ton		414.50		455.95		
2 Flatbed Trailers, 40 Ton		376.90		414.59		
1 Pickup Truck, 4x4, 3/4 Ton		176.75		194.43		
1 S.P. Crane, 4x4, 20 Ton		574.35		631.78	49.15	54.07
72 L.H., Daily Totals		$7421.50		$9689.01	$103.08	$134.57
Crew B-35	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$56.75	$84.76
1 Skilled Worker	57.10	456.80	85.90	687.20		
2 Welders	67.70	1083.20	101.05	1616.80		
1 Laborer	44.40	355.20	66.25	530.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
2 Welder, Electric, 300 amp		215.10		236.61		
1 Hyd. Excavator, .75 C.Y.		701.80		771.98	16.37	18.01
56 L.H., Daily Totals		$4094.90		$5754.99	$73.12	$102.77
Crew B-35A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$53.42	$79.79
2 Laborers	44.40	710.40	66.25	1060.00		
1 Skilled Worker	57.10	456.80	85.90	687.20		
1 Welder (plumber)	67.70	541.60	101.05	808.40		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Welder, Gas Engine, 300 amp		148.75		163.63		
1 Crawler Crane, 75 Ton		1967.00		2163.70	37.78	41.56
56 L.H., Daily Totals		$5107.35		$6795.32	$91.20	$121.35
Crew B-36	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$50.64	$75.51
2 Laborers	44.40	710.40	66.25	1060.00		
2 Equip. Oper. (medium)	59.00	944.00	87.90	1406.40		
1 Dozer, 200 H.P.		1520.00		1672.00		
1 Aggregate Spreader		59.95		65.94		
1 Tandem Roller, 10 Ton		246.80		271.48	45.67	50.24
40 L.H., Daily Totals		$3852.35		$5029.82	$96.31	$125.75
Crew B-36A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$53.03	$79.05
2 Laborers	44.40	710.40	66.25	1060.00		
4 Equip. Oper. (medium)	59.00	1888.00	87.90	2812.80		
1 Dozer, 200 H.P.		1520.00		1672.00		
1 Aggregate Spreader		59.95		65.94		
1 Tandem Roller, 10 Ton		246.80		271.48		
1 Roller, Pneum. Whl., 12 Ton		349.90		384.89	38.87	42.76
56 L.H., Daily Totals		$5146.25		$6821.11	$91.90	$121.81

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-36B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$52.81	$78.76
2 Laborers	44.40	710.40	66.25	1060.00		
4 Equip. Oper. (medium)	59.00	1888.00	87.90	2812.80		
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Grader, 30,000 Lbs.		1073.00		1180.30		
1 F.E. Loader, Crl, 1.5 C.Y.		668.35		735.18		
1 Dozer, 300 H.P.		1785.00		1963.50		
1 Roller, Vibratory, 25 Ton		672.35		739.59		
1 Truck Tractor, 6x4, 450 H.P.		608.95		669.85		
1 Water Tank Trailer, 5000 Gal.		154.10		169.51	77.53	85.28
64 L.H., Daily Totals		$8341.75		$10498.33	$130.34	$164.04
Crew B-36C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$54.94	$81.93
3 Equip. Oper. (medium)	59.00	1416.00	87.90	2109.60		
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Grader, 30,000 Lbs.		1073.00		1180.30		
1 Dozer, 300 H.P.		1785.00		1963.50		
1 Roller, Vibratory, 25 Ton		672.35		739.59		
1 Truck Tractor, 6x4, 450 H.P.		608.95		669.85		
1 Water Tank Trailer, 5000 Gal.		154.10		169.51	107.33	118.07
40 L.H., Daily Totals		$6491.00		$7999.94	$162.28	$200.00
Crew B-36D	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$55.85	$83.24
3 Equip. Oper. (medium)	59.00	1416.00	87.90	2109.60		
1 Grader, 30,000 Lbs.		1073.00		1180.30		
1 Dozer, 300 H.P.		1785.00		1963.50		
1 Roller, Vibratory, 25 Ton		672.35		739.59	110.32	121.36
32 L.H., Daily Totals		$5317.55		$6546.98	$166.17	$204.59
Crew B-37	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$46.58	$69.49
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Tandem Roller, 5 Ton		258.75		284.63	5.39	5.93
48 L.H., Daily Totals		$2494.75		$3620.22	$51.97	$75.42
Crew B-37A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$45.87	$68.50
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Flatbed Truck, Gas, 1.5 Ton		198.50		218.35		
1 Tar Kettle, T.M.		156.70		172.37	14.80	16.28
24 L.H., Daily Totals		$1456.00		$2034.72	$60.67	$84.78
Crew B-37B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
3 Laborers	$44.40	$1065.60	$66.25	$1590.00	$45.50	$67.94
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Flatbed Truck, Gas, 1.5 Ton		198.50		218.35		
1 Tar Kettle, T.M.		156.70		172.37	11.10	12.21
32 L.H., Daily Totals		$1811.20		$2564.72	$56.60	$80.15
Crew B-37C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$46.60	$69.63
2 Truck Drivers (light)	48.80	780.80	73.00	1168.00		
2 Flatbed Trucks, Gas, 1.5 Ton		397.00		436.70		
1 Tar Kettle, T.M.		156.70		172.37	17.30	19.03
32 L.H., Daily Totals		$2044.90		$2837.07	$63.90	$88.66

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-37D	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$46.60	$69.63
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Pickup Truck, 3/4 Ton		112.20		123.42	7.01	7.71
16 L.H., Daily Totals		$857.80		$1237.42	$53.61	$77.34
Crew B-37E	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
3 Laborers	$44.40	$1065.60	$66.25	$1590.00	$49.33	$73.62
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
2 Truck Drivers (light)	48.80	780.80	73.00	1168.00		
4 Barrels w/ Flasher		16.60		18.26		
1 Concrete Saw		112.85		124.14		
1 Rotary Hammer Drill		52.25		57.48		
1 Hammer Drill Bit		25.25		27.77		
1 Loader, Skid Steer, 30 H.P.		179.50		197.45		
1 Conc. Hammer Attach.		118.50		130.35		
1 Vibrating Plate, Gas, 18		31.90		35.09		
2 Flatbed Trucks, Gas, 1.5 Ton		397.00		436.70	16.68	18.34
56 L.H., Daily Totals		$3696.25		$5150.03	$66.00	$91.96
Crew B-37F	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
3 Laborers	$44.40	$1065.60	$66.25	$1590.00	$45.50	$67.94
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
4 Barrels w/ Flasher		16.60		18.26		
1 Concrete Mixer, 10 C.F.		147.15		161.87		
1 Air Compressor, 60 cfm		153.85		169.24		
1 -50' Air Hose, 3/4		7.15		7.87		
1 Spade (Chipper)		8.55		9.40		
1 Flatbed Truck, Gas, 1.5 Ton		198.50		218.35	16.62	18.28
32 L.H., Daily Totals		$1987.80		$2758.98	$62.12	$86.22
Crew B-37G	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$46.58	$69.49
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Berm Machine		253.55		278.90		
1 Tandem Roller, 5 Ton		258.75		284.63	10.67	11.74
48 L.H., Daily Totals		$2748.30		$3899.13	$57.26	$81.23
Crew B-37H	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$46.58	$69.49
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Tandem Roller, 5 Ton		258.75		284.63		
1 Flatbed Truck, Gas, 1.5 Ton		198.50		218.35		
1 Tar Kettle, T.M.		156.70		172.37	12.79	14.07
48 L.H., Daily Totals		$2849.95		$4010.95	$59.37	$83.56

Crews - Standard

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-37I	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
3 Laborers	$44.40	$1065.60	$66.25	$1590.00	$49.33	$73.62
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
2 Truck Drivers (light)	48.80	780.80	73.00	1168.00		
4 Barrels w/ Flasher		16.60		18.26		
1 Concrete Saw		112.85		124.14		
1 Rotary Hammer Drill		52.25		57.48		
1 Hammer Drill Bit		25.25		27.77		
1 Air Compressor, 60 cfm		153.85		169.24		
1 -50' Air Hose, 3/4		7.15		7.87		
1 Spade (Chipper)		8.55		9.40		
1 Loader, Skid Steer, 30 H.P.		179.50		197.45		
1 Conc. Hammer Attach.		118.50		130.35		
1 Concrete Mixer, 10 C.F.		147.15		161.87		
1 Vibrating Plate, Gas, 18		31.90		35.09		
2 Flatbed Trucks, Gas, 1.5 Ton		397.00		436.70	22.33	24.56
56 L.H., Daily Totals		$4012.95		$5498.40	$71.66	$98.19
Crew B-37J	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$46.58	$69.49
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Air Compressor, 60 cfm		153.85		169.24		
1 -50' Air Hose, 3/4		7.15		7.87		
2 Concrete Mixers, 10 C.F.		294.30		323.73		
2 Flatbed Trucks, Gas, 1.5 Ton		397.00		436.70		
1 Shot Blaster, 20		208.70		229.57	22.10	24.31
48 L.H., Daily Totals		$3297.00		$4502.70	$68.69	$93.81
Crew B-37K	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$46.58	$69.49
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Air Compressor, 60 cfm		153.85		169.24		
1 -50' Air Hose, 3/4		7.15		7.87		
2 Flatbed Trucks, Gas, 1.5 Ton		397.00		436.70		
1 Shot Blaster, 20		208.70		229.57	15.97	17.57
48 L.H., Daily Totals		$3002.70		$4178.97	$62.56	$87.06
Crew B-38	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.94	$74.47
2 Laborers	44.40	710.40	66.25	1060.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Backhoe Loader, 48 H.P.		216.20		237.82		
1 Hyd. Hammer (1200 lb.)		177.25		194.97		
1 F.E. Loader, W.M., 4 C.Y.		759.00		834.90		
1 Pvmt. Rem. Bucket		63.80		70.18	30.41	33.45
40 L.H., Daily Totals		$3213.85		$4316.68	$80.35	$107.92
Crew B-39	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$46.58	$69.49
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Air Compressor, 250 cfm		202.85		223.13		
2 Breakers, Pavement, 60 lb.		107.20		117.92		
2 -50' Air Hoses, 1.5		45.60		50.16	7.41	8.15
48 L.H., Daily Totals		$2591.65		$3726.82	$53.99	$77.64

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-40	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Pile Driver Foreman (outside)	$57.90	$463.20	$89.50	$716.00	$57.11	$87.06
4 Pile Drivers	55.90	1788.80	86.40	2764.80		
2 Equip. Oper. (crane)	61.45	983.20	91.55	1464.80		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Crawler Crane, 40 Ton		1231.00		1354.10		
1 Vibratory Hammer & Gen.		2298.00		2527.80	55.14	60.65
64 L.H., Daily Totals		$7184.20		$9453.50	$112.25	$147.71
Crew B-40B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.92	$72.97
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Lattice Boom Crane, 40 Ton		2127.00		2339.70	44.31	48.74
48 L.H., Daily Totals		$4475.40		$5842.10	$93.24	$121.71
Crew B-41	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$45.91	$68.49
4 Laborers	44.40	1420.80	66.25	2120.00		
.25 Equip. Oper. (crane)	61.45	122.90	91.55	183.10		
.25 Equip. Oper. (oiler)	52.50	105.00	78.25	156.50		
.25 Crawler Crane, 40 Ton		307.75		338.52	6.99	7.69
44 L.H., Daily Totals		$2327.65		$3352.13	$52.90	$76.18
Crew B-42	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.78	$74.67
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Welder	60.30	482.40	93.30	746.40		
1 Hyd. Crane, 25 Ton		586.70		645.37		
1 Welder, Gas Engine, 300 amp		148.75		163.63		
1 Horz. Boring Csg. Mch.		329.75		362.73	16.64	18.31
64 L.H., Daily Totals		$4251.20		$5950.52	$66.43	$92.98
Crew B-43	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.92	$72.97
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Drill Rig, Truck-Mounted		768.40		845.24	16.01	17.61
48 L.H., Daily Totals		$3116.80		$4347.64	$64.93	$90.58
Crew B-44	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Pile Driver Foreman (outside)	$57.90	$463.20	$89.50	$716.00	$56.10	$85.56
4 Pile Drivers	55.90	1788.80	86.40	2764.80		
2 Equip. Oper. (crane)	61.45	983.20	91.55	1464.80		
1 Laborer	44.40	355.20	66.25	530.00		
1 Crawler Crane, 40 Ton		1231.00		1354.10		
1 Lead, 60' High		211.80		232.98		
1 Hammer, Diesel, 15K ft.-lbs.		624.45		686.89	32.30	35.53
64 L.H., Daily Totals		$5657.65		$7749.57	$88.40	$121.09
Crew B-45	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$55.15	$82.30
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Dist. Tanker, 3000 Gallon		334.10		367.51		
1 Truck Tractor, 6x4, 380 H.P.		499.15		549.07	52.08	57.29
16 L.H., Daily Totals		$1715.65		$2233.38	$107.23	$139.59

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-46	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Pile Driver Foreman (outside)	$57.90	$463.20	$89.50	$716.00	$50.48	$76.84
2 Pile Drivers	55.90	894.40	86.40	1382.40		
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Chain Saw, Gas, 36 Long		41.65		45.81	.87	.95
48 L.H., Daily Totals		$2464.85		$3734.22	$51.35	$77.80
Crew B-47	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Blast Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.77	$72.73
1 Driller	44.40	355.20	66.25	530.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Air Track Drill, 4		1127.00		1239.70		
1 Air Compressor, 600 cfm		426.55		469.20		
2 -50' Air Hoses, 3		76.70		84.37	67.93	74.72
24 L.H., Daily Totals		$2800.65		$3538.88	$116.69	$147.45
Crew B-47A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Drilling Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$53.45	$79.68
1 Equip. Oper. (heavy)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Air Track Drill, 5		1127.00		1239.70	46.96	51.65
24 L.H., Daily Totals		$2409.80		$3152.10	$100.41	$131.34
Crew B-47C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$49.95	$74.47
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Air Compressor, 750 cfm		596.30		655.93		
2 -50' Air Hoses, 3		76.70		84.37		
1 Air Track Drill, 4		1127.00		1239.70	112.50	123.75
16 L.H., Daily Totals		$2599.20		$3171.60	$162.45	$198.22
Crew B-47E	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$44.90	$67.00
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05	26.56	29.22
32 L.H., Daily Totals		$2286.85		$3079.05	$71.46	$96.22
Crew B-47G	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$47.67	$71.11
2 Laborers	44.40	710.40	66.25	1060.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Air Track Drill, 4		1127.00		1239.70		
1 Air Compressor, 600 cfm		426.55		469.20		
2 -50' Air Hoses, 3		76.70		84.37		
1 Gunite Pump Rig		321.75		353.93	61.00	67.10
32 L.H., Daily Totals		$3477.60		$4422.80	$108.68	$138.21
Crew B-47H	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Skilled Worker Foreman (out)	$59.10	$472.80	$88.90	$711.20	$57.60	$86.65
3 Skilled Workers	57.10	1370.40	85.90	2061.60		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05	26.56	29.22
32 L.H., Daily Totals		$2693.25		$3707.86	$84.16	$115.87

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-48	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.86	$74.36
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Centr. Water Pump, 6		235.25		258.77		
1 -20' Suction Hose, 6		25.50		28.05		
1 -50' Discharge Hose, 6		18.10		19.91		
1 Drill Rig, Truck-Mounted		768.40		845.24	18.70	20.57
56 L.H., Daily Totals		$3839.65		$5315.98	$68.57	$94.93
Crew B-49	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$52.25	$78.46
3 Laborers	44.40	1065.60	66.25	1590.00		
2 Equip. Oper. (crane)	61.45	983.20	91.55	1464.80		
2 Equip. Oper. (oilers)	52.50	840.00	78.25	1252.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
2 Pile Drivers	55.90	894.40	86.40	1382.40		
1 Hyd. Crane, 25 Ton		586.70		645.37		
1 Centr. Water Pump, 6		235.25		258.77		
1 -20' Suction Hose, 6		25.50		28.05		
1 -50' Discharge Hose, 6		18.10		19.91		
1 Drill Rig, Truck-Mounted		768.40		845.24	18.57	20.42
88 L.H., Daily Totals		$6232.35		$8702.15	$70.82	$98.89
Crew B-50	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Pile Driver Foremen (outside)	$57.90	$926.40	$89.50	$1432.00	$54.27	$82.68
6 Pile Drivers	55.90	2683.20	86.40	4147.20		
2 Equip. Oper. (crane)	61.45	983.20	91.55	1464.80		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Crawler Crane, 40 Ton		1231.00		1354.10		
1 Lead, 60' High		211.80		232.98		
1 Hammer, Diesel, 15K ft.-lbs.		624.45		686.89		
1 Air Compressor, 600 cfm		426.55		469.20		
2 -50' Air Hoses, 3		76.70		84.37		
1 Chain Saw, Gas, 36 Long		41.65		45.81	23.32	25.66
112 L.H., Daily Totals		$8690.55		$12133.37	$77.59	$108.33
Crew B-51	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$45.47	$67.88
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Flatbed Truck, Gas, 1.5 Ton		198.50		218.35	4.14	4.55
48 L.H., Daily Totals		$2380.90		$3476.35	$49.60	$72.42
Crew B-52	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Carpenter Foreman (outside)	$56.70	$453.60	$84.60	$676.80	$50.76	$75.55
1 Carpenter	54.70	437.60	81.65	653.20		
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Cement Finisher	51.80	414.40	75.90	607.20		
.5 Rodman (reinf.)	58.90	235.60	88.05	352.20		
.5 Equip. Oper. (medium)	59.00	236.00	87.90	351.60		
.5 Crawler Loader, 3 C.Y.		573.00		630.30	10.23	11.26
56 L.H., Daily Totals		$3415.80		$4861.30	$61.00	$86.81
Crew B-53	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (light)	$55.50	$444.00	$82.70	$661.60	$55.50	$82.70
1 Trencher, Chain, 12 H.P.		158.60		174.46	19.82	21.81
8 L.H., Daily Totals		$602.60		$836.06	$75.33	$104.51

Crews - Standard

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-54	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (light)	$55.50	$444.00	$82.70	$661.60	$55.50	$82.70
1 Trencher, Chain, 40 H.P.		450.70		495.77	56.34	61.97
8 L.H., Daily Totals		$894.70		$1157.37	$111.84	$144.67
Crew B-54A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
.17 Labor Foreman (outside)	$46.40	$63.10	$69.25	$94.18	$57.17	$85.19
1 Equipment Operator (med.)	59.00	472.00	87.90	703.20		
1 Wheel Trencher, 67 H.P.		1140.00		1254.00	121.79	133.97
9.36 L.H., Daily Totals		$1675.10		$2051.38	$178.96	$219.16
Crew B-54B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
.25 Labor Foreman (outside)	$46.40	$92.80	$69.25	$138.50	$56.48	$84.17
1 Equipment Operator (med.)	59.00	472.00	87.90	703.20		
1 Wheel Trencher, 150 H.P.		1238.00		1361.80	123.80	136.18
10 L.H., Daily Totals		$1802.80		$2203.50	$180.28	$220.35
Crew B-54C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$51.70	$77.08
1 Equipment Operator (med.)	59.00	472.00	87.90	703.20		
1 Wheel Trencher, 67 H.P.		1140.00		1254.00	71.25	78.38
16 L.H., Daily Totals		$1967.20		$2487.20	$122.95	$155.45
Crew B-54D	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$51.70	$77.08
1 Equipment Operator (med.)	59.00	472.00	87.90	703.20		
1 Rock Trencher, 6 Width		434.20		477.62	27.14	29.85
16 L.H., Daily Totals		$1261.40		$1710.82	$78.84	$106.93
Crew B-54E	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$51.70	$77.08
1 Equipment Operator (med.)	59.00	472.00	87.90	703.20		
1 Rock Trencher, 18 Width		1015.00		1116.50	63.44	69.78
16 L.H., Daily Totals		$1842.20		$2349.70	$115.14	$146.86
Crew B-55	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$45.87	$68.50
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Truck-Mounted Earth Auger		394.15		433.57		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05	51.84	57.03
24 L.H., Daily Totals		$2345.00		$3012.62	$97.71	$125.53
Crew B-56	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$49.95	$74.47
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Air Track Drill, 4		1127.00		1239.70		
1 Air Compressor, 600 cfm		426.55		469.20		
1 -50' Air Hose, 3		38.35		42.19	99.49	109.44
16 L.H., Daily Totals		$2391.10		$2942.69	$149.44	$183.92

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-57	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$50.77	$75.71
2 Laborers	44.40	710.40	66.25	1060.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Crawler Crane, 25 Ton		1152.00		1267.20		
1 Clamshell Bucket, 1 C.Y.		69.25		76.17		
1 Centr. Water Pump, 6		235.25		258.77		
1 -20' Suction Hose, 6		25.50		28.05		
20 -50' Discharge Hoses, 6		362.00		398.20	38.42	42.26
48 L.H., Daily Totals		$4281.20		$5662.40	$89.19	$117.97
Crew B-58	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$48.10	$71.73
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Backhoe Loader, 48 H.P.		216.20		237.82		
1 Small Helicopter, w/ Pilot		2101.00		2311.10	96.55	106.21
24 L.H., Daily Totals		$3471.60		$4270.52	$144.65	$177.94
Crew B-59	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Truck Driver (heavy)	$51.30	$410.40	$76.70	$613.60	$51.30	$76.70
1 Truck Tractor, 220 H.P.		310.80		341.88		
1 Water Tank Trailer, 5000 Gal.		154.10		169.51	58.11	63.92
8 L.H., Daily Totals		$875.30		$1124.99	$109.41	$140.62
Crew B-59A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$46.70	$69.73
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Water Tank Trailer, 5000 Gal.		154.10		169.51		
1 Truck Tractor, 220 H.P.		310.80		341.88	19.37	21.31
24 L.H., Daily Totals		$1585.70		$2184.99	$66.07	$91.04
Crew B-60	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$51.45	$76.71
2 Laborers	44.40	710.40	66.25	1060.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
2 Equip. Oper. (light)	55.50	888.00	82.70	1323.20		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Crawler Crane, 40 Ton		1231.00		1354.10		
1 Lead, 60' High		211.80		232.98		
1 Hammer, Diesel, 15K ft.-lbs.		624.45		686.89		
1 Backhoe Loader, 48 H.P.		216.20		237.82	40.78	44.85
56 L.H., Daily Totals		$5164.65		$6807.40	$92.23	$121.56
Crew B-61	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$47.02	$70.14
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Cement Mixer, 2 C.Y.		112.35		123.58		
1 Air Compressor, 160 cfm		212.30		233.53	8.12	8.93
40 L.H., Daily Totals		$2205.45		$3162.72	$55.14	$79.07
Crew B-62	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$48.10	$71.73
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Loader, Skid Steer, 30 H.P.		179.50		197.45	7.48	8.23
24 L.H., Daily Totals		$1333.90		$1919.05	$55.58	$79.96

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-62A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$48.10	$71.73
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Loader, Skid Steer, 30 H.P.		179.50		197.45		
1 Trencher Attachment		66.25		72.88	10.24	11.26
24 L.H., Daily Totals		$1400.15		$1991.93	$58.34	$83.00
Crew B-63	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
4 Laborers	$44.40	$1420.80	$66.25	$2120.00	$46.62	$69.54
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Loader, Skid Steer, 30 H.P.		179.50		197.45	4.49	4.94
40 L.H., Daily Totals		$2044.30		$2979.05	$51.11	$74.48
Crew B-63B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (inside)	$44.90	$359.20	$67.00	$536.00	$47.30	$70.55
2 Laborers	44.40	710.40	66.25	1060.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Loader, Skid Steer, 78 H.P.		446.30		490.93	13.95	15.34
32 L.H., Daily Totals		$1959.90		$2748.53	$61.25	$85.89
Crew B-64	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$46.60	$69.63
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Power Mulcher (small)		201.00		221.10		
1 Flatbed Truck, Gas, 1.5 Ton		198.50		218.35	24.97	27.47
16 L.H., Daily Totals		$1145.10		$1553.45	$71.57	$97.09
Crew B-65	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$46.60	$69.63
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Power Mulcher (Large)		345.35		379.88		
1 Flatbed Truck, Gas, 1.5 Ton		198.50		218.35	33.99	37.39
16 L.H., Daily Totals		$1289.45		$1712.23	$80.59	$107.01
Crew B-66	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (light)	$55.50	$444.00	$82.70	$661.60	$55.50	$82.70
1 Loader-Backhoe, 40 H.P.		267.55		294.31	33.44	36.79
8 L.H., Daily Totals		$711.55		$955.90	$88.94	$119.49
Crew B-67	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Millwright	$58.75	$470.00	$84.90	$679.20	$57.13	$83.80
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 R.T. Forklift, 5,000 Lb., diesel		272.85		300.13	17.05	18.76
16 L.H., Daily Totals		$1186.85		$1640.93	$74.18	$102.56
Crew B-67B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Millwright Foreman (inside)	$59.25	$474.00	$85.60	$684.80	$59.00	$85.25
1 Millwright	58.75	470.00	84.90	679.20		
16 L.H., Daily Totals		$944.00		$1364.00	$59.00	$85.25
Crew B-68	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Millwrights	$58.75	$940.00	$84.90	$1358.40	$57.67	$84.17
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 R.T. Forklift, 5,000 Lb., diesel		272.85		300.13	11.37	12.51
24 L.H., Daily Totals		$1656.85		$2320.14	$69.04	$96.67
Crew B-68A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Millwright Foreman (inside)	$59.25	$474.00	$85.60	$684.80	$58.92	$85.13
2 Millwrights	58.75	940.00	84.90	1358.40		
1 Forklift, Smooth Floor, 8,000 Lb.		283.25		311.57	11.80	12.98
24 L.H., Daily Totals		$1697.25		$2354.78	$70.72	$98.12

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-68B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Millwright Foreman (inside)	$59.25	$474.00	$85.60	$684.80	$62.79	$92.40
2 Millwrights	58.75	940.00	84.90	1358.40		
2 Electricians	63.70	1019.20	94.65	1514.40		
2 Plumbers	67.70	1083.20	101.05	1616.80		
1 R.T. Forklift, 5,000 Lb., gas		283.30		311.63	5.06	5.56
56 L.H., Daily Totals		$3799.70		$5486.03	$67.85	$97.96
Crew B-68C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Millwright Foreman (inside)	$59.25	$474.00	$85.60	$684.80	$62.35	$91.55
1 Millwright	58.75	470.00	84.90	679.20		
1 Electrician	63.70	509.60	94.65	757.20		
1 Plumber	67.70	541.60	101.05	808.40		
1 R.T. Forklift, 5,000 Lb., gas		283.30		311.63	8.85	9.74
32 L.H., Daily Totals		$2278.50		$3241.23	$71.20	$101.29
Crew B-68D	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (inside)	$44.90	$359.20	$67.00	$536.00	$48.27	$71.98
1 Laborer	44.40	355.20	66.25	530.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 R.T. Forklift, 5,000 Lb., gas		283.30		311.63	11.80	12.98
24 L.H., Daily Totals		$1441.70		$2039.23	$60.07	$84.97
Crew B-68E	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Struc. Steel Foreman (inside)	$60.80	$486.40	$94.10	$752.80	$60.40	$93.46
3 Struc. Steel Workers	60.30	1447.20	93.30	2239.20		
1 Welder	60.30	482.40	93.30	746.40		
1 Forklift, Smooth Floor, 8,000 Lb.		283.25		311.57	7.08	7.79
40 L.H., Daily Totals		$2699.25		$4049.97	$67.48	$101.25
Crew B-68F	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Skilled Worker Foreman (out)	$59.10	$472.80	$88.90	$711.20	$57.77	$86.90
2 Skilled Workers	57.10	913.60	85.90	1374.40		
1 R.T. Forklift, 5,000 Lb., gas		283.30		311.63	11.80	12.98
24 L.H., Daily Totals		$1669.70		$2397.23	$69.57	$99.88
Crew B-68G	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Structural Steel Workers	$60.30	$964.80	$93.30	$1492.80	$60.30	$93.30
1 R.T. Forklift, 5,000 Lb., gas		283.30		311.63	17.71	19.48
16 L.H., Daily Totals		$1248.10		$1804.43	$78.01	$112.78
Crew B-69	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.92	$72.97
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Hyd. Crane, 80 Ton		1458.00		1603.80	30.38	33.41
48 L.H., Daily Totals		$3806.40		$5106.20	$79.30	$106.38
Crew B-69A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.40	$71.97
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Concrete Finisher	51.80	414.40	75.90	607.20		
1 Curb/Gutter Paver, 2-Track		1231.00		1354.10	25.65	28.21
48 L.H., Daily Totals		$3554.20		$4808.50	$74.05	$100.18

Crews - Standard

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-69B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.40	$71.97
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Cement Finisher	51.80	414.40	75.90	607.20		
1 Curb/Gutter Paver, 4-Track		801.05		881.15	16.69	18.36
48 L.H., Daily Totals		$3124.25		$4335.56	$65.09	$90.32
Crew B-70	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$50.94	$75.96
3 Laborers	44.40	1065.60	66.25	1590.00		
3 Equip. Oper. (medium)	59.00	1416.00	87.90	2109.60		
1 Grader, 30,000 Lbs.		1073.00		1180.30		
1 Ripper, Beam & 1 Shank		91.60		100.76		
1 Road Sweeper, S.P., 8' wide		723.65		796.01		
1 F.E. Loader, W.M., 1.5 C.Y.		441.40		485.54	41.60	45.76
56 L.H., Daily Totals		$5182.45		$6816.22	$92.54	$121.72
Crew B-70A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$56.08	$83.57
4 Equip. Oper. (medium)	59.00	1888.00	87.90	2812.80		
1 Grader, 40,000 Lbs.		1219.00		1340.90		
1 F.E. Loader, W.M., 2.5 C.Y.		638.30		702.13		
1 Dozer, 80 H.P.		405.85		446.44		
1 Roller, Pneum. Whl., 12 Ton		349.90		384.89	65.33	71.86
40 L.H., Daily Totals		$4856.25		$6217.15	$121.41	$155.43
Crew B-71	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$50.94	$75.96
3 Laborers	44.40	1065.60	66.25	1590.00		
3 Equip. Oper. (medium)	59.00	1416.00	87.90	2109.60		
1 Pvmt. Profiler, 750 H.P.		3483.00		3831.30		
1 Road Sweeper, S.P., 8' wide		723.65		796.01		
1 F.E. Loader, W.M., 1.5 C.Y.		441.40		485.54	83.00	91.30
56 L.H., Daily Totals		$7500.85		$9366.45	$133.94	$167.26
Crew B-72	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$51.95	$77.45
3 Laborers	44.40	1065.60	66.25	1590.00		
4 Equip. Oper. (medium)	59.00	1888.00	87.90	2812.80		
1 Pvmt. Profiler, 750 H.P.		3483.00		3831.30		
1 Hammermill, 250 H.P.		857.40		943.14		
1 Windrow Loader		1461.00		1607.10		
1 Mix Paver, 165 H.P.		2172.00		2389.20		
1 Roller, Pneum. Whl., 12 Ton		349.90		384.89	130.05	143.06
64 L.H., Daily Totals		$11648.10		$14112.43	$182.00	$220.51
Crew B-73	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$53.77	$80.16
2 Laborers	44.40	710.40	66.25	1060.00		
5 Equip. Oper. (medium)	59.00	2360.00	87.90	3516.00		
1 Road Mixer, 310 H.P.		1919.00		2110.90		
1 Tandem Roller, 10 Ton		246.80		271.48		
1 Hammermill, 250 H.P.		857.40		943.14		
1 Grader, 30,000 Lbs.		1073.00		1180.30		
.5 F.E. Loader, W.M., 1.5 C.Y.		220.70		242.77		
.5 Truck Tractor, 220 H.P.		155.40		170.94		
.5 Water Tank Trailer, 5000 Gal.		77.05		84.75	71.08	78.19
64 L.H., Daily Totals		$7990.95		$10134.29	$124.86	$158.35

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-74	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$53.67	$80.06
1 Laborer	44.40	355.20	66.25	530.00		
4 Equip. Oper. (medium)	59.00	1888.00	87.90	2812.80		
2 Truck Drivers (heavy)	51.30	820.80	76.70	1227.20		
1 Grader, 30,000 Lbs.		1073.00		1180.30		
1 Ripper, Beam & 1 Shank		91.60		100.76		
2 Stabilizers, 310 H.P.		2808.00		3088.80		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05		
1 Chem. Spreader, Towed		85.40		93.94		
1 Roller, Vibratory, 25 Ton		672.35		739.59		
1 Water Tank Trailer, 5000 Gal.		154.10		169.51		
1 Truck Tractor, 220 H.P.		310.80		341.88	94.46	103.90
64 L.H., Daily Totals		$9480.50		$11773.83	$148.13	$183.97
Crew B-75	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$54.01	$80.54
1 Laborer	44.40	355.20	66.25	530.00		
4 Equip. Oper. (medium)	59.00	1888.00	87.90	2812.80		
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Grader, 30,000 Lbs.		1073.00		1180.30		
1 Ripper, Beam & 1 Shank		91.60		100.76		
2 Stabilizers, 310 H.P.		2808.00		3088.80		
1 Dist. Tanker, 3000 Gallon		334.10		367.51		
1 Truck Tractor, 6x4, 380 H.P.		499.15		549.07		
1 Roller, Vibratory, 25 Ton		672.35		739.59	97.83	107.61
56 L.H., Daily Totals		$8503.00		$10536.42	$151.84	$188.15
Crew B-76	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Dock Builder Foreman (outside)	$57.90	$463.20	$89.50	$716.00	$56.98	$86.98
5 Dock Builders	55.90	2236.00	86.40	3456.00		
2 Equip. Oper. (crane)	61.45	983.20	91.55	1464.80		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Crawler Crane, 50 Ton		1541.00		1695.10		
1 Barge, 400 Ton		869.15		956.07		
1 Hammer, Diesel, 15K ft.-lbs.		624.45		686.89		
1 Lead, 60' High		211.80		232.98		
1 Air Compressor, 600 cfm		426.55		469.20		
2 -50' Air Hoses, 3		76.70		84.37	52.08	57.29
72 L.H., Daily Totals		$7852.05		$10387.42	$109.06	$144.27
Crew B-76A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$47.79	$71.29
5 Laborers	44.40	1776.00	66.25	2650.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Crawler Crane, 50 Ton		1541.00		1695.10		
1 Barge, 400 Ton		869.15		956.07	37.66	41.42
64 L.H., Daily Totals		$5468.95		$7213.56	$85.45	$112.71
Crew B-77	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$45.68	$68.20
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Crack Cleaner, 25 H.P.		53.00		58.30		
1 Crack Filler, Trailer Mtd.		170.95		188.04		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05	26.85	29.54
40 L.H., Daily Totals		$2901.20		$3909.40	$72.53	$97.73

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-78	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$45.47	$67.88
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Paint Striper, S.P., 40 Gallon		128.35		141.19		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05		
1 Pickup Truck, 3/4 Ton		112.20		123.42	22.72	24.99
48 L.H., Daily Totals		$3273.00		$4457.66	$68.19	$92.87
Crew B-78A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (light)	$55.50	$444.00	$82.70	$661.60	$55.50	$82.70
1 Line Rem. (Metal Balls) 115 H.P.		996.25		1095.88	124.53	136.98
8 L.H., Daily Totals		$1440.25		$1757.47	$180.03	$219.68
Crew B-78B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$45.63	$68.08
.25 Equip. Oper. (light)	55.50	111.00	82.70	165.40		
1 Pickup Truck, 3/4 Ton		112.20		123.42		
1 Line Rem.,11 H.P.,Walk Behind		114.75		126.22		
.25 Road Sweeper, S.P., 8' wide		180.91		199.00	22.66	24.92
18 L.H., Daily Totals		$1229.26		$1674.05	$68.29	$93.00
Crew B-78C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$45.47	$67.88
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Paint Striper, T.M., 120 Gal.		603.10		663.41		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05		
1 Pickup Truck, 3/4 Ton		112.20		123.42	32.61	35.87
48 L.H., Daily Totals		$3747.75		$4979.89	$78.08	$103.75
Crew B-78D	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Labor Foremen (outside)	$46.40	$742.40	$69.25	$1108.00	$45.24	$67.53
7 Laborers	44.40	2486.40	66.25	3710.00		
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Paint Striper, T.M., 120 Gal.		603.10		663.41		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05		
3 Pickup Trucks, 3/4 Ton		336.60		370.26		
1 Air Compressor, 60 cfm		153.85		169.24		
1 -50' Air Hose, 3/4		7.15		7.87		
1 Breaker, Pavement, 60 lb.		53.60		58.96	25.05	27.56
80 L.H., Daily Totals		$5623.55		$7606.78	$70.29	$95.08
Crew B-78E	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Labor Foremen (outside)	$46.40	$742.40	$69.25	$1108.00	$45.10	$67.31
9 Laborers	44.40	3196.80	66.25	4770.00		
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Paint Striper, T.M., 120 Gal.		603.10		663.41		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05		
4 Pickup Trucks, 3/4 Ton		448.80		493.68		
2 Air Compressors, 60 cfm		307.70		338.47		
2 -50' Air Hoses, 3/4		14.30		15.73		
2 Breakers, Pavement, 60 lb.		107.20		117.92	24.28	26.71
96 L.H., Daily Totals		$6660.75		$9026.26	$69.38	$94.02

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-78F	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Labor Foremen (outside)	$46.40	$742.40	$69.25	$1108.00	$45.00	$67.16
11 Laborers	44.40	3907.20	66.25	5830.00		
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Paint Striper, T.M., 120 Gal.		603.10		663.41		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05		
7 Pickup Trucks, 3/4 Ton		785.40		863.94		
3 Air Compressors, 60 cfm		461.55		507.70		
3 -50' Air Hoses, 3/4		21.45		23.59		
3 Breakers, Pavement, 60 lb.		160.80		176.88	25.74	28.31
112 L.H., Daily Totals		$7922.35		$10692.58	$70.74	$95.47
Crew B-79	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$45.68	$68.20
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Paint Striper, T.M., 120 Gal.		603.10		663.41		
1 Heating Kettle, 115 Gallon		107.25		117.97		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05		
2 Pickup Trucks, 3/4 Ton		224.40		246.84	44.62	49.08
40 L.H., Daily Totals		$3612.00		$4691.28	$90.30	$117.28
Crew B-79A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1.5 Equip. Oper. (light)	$55.50	$666.00	$82.70	$992.40	$55.50	$82.70
.5 Line Remov. (Grinder) 115 H.P.		515.50		567.05		
1 Line Rem. (Metal Balls) 115 H.P.		996.25		1095.88	125.98	138.58
12 L.H., Daily Totals		$2177.75		$2655.32	$181.48	$221.28
Crew B-79B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$44.40	$66.25
1 Set of Gases		173.60		190.96	21.70	23.87
8 L.H., Daily Totals		$528.80		$720.96	$66.10	$90.12
Crew B-79C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$45.31	$67.64
5 Laborers	44.40	1776.00	66.25	2650.00		
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Paint Striper, T.M., 120 Gal.		603.10		663.41		
1 Heating Kettle, 115 Gallon		107.25		117.97		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05		
3 Pickup Trucks, 3/4 Ton		336.60		370.26		
1 Air Compressor, 60 cfm		153.85		169.24		
1 -50' Air Hose, 3/4		7.15		7.87		
1 Breaker, Pavement, 60 lb.		53.60		58.96	37.71	41.48
56 L.H., Daily Totals		$4649.20		$6110.76	$83.02	$109.12
Crew B-79D	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Labor Foremen (outside)	$46.40	$742.40	$69.25	$1108.00	$45.45	$67.84
5 Laborers	44.40	1776.00	66.25	2650.00		
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Paint Striper, T.M., 120 Gal.		603.10		663.41		
1 Heating Kettle, 115 Gallon		107.25		117.97		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05		
4 Pickup Trucks, 3/4 Ton		448.80		493.68		
1 Air Compressor, 60 cfm		153.85		169.24		
1 -50' Air Hose, 3/4		7.15		7.87		
1 Breaker, Pavement, 60 lb.		53.60		58.96	34.75	38.22
64 L.H., Daily Totals		$5132.60		$6788.18	$80.20	$106.07

Crews - Standard

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-79E	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Labor Foremen (outside)	$46.40	$742.40	$69.25	$1108.00	$45.24	$67.53
7 Laborers	44.40	2486.40	66.25	3710.00		
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Paint Striper, T.M., 120 Gal.		603.10		663.41		
1 Heating Kettle, 115 Gallon		107.25		117.97		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05		
5 Pickup Trucks, 3/4 Ton		561.00		617.10		
2 Air Compressors, 60 cfm		307.70		338.47		
2 -50' Air Hoses, 3/4		14.30		15.73		
2 Breakers, Pavement, 60 lb.		107.20		117.92	31.88	35.07
80 L.H., Daily Totals		$6169.80		$8207.66	$77.12	$102.60
Crew B-80	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.77	$72.80
1 Laborer	44.40	355.20	66.25	530.00		
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05		
1 Earth Auger, Truck-Mtd.		202.55		222.81	32.89	36.18
32 L.H., Daily Totals		$2613.40		$3487.46	$81.67	$108.98
Crew B-80A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
3 Laborers	$44.40	$1065.60	$66.25	$1590.00	$44.40	$66.25
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05	35.42	38.96
24 L.H., Daily Totals		$1915.65		$2525.05	$79.82	$105.21
Crew B-80B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
3 Laborers	$44.40	$1065.60	$66.25	$1590.00	$47.17	$70.36
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Crane, Flatbed Mounted, 3 Ton		238.75		262.63	7.46	8.21
32 L.H., Daily Totals		$1748.35		$2514.22	$54.64	$78.57
Crew B-80C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$45.87	$68.50
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Flatbed Truck, Gas, 1.5 Ton		198.50		218.35		
1 Manual Fence Post Auger, Gas		54.40		59.84	10.54	11.59
24 L.H., Daily Totals		$1353.70		$1922.19	$56.40	$80.09
Crew B-81	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$51.57	$76.95
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Hydromulcher, T.M., 3000 Gal.		256.85		282.54		
1 Truck Tractor, 220 H.P.		310.80		341.88	23.65	26.02
24 L.H., Daily Totals		$1805.25		$2471.22	$75.22	$102.97
Crew B-81A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$46.60	$69.63
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Hydromulcher, T.M., 600 Gal.		118.15		129.97		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05	60.51	66.56
16 L.H., Daily Totals		$1713.80		$2179.02	$107.11	$136.19
Crew B-82	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$49.95	$74.47
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Horiz. Borer, 6 H.P.		184.15		202.57	11.51	12.66
16 L.H., Daily Totals		$983.35		$1394.17	$61.46	$87.14

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-82A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$49.95	$74.47
2 Equip. Opers. (light)	55.50	888.00	82.70	1323.20		
2 Dump Truck, 8 C.Y., 220 H.P.		815.20		896.72		
1 Flatbed Trailer, 25 Ton		137.20		150.92		
1 Horiz. Dir. Drill, 20k lb. Thrust		544.10		598.51		
1 Mud Trailer for HDD, 1500 Gal.		312.15		343.37		
1 Pickup Truck, 4x4, 3/4 Ton		176.75		194.43		
1 Flatbed Trailer, 3 Ton		71.15		78.27		
1 Loader, Skid Steer, 78 H.P.		446.30		490.93	78.21	86.04
32 L.H., Daily Totals		$4101.25		$5136.34	$128.16	$160.51
Crew B-82B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$49.95	$74.47
2 Equip. Opers. (light)	55.50	888.00	82.70	1323.20		
2 Dump Truck, 8 C.Y., 220 H.P.		815.20		896.72		
1 Flatbed Trailer, 25 Ton		137.20		150.92		
1 Horiz. Dir. Drill, 30k lb. Thrust		647.65		712.41		
1 Mud Trailer for HDD, 1500 Gal.		312.15		343.37		
1 Pickup Truck, 4x4, 3/4 Ton		176.75		194.43		
1 Flatbed Trailer, 3 Ton		71.15		78.27		
1 Loader, Skid Steer, 78 H.P.		446.30		490.93	81.45	89.59
32 L.H., Daily Totals		$4204.80		$5250.24	$131.40	$164.07
Crew B-82C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$49.95	$74.47
2 Equip. Opers. (light)	55.50	888.00	82.70	1323.20		
2 Dump Truck, 8 C.Y., 220 H.P.		815.20		896.72		
1 Flatbed Trailer, 25 Ton		137.20		150.92		
1 Horiz. Dir. Drill, 50k lb. Thrust		824.05		906.46		
1 Mud Trailer for HDD, 1500 Gal.		312.15		343.37		
1 Pickup Truck, 4x4, 3/4 Ton		176.75		194.43		
1 Flatbed Trailer, 3 Ton		71.15		78.27		
1 Loader, Skid Steer, 78 H.P.		446.30		490.93	86.96	95.66
32 L.H., Daily Totals		$4381.20		$5444.28	$136.91	$170.13
Crew B-82D	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (light)	$55.50	$444.00	$82.70	$661.60	$55.50	$82.70
1 Mud Trailer for HDD, 1500 Gal.		312.15		343.37	39.02	42.92
8 L.H., Daily Totals		$756.15		$1004.97	$94.52	$125.62
Crew B-83	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Tugboat Captain	$59.00	$472.00	$87.90	$703.20	$51.70	$77.08
1 Tugboat Hand	44.40	355.20	66.25	530.00		
1 Tugboat, 250 H.P.		726.10		798.71	45.38	49.92
16 L.H., Daily Totals		$1553.30		$2031.91	$97.08	$126.99
Crew B-84	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$59.00	$87.90
1 Rotary Mower/Tractor		371.15		408.26	46.39	51.03
8 L.H., Daily Totals		$843.15		$1111.46	$105.39	$138.93
Crew B-85	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
3 Laborers	$44.40	$1065.60	$66.25	$1590.00	$48.70	$72.67
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Telescoping Boom Lift, to 80'		387.75		426.52		
1 Brush Chipper, 12 , 130 H.P.		366.05		402.65		
1 Pruning Saw, Rotary		26.40		29.04	19.50	21.46
40 L.H., Daily Totals		$2728.20		$3765.02	$68.20	$94.13

Crews - Standard

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-86	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$59.00	$87.90
1 Stump Chipper, S.P.		189.20		208.12	23.65	26.02
8 L.H., Daily Totals		$661.20		$911.32	$82.65	$113.92
Crew B-86A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$59.00	$87.90
1 Grader, 30,000 Lbs.		1073.00		1180.30	134.13	147.54
8 L.H., Daily Totals		$1545.00		$1883.50	$193.13	$235.44
Crew B-86B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$59.00	$87.90
1 Dozer, 200 H.P.		1520.00		1672.00	190.00	209.00
8 L.H., Daily Totals		$1992.00		$2375.20	$249.00	$296.90
Crew B-87	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$56.08	$83.57
4 Equip. Oper. (medium)	59.00	1888.00	87.90	2812.80		
2 Feller Bunchers, 100 H.P.		1257.60		1383.36		
1 Log Chipper, 22 Tree		555.00		610.50		
1 Dozer, 105 H.P.		640.80		704.88		
1 Chain Saw, Gas, 36 Long		41.65		45.81	62.38	68.61
40 L.H., Daily Totals		$4738.25		$6087.35	$118.46	$152.18
Crew B-88	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$56.91	$84.81
6 Equip. Oper. (medium)	59.00	2832.00	87.90	4219.20		
2 Feller Bunchers, 100 H.P.		1257.60		1383.36		
1 Log Chipper, 22 Tree		555.00		610.50		
2 Log Skidders, 50 H.P.		1826.70		2009.37		
1 Dozer, 105 H.P.		640.80		704.88		
1 Chain Saw, Gas, 36 Long		41.65		45.81	77.17	84.89
56 L.H., Daily Totals		$7508.95		$9503.13	$134.09	$169.70
Crew B-89	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (light)	$55.50	$444.00	$82.70	$661.60	$52.15	$77.85
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05		
1 Concrete Saw		112.85		124.14		
1 Water Tank, 65 Gal.		102.90		113.19	66.61	73.27
16 L.H., Daily Totals		$1900.20		$2417.98	$118.76	$151.12
Crew B-89A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Skilled Worker	$57.10	$456.80	$85.90	$687.20	$50.75	$76.08
1 Laborer	44.40	355.20	66.25	530.00		
1 Core Drill (Large)		121.60		133.76	7.60	8.36
16 L.H., Daily Totals		$933.60		$1350.96	$58.35	$84.44
Crew B-89B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (light)	$55.50	$444.00	$82.70	$661.60	$52.15	$77.85
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Wall Saw, Hydraulic, 10 H.P.		86.40		95.04		
1 Generator, Diesel, 100 kW		521.85		574.03		
1 Water Tank, 65 Gal.		102.90		113.19		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05	97.58	107.33
16 L.H., Daily Totals		$2395.60		$2962.92	$149.72	$185.18
Crew B-89C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Cement Finisher	$51.80	$414.40	$75.90	$607.20	$51.80	$75.90
1 Masonry cut-off saw, gas		58.15		63.97	7.27	8.00
8 L.H., Daily Totals		$472.55		$671.16	$59.07	$83.90

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-90	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.15	$73.35
3 Laborers	44.40	1065.60	66.25	1590.00		
2 Equip. Oper. (light)	55.50	888.00	82.70	1323.20		
2 Truck Drivers (heavy)	51.30	820.80	76.70	1227.20		
1 Road Mixer, 310 H.P.		1919.00		2110.90		
1 Dist. Truck, 2000 Gal.		303.25		333.57	34.72	38.19
64 L.H., Daily Totals		$5367.85		$7138.88	$83.87	$111.54
Crew B-90A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$53.03	$79.05
2 Laborers	44.40	710.40	66.25	1060.00		
4 Equip. Oper. (medium)	59.00	1888.00	87.90	2812.80		
2 Graders, 30,000 Lbs.		2146.00		2360.60		
1 Tandem Roller, 10 Ton		246.80		271.48		
1 Roller, Pneum. Whl., 12 Ton		349.90		384.89	48.98	53.87
56 L.H., Daily Totals		$5712.30		$7443.77	$102.01	$132.92
Crew B-90B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$52.03	$77.58
2 Laborers	44.40	710.40	66.25	1060.00		
3 Equip. Oper. (medium)	59.00	1416.00	87.90	2109.60		
1 Roller, Pneum. Whl., 12 Ton		349.90		384.89		
1 Road Mixer, 310 H.P.		1919.00		2110.90	47.27	52.00
48 L.H., Daily Totals		$4766.50		$6219.39	$99.30	$129.57
Crew B-90C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$50.45	$75.28
4 Laborers	44.40	1420.80	66.25	2120.00		
3 Equip. Oper. (medium)	59.00	1416.00	87.90	2109.60		
3 Truck Drivers (heavy)	51.30	1231.20	76.70	1840.80		
3 Road Mixers, 310 H.P.		5757.00		6332.70	65.42	71.96
88 L.H., Daily Totals		$10196.20		$12957.10	$115.87	$147.24
Crew B-90D	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.52	$73.89
6 Laborers	44.40	2131.20	66.25	3180.00		
3 Equip. Oper. (medium)	59.00	1416.00	87.90	2109.60		
3 Truck Drivers (heavy)	51.30	1231.20	76.70	1840.80		
3 Road Mixers, 310 H.P.		5757.00		6332.70	55.36	60.89
104 L.H., Daily Totals		$10906.60		$14017.10	$104.87	$134.78
Crew B-90E	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$50.26	$74.96
4 Laborers	44.40	1420.80	66.25	2120.00		
3 Equip. Oper. (medium)	59.00	1416.00	87.90	2109.60		
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Road Mixer, 310 H.P.		1919.00		2110.90	26.65	29.32
72 L.H., Daily Totals		$5537.40		$7508.10	$76.91	$104.28
Crew B-91	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$52.81	$78.76
2 Laborers	44.40	710.40	66.25	1060.00		
4 Equip. Oper. (medium)	59.00	1888.00	87.90	2812.80		
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Dist. Tanker, 3000 Gallon		334.10		367.51		
1 Truck Tractor, 6x4, 380 H.P.		499.15		549.07		
1 Aggreg. Spreader, S.P.		859.10		945.01		
1 Roller, Pneum. Whl., 12 Ton		349.90		384.89		
1 Tandem Roller, 10 Ton		246.80		271.48	35.77	39.34
64 L.H., Daily Totals		$5669.05		$7558.35	$88.58	$118.10

Crews - Standard

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-91B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$51.70	$77.08
1 Equipment Oper. (med.)	59.00	472.00	87.90	703.20		
1 Road Sweeper, Vac. Assist.		879.45		967.39	54.97	60.46
16 L.H., Daily Totals		$1706.65		$2200.59	$106.67	$137.54
Crew B-91C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$46.60	$69.63
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Catch Basin Cleaning Truck		542.60		596.86	33.91	37.30
16 L.H., Daily Totals		$1288.20		$1710.86	$80.51	$106.93
Crew B-91D	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$51.23	$76.42
5 Laborers	44.40	1776.00	66.25	2650.00		
5 Equip. Oper. (medium)	59.00	2360.00	87.90	3516.00		
2 Truck Drivers (heavy)	51.30	820.80	76.70	1227.20		
1 Aggreg. Spreader, S.P.		859.10		945.01		
2 Truck Tractors, 6x4, 380 H.P.		998.30		1098.13		
2 Dist. Tankers, 3000 Gallon		668.20		735.02		
2 Pavement Brushes, Towed		176.70		194.37		
2 Rollers Pneum. Whl., 12 Ton		699.80		769.78	32.71	35.98
104 L.H., Daily Totals		$8730.10		$11689.51	$83.94	$112.40
Crew B-92	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$44.90	$67.00
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Crack Cleaner, 25 H.P.		53.00		58.30		
1 Air Compressor, 60 cfm		153.85		169.24		
1 Tar Kettle, T.M.		156.70		172.37		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05	37.92	41.72
32 L.H., Daily Totals		$2650.40		$3478.96	$82.83	$108.72
Crew B-93	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$59.00	$87.90
1 Feller Buncher, 100 H.P.		628.80		691.68	78.60	86.46
8 L.H., Daily Totals		$1100.80		$1394.88	$137.60	$174.36
Crew B-94A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$44.40	$66.25
1 Diaphragm Water Pump, 2		87.70		96.47		
1 -20' Suction Hose, 2		3.55		3.90		
2 -50' Discharge Hoses, 2		8.00		8.80	12.41	13.65
8 L.H., Daily Totals		$454.45		$639.17	$56.81	$79.90
Crew B-94B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$44.40	$66.25
1 Diaphragm Water Pump, 4		106.35		116.99		
1 -20' Suction Hose, 4		17.25		18.98		
2 -50' Discharge Hoses, 4		25.60		28.16	18.65	20.52
8 L.H., Daily Totals		$504.40		$694.12	$63.05	$86.77
Crew B-94C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$44.40	$66.25
1 Centrifugal Water Pump, 3		74.40		81.84		
1 -20' Suction Hose, 3		8.75		9.63		
2 -50' Discharge Hoses, 3		9.00		9.90	11.52	12.67
8 L.H., Daily Totals		$447.35		$631.37	$55.92	$78.92

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-94D	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$44.40	$66.25
1 Centr. Water Pump, 6		235.25		258.77		
1 -20' Suction Hose, 6		25.50		28.05		
2 -50' Discharge Hoses, 6		36.20		39.82	37.12	40.83
8 L.H., Daily Totals		$652.15		$856.64	$81.52	$107.08
Crew C-1	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
3 Carpenters	$54.70	$1312.80	$81.65	$1959.60	$52.13	$77.80
1 Laborer	44.40	355.20	66.25	530.00		
32 L.H., Daily Totals		$1668.00		$2489.60	$52.13	$77.80
Crew C-2	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Carpenter Foreman (outside)	$56.70	$453.60	$84.60	$676.80	$53.32	$79.58
4 Carpenters	54.70	1750.40	81.65	2612.80		
1 Laborer	44.40	355.20	66.25	530.00		
48 L.H., Daily Totals		$2559.20		$3819.60	$53.32	$79.58
Crew C-2A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Carpenter Foreman (outside)	$56.70	$453.60	$84.60	$676.80	$52.83	$78.62
3 Carpenters	54.70	1312.80	81.65	1959.60		
1 Cement Finisher	51.80	414.40	75.90	607.20		
1 Laborer	44.40	355.20	66.25	530.00		
48 L.H., Daily Totals		$2536.00		$3773.60	$52.83	$78.62
Crew C-3	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Rodman Foreman (outside)	$60.90	$487.20	$91.05	$728.40	$55.10	$82.31
4 Rodmen (reinf.)	58.90	1884.80	88.05	2817.60		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
2 Laborers	44.40	710.40	66.25	1060.00		
3 Stressing Equipment		56.85		62.53		
.5 Grouting Equipment		123.33		135.66	2.82	3.10
64 L.H., Daily Totals		$3706.57		$5465.79	$57.92	$85.40
Crew C-4	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Rodman Foreman (outside)	$60.90	$487.20	$91.05	$728.40	$59.40	$88.80
3 Rodmen (reinf.)	58.90	1413.60	88.05	2113.20		
3 Stressing Equipment		56.85		62.53	1.78	1.95
32 L.H., Daily Totals		$1957.65		$2904.14	$61.18	$90.75
Crew C-4A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Rodmen (reinf.)	$58.90	$942.40	$88.05	$1408.80	$58.90	$88.05
4 Stressing Equipment		75.80		83.38	4.74	5.21
16 L.H., Daily Totals		$1018.20		$1492.18	$63.64	$93.26
Crew C-5	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Rodman Foreman (outside)	$60.90	$487.20	$91.05	$728.40	$58.64	$87.58
4 Rodmen (reinf.)	58.90	1884.80	88.05	2817.60		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Hyd. Crane, 25 Ton		586.70		645.37	10.48	11.52
56 L.H., Daily Totals		$3870.30		$5549.77	$69.11	$99.10
Crew C-6	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$45.97	$68.36
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Cement Finisher	51.80	414.40	75.90	607.20		
2 Gas Engine Vibrators		54.30		59.73	1.13	1.24
48 L.H., Daily Totals		$2260.70		$3340.93	$47.10	$69.60

Crews - Standard

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew C-6A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Cement Finishers	$51.80	$828.80	$75.90	$1214.40	$51.80	$75.90
1 Concrete Vibrator, Elec, 2 HP		45.80		50.38	2.86	3.15
16 L.H., Daily Totals		$874.60		$1264.78	$54.66	$79.05
Crew C-7	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$47.97	$71.39
5 Laborers	44.40	1776.00	66.25	2650.00		
1 Cement Finisher	51.80	414.40	75.90	607.20		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
2 Gas Engine Vibrators		54.30		59.73		
1 Concrete Bucket, 1 C.Y.		45.90		50.49		
1 Hyd. Crane, 55 Ton		990.15		1089.17	15.14	16.66
72 L.H., Daily Totals		$4543.95		$6339.78	$63.11	$88.05
Crew C-7A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$46.38	$69.24
5 Laborers	44.40	1776.00	66.25	2650.00		
2 Truck Drivers (heavy)	51.30	820.80	76.70	1227.20		
2 Conc. Transit Mixers		1176.30		1293.93	18.38	20.22
64 L.H., Daily Totals		$4144.30		$5725.13	$64.75	$89.46
Crew C-7B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$47.79	$71.29
5 Laborers	44.40	1776.00	66.25	2650.00		
1 Equipment Operator, Crane	61.45	491.60	91.55	732.40		
1 Equipment Oiler	52.50	420.00	78.25	626.00		
1 Conc. Bucket, 2 C.Y.		55.65		61.22		
1 Lattice Boom Crane, 165 Ton		2403.00		2643.30	38.42	42.26
64 L.H., Daily Totals		$5517.45		$7266.92	$86.21	$113.55
Crew C-7C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.30	$72.04
5 Laborers	44.40	1776.00	66.25	2650.00		
2 Equipment Operators (med.)	59.00	944.00	87.90	1406.40		
2 F.E. Loaders, W.M., 4 C.Y.		1518.00		1669.80	23.72	26.09
64 L.H., Daily Totals		$4609.20		$6280.20	$72.02	$98.13
Crew C-7D	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$46.77	$69.77
5 Laborers	44.40	1776.00	66.25	2650.00		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Concrete Conveyer		206.25		226.88	3.68	4.05
56 L.H., Daily Totals		$2825.45		$4134.07	$50.45	$73.82
Crew C-8	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.89	$72.53
3 Laborers	44.40	1065.60	66.25	1590.00		
2 Cement Finishers	51.80	828.80	75.90	1214.40		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Concrete Pump (Small)		423.65		466.01	7.57	8.32
56 L.H., Daily Totals		$3161.25		$4527.61	$56.45	$80.85
Crew C-8A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$47.20	$69.97
3 Laborers	44.40	1065.60	66.25	1590.00		
2 Cement Finishers	51.80	828.80	75.90	1214.40		
48 L.H., Daily Totals		$2265.60		$3358.40	$47.20	$69.97

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew C-8B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$47.72	$71.18
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Vibrating Power Screed		87.65		96.42		
1 Roller, Vibratory, 25 Ton		672.35		739.59		
1 Dozer, 200 H.P.		1520.00		1672.00	57.00	62.70
40 L.H., Daily Totals		$4188.80		$5355.20	$104.72	$133.88
Crew C-8C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.40	$71.97
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Cement Finisher	51.80	414.40	75.90	607.20		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Shotcrete Rig, 12 C.Y./hr		269.20		296.12		
1 Air Compressor, 160 cfm		212.30		233.53		
4 -50' Air Hoses, 1		32.20		35.42		
4 -50' Air Hoses, 2		115.80		127.38	13.11	14.43
48 L.H., Daily Totals		$2952.70		$4146.85	$61.51	$86.39
Crew C-8D	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.52	$73.53
1 Laborer	44.40	355.20	66.25	530.00		
1 Cement Finisher	51.80	414.40	75.90	607.20		
1 Equipment Oper. (light)	55.50	444.00	82.70	661.60		
1 Air Compressor, 250 cfm		202.85		223.13		
2 -50' Air Hoses, 1		16.10		17.71	6.84	7.53
32 L.H., Daily Totals		$1803.75		$2593.65	$56.37	$81.05
Crew C-8E	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$47.82	$71.10
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Cement Finisher	51.80	414.40	75.90	607.20		
1 Equipment Oper. (light)	55.50	444.00	82.70	661.60		
1 Shotcrete Rig, 35 C.Y./hr.		301.05		331.15		
1 Air Compressor, 250 cfm		202.85		223.13		
4 -50' Air Hoses, 1		32.20		35.42		
4 -50' Air Hoses, 2		115.80		127.38	13.58	14.94
48 L.H., Daily Totals		$2947.10		$4129.89	$61.40	$86.04
Crew C-9	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Cement Finisher	$51.80	$414.40	$75.90	$607.20	$49.02	$72.78
2 Laborers	44.40	710.40	66.25	1060.00		
1 Equipment Oper. (light)	55.50	444.00	82.70	661.60		
1 Grout Pump, 50 C.F./hr.		190.35		209.38		
1 Air Compressor, 160 cfm		212.30		233.53		
2 -50' Air Hoses, 1		16.10		17.71		
2 -50' Air Hoses, 2		57.90		63.69	14.90	16.38
32 L.H., Daily Totals		$2045.45		$2853.11	$63.92	$89.16
Crew C-10	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$49.33	$72.68
2 Cement Finishers	51.80	828.80	75.90	1214.40		
24 L.H., Daily Totals		$1184.00		$1744.40	$49.33	$72.68
Crew C-10B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
3 Laborers	$44.40	$1065.60	$66.25	$1590.00	$47.36	$70.11
2 Cement Finishers	51.80	828.80	75.90	1214.40		
1 Concrete Mixer, 10 C.F.		147.15		161.87		
2 Trowels, 48 Walk-Behind		188.60		207.46	8.39	9.23
40 L.H., Daily Totals		$2230.15		$3173.72	$55.75	$79.34

Crews - Standard

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew C-10C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$49.33	$72.68
2 Cement Finishers	51.80	828.80	75.90	1214.40		
1 Trowel, 48 Walk-Behind		94.30		103.73	3.93	4.32
24 L.H., Daily Totals		$1278.30		$1848.13	$53.26	$77.01
Crew C-10D	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$49.33	$72.68
2 Cement Finishers	51.80	828.80	75.90	1214.40		
1 Vibrating Power Screed		87.65		96.42		
1 Trowel, 48 Walk-Behind		94.30		103.73	7.58	8.34
24 L.H., Daily Totals		$1365.95		$1944.55	$56.91	$81.02
Crew C-10E	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$49.33	$72.68
2 Cement Finishers	51.80	828.80	75.90	1214.40		
1 Vibrating Power Screed		87.65		96.42		
1 Cement Trowel, 96 Ride-On		171.05		188.16	10.78	11.86
24 L.H., Daily Totals		$1442.70		$2028.97	$60.11	$84.54
Crew C-10F	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$49.33	$72.68
2 Cement Finishers	51.80	828.80	75.90	1214.40		
1 Telescoping Boom Lift, to 60'		292.45		321.69	12.19	13.40
24 L.H., Daily Totals		$1476.45		$2066.09	$61.52	$86.09
Crew C-11	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Struc. Steel Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$59.78	$91.78
6 Struc. Steel Workers	60.30	2894.40	93.30	4478.40		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Lattice Boom Crane, 150 Ton		2324.00		2556.40	32.28	35.51
72 L.H., Daily Totals		$6628.40		$9164.40	$92.06	$127.28
Crew C-12	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Carpenter Foreman (outside)	$56.70	$453.60	$84.60	$676.80	$54.44	$81.22
3 Carpenters	54.70	1312.80	81.65	1959.60		
1 Laborer	44.40	355.20	66.25	530.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Hyd. Crane, 12 Ton		475.80		523.38	9.91	10.90
48 L.H., Daily Totals		$3089.00		$4422.18	$64.35	$92.13
Crew C-13	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Struc. Steel Worker	$60.30	$482.40	$93.30	$746.40	$58.43	$89.42
1 Welder	60.30	482.40	93.30	746.40		
1 Carpenter	54.70	437.60	81.65	653.20		
1 Welder, Gas Engine, 300 amp		148.75		163.63	6.20	6.82
24 L.H., Daily Totals		$1551.15		$2309.63	$64.63	$96.23
Crew C-14	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Carpenter Foreman (outside)	$56.70	$453.60	$84.60	$676.80	$53.39	$79.54
5 Carpenters	54.70	2188.00	81.65	3266.00		
4 Laborers	44.40	1420.80	66.25	2120.00		
4 Rodmen (reinf.)	58.90	1884.80	88.05	2817.60		
2 Cement Finishers	51.80	828.80	75.90	1214.40		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Hyd. Crane, 80 Ton		1458.00		1603.80	10.13	11.14
144 L.H., Daily Totals		$9145.60		$13057.00	$63.51	$90.67

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew C-14A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Carpenter Foreman (outside)	$56.70	$453.60	$84.60	$676.80	$54.68	$81.58
16 Carpenters	54.70	7001.60	81.65	10451.20		
4 Rodmen (reinf.)	58.90	1884.80	88.05	2817.60		
2 Laborers	44.40	710.40	66.25	1060.00		
1 Cement Finisher	51.80	414.40	75.90	607.20		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Gas Engine Vibrator		27.15		29.86		
1 Concrete Pump (Small)		423.65		466.01	2.25	2.48
200 L.H., Daily Totals		$11387.60		$16811.88	$56.94	$84.06
Crew C-14B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Carpenter Foreman (outside)	$56.70	$453.60	$84.60	$676.80	$54.57	$81.36
16 Carpenters	54.70	7001.60	81.65	10451.20		
4 Rodmen (reinf.)	58.90	1884.80	88.05	2817.60		
2 Laborers	44.40	710.40	66.25	1060.00		
2 Cement Finishers	51.80	828.80	75.90	1214.40		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Gas Engine Vibrator		27.15		29.86		
1 Concrete Pump (Small)		423.65		466.01	2.17	2.38
208 L.H., Daily Totals		$11802.00		$17419.08	$56.74	$83.75
Crew C-14C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Carpenter Foreman (outside)	$56.70	$453.60	$84.60	$676.80	$52.29	$77.96
6 Carpenters	54.70	2625.60	81.65	3919.20		
2 Rodmen (reinf.)	58.90	942.40	88.05	1408.80		
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Cement Finisher	51.80	414.40	75.90	607.20		
1 Gas Engine Vibrator		27.15		29.86	.24	.27
112 L.H., Daily Totals		$5883.95		$8761.86	$52.54	$78.23
Crew C-14D	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Carpenter Foreman (outside)	$56.70	$453.60	$84.60	$676.80	$54.35	$81.07
18 Carpenters	54.70	7876.80	81.65	11757.60		
2 Rodmen (reinf.)	58.90	942.40	88.05	1408.80		
2 Laborers	44.40	710.40	66.25	1060.00		
1 Cement Finisher	51.80	414.40	75.90	607.20		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Gas Engine Vibrator		27.15		29.86		
1 Concrete Pump (Small)		423.65		466.01	2.25	2.48
200 L.H., Daily Totals		$11320.40		$16709.48	$56.60	$83.55
Crew C-14E	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Carpenter Foreman (outside)	$56.70	$453.60	$84.60	$676.80	$53.34	$79.52
2 Carpenters	54.70	875.20	81.65	1306.40		
4 Rodmen (reinf.)	58.90	1884.80	88.05	2817.60		
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Cement Finisher	51.80	414.40	75.90	607.20		
1 Gas Engine Vibrator		27.15		29.86	.31	.34
88 L.H., Daily Totals		$4720.75		$7027.86	$53.64	$79.86
Crew C-14F	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.56	$73.02
2 Laborers	44.40	710.40	66.25	1060.00		
6 Cement Finishers	51.80	2486.40	75.90	3643.20		
1 Gas Engine Vibrator		27.15		29.86	.38	.41
72 L.H., Daily Totals		$3595.15		$5287.06	$49.93	$73.43

Crews - Standard

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew C-14G	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.91	$72.19
2 Laborers	44.40	710.40	66.25	1060.00		
4 Cement Finishers	51.80	1657.60	75.90	2428.80		
1 Gas Engine Vibrator		27.15		29.86	.48	.53
56 L.H., Daily Totals		$2766.35		$4072.67	$49.40	$72.73
Crew C-14H	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Carpenter Foreman (outside)	$56.70	$453.60	$84.60	$676.80	$53.53	$79.68
2 Carpenters	54.70	875.20	81.65	1306.40		
1 Rodman (reinf.)	58.90	471.20	88.05	704.40		
1 Laborer	44.40	355.20	66.25	530.00		
1 Cement Finisher	51.80	414.40	75.90	607.20		
1 Gas Engine Vibrator		27.15		29.86	.57	.62
48 L.H., Daily Totals		$2596.75		$3854.67	$54.10	$80.31
Crew C-14L	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Carpenter Foreman (outside)	$56.70	$453.60	$84.60	$676.80	$51.19	$76.28
6 Carpenters	54.70	2625.60	81.65	3919.20		
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Cement Finisher	51.80	414.40	75.90	607.20		
1 Gas Engine Vibrator		27.15		29.86	.28	.31
96 L.H., Daily Totals		$4941.55		$7353.06	$51.47	$76.59
Crew C-14M	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Carpenter Foreman (outside)	$56.70	$453.60	$84.60	$676.80	$53.08	$79.03
2 Carpenters	54.70	875.20	81.65	1306.40		
1 Rodman (reinf.)	58.90	471.20	88.05	704.40		
2 Laborers	44.40	710.40	66.25	1060.00		
1 Cement Finisher	51.80	414.40	75.90	607.20		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Gas Engine Vibrator		27.15		29.86		
1 Concrete Pump (Small)		423.65		466.01	7.04	7.75
64 L.H., Daily Totals		$3847.60		$5553.88	$60.12	$86.78
Crew C-15	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Carpenter Foreman (outside)	$56.70	$453.60	$84.60	$676.80	$51.31	$76.28
2 Carpenters	54.70	875.20	81.65	1306.40		
3 Laborers	44.40	1065.60	66.25	1590.00		
2 Cement Finishers	51.80	828.80	75.90	1214.40		
1 Rodman (reinf.)	58.90	471.20	88.05	704.40		
72 L.H., Daily Totals		$3694.40		$5492.00	$51.31	$76.28
Crew C-16	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.89	$72.53
3 Laborers	44.40	1065.60	66.25	1590.00		
2 Cement Finishers	51.80	828.80	75.90	1214.40		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Gunite Pump Rig		321.75		353.93		
2 -50' Air Hoses, 3/4		14.30		15.73		
2 -50' Air Hoses, 2		57.90		63.69	7.03	7.74
56 L.H., Daily Totals		$3131.55		$4494.94	$55.92	$80.27
Crew C-16A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$51.75	$76.49
2 Cement Finishers	51.80	828.80	75.90	1214.40		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Gunite Pump Rig		321.75		353.93		
2 -50' Air Hoses, 3/4		14.30		15.73		
2 -50' Air Hoses, 2		57.90		63.69		
1 Telescoping Boom Lift, to 60'		292.45		321.69	21.45	23.59
32 L.H., Daily Totals		$2342.40		$3202.64	$73.20	$100.08

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew C-17	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Skilled Worker Foremen (out)	$59.10	$945.60	$88.90	$1422.40	$57.50	$86.50
8 Skilled Workers	57.10	3654.40	85.90	5497.60		
80 L.H., Daily Totals		$4600.00		$6920.00	$57.50	$86.50
Crew C-17A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Skilled Worker Foremen (out)	$59.10	$945.60	$88.90	$1422.40	$57.55	$86.56
8 Skilled Workers	57.10	3654.40	85.90	5497.60		
.125 Equip. Oper. (crane)	61.45	61.45	91.55	91.55		
.125 Hyd. Crane, 80 Ton		182.25		200.47	2.25	2.48
81 L.H., Daily Totals		$4843.70		$7212.02	$59.80	$89.04
Crew C-17B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Skilled Worker Foremen (out)	$59.10	$945.60	$88.90	$1422.40	$57.60	$86.62
8 Skilled Workers	57.10	3654.40	85.90	5497.60		
.25 Equip. Oper. (crane)	61.45	122.90	91.55	183.10		
.25 Hyd. Crane, 80 Ton		364.50		400.95		
.25 Trowel, 48 Walk-Behind		23.57		25.93	4.73	5.21
82 L.H., Daily Totals		$5110.98		$7529.98	$62.33	$91.83
Crew C-17C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Skilled Worker Foremen (out)	$59.10	$945.60	$88.90	$1422.40	$57.64	$86.68
8 Skilled Workers	57.10	3654.40	85.90	5497.60		
.375 Equip. Oper. (crane)	61.45	184.35	91.55	274.65		
.375 Hyd. Crane, 80 Ton		546.75		601.42	6.59	7.25
83 L.H., Daily Totals		$5331.10		$7796.07	$64.23	$93.93
Crew C-17D	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Skilled Worker Foremen (out)	$59.10	$945.60	$88.90	$1422.40	$57.69	$86.74
8 Skilled Workers	57.10	3654.40	85.90	5497.60		
.5 Equip. Oper. (crane)	61.45	245.80	91.55	366.20		
.5 Hyd. Crane, 80 Ton		729.00		801.90	8.68	9.55
84 L.H., Daily Totals		$5574.80		$8088.10	$66.37	$96.29
Crew C-17E	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Skilled Worker Foremen (out)	$59.10	$945.60	$88.90	$1422.40	$57.50	$86.50
8 Skilled Workers	57.10	3654.40	85.90	5497.60		
1 Hyd. Jack with Rods		36.70		40.37	.46	.50
80 L.H., Daily Totals		$4636.70		$6960.37	$57.96	$87.00
Crew C-18	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
.125 Labor Foreman (outside)	$46.40	$46.40	$69.25	$69.25	$44.62	$66.58
1 Laborer	44.40	355.20	66.25	530.00		
1 Concrete Cart, 10 C.F.		116.95		128.65	12.99	14.29
9 L.H., Daily Totals		$518.55		$727.89	$57.62	$80.88
Crew C-19	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
.125 Labor Foreman (outside)	$46.40	$46.40	$69.25	$69.25	$44.62	$66.58
1 Laborer	44.40	355.20	66.25	530.00		
1 Concrete Cart, 18 C.F.		138.95		152.85	15.44	16.98
9 L.H., Daily Totals		$540.55		$752.10	$60.06	$83.57
Crew C-20	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$47.40	$70.54
5 Laborers	44.40	1776.00	66.25	2650.00		
1 Cement Finisher	51.80	414.40	75.90	607.20		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
2 Gas Engine Vibrators		54.30		59.73		
1 Concrete Pump (Small)		423.65		466.01	7.47	8.21
64 L.H., Daily Totals		$3511.55		$5040.15	$54.87	$78.75

Crews - Standard

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew C-21	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$47.40	$70.54
5 Laborers	44.40	1776.00	66.25	2650.00		
1 Cement Finisher	51.80	414.40	75.90	607.20		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
2 Gas Engine Vibrators		54.30		59.73		
1 Concrete Conveyer		206.25		226.88	4.07	4.48
64 L.H., Daily Totals		$3294.15		$4801.01	$51.47	$75.02
Crew C-22	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Rodman Foreman (outside)	$60.90	$487.20	$91.05	$728.40	$59.19	$88.47
4 Rodmen (reinf.)	58.90	1884.80	88.05	2817.60		
.125 Equip. Oper. (crane)	61.45	61.45	91.55	91.55		
.125 Equip. Oper. (oiler)	52.50	52.50	78.25	78.25		
.125 Hyd. Crane, 25 Ton		73.34		80.67	1.75	1.92
42 L.H., Daily Totals		$2559.29		$3796.47	$60.94	$90.39
Crew C-23	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Skilled Worker Foremen (out)	$59.10	$945.60	$88.90	$1422.40	$57.48	$86.30
6 Skilled Workers	57.10	2740.80	85.90	4123.20		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Lattice Boom Crane, 90 Ton		1713.00		1884.30	21.41	23.55
80 L.H., Daily Totals		$6311.00		$8788.30	$78.89	$109.85
Crew C-23A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.83	$74.31
2 Laborers	44.40	710.40	66.25	1060.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Crawler Crane, 100 Ton		2310.00		2541.00		
3 Conc. Buckets, 8 C.Y.		337.95		371.75	66.20	72.82
40 L.H., Daily Totals		$4641.15		$5885.15	$116.03	$147.13
Crew C-24	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Skilled Worker Foremen (out)	$59.10	$945.60	$88.90	$1422.40	$57.48	$86.30
6 Skilled Workers	57.10	2740.80	85.90	4123.20		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Lattice Boom Crane, 150 Ton		2324.00		2556.40	29.05	31.95
80 L.H., Daily Totals		$6922.00		$9460.40	$86.53	$118.26
Crew C-25	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Rodmen (reinf.)	$58.90	$942.40	$88.05	$1408.80	$47.42	$73.15
2 Rodmen Helpers	35.95	575.20	58.25	932.00		
32 L.H., Daily Totals		$1517.60		$2340.80	$47.42	$73.15
Crew C-27	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Cement Finishers	$51.80	$828.80	$75.90	$1214.40	$51.80	$75.90
1 Concrete Saw		112.85		124.14	7.05	7.76
16 L.H., Daily Totals		$941.65		$1338.54	$58.85	$83.66
Crew C-28	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Cement Finisher	$51.80	$414.40	$75.90	$607.20	$51.80	$75.90
1 Portable Air Compressor, Gas		38.80		42.68	4.85	5.34
8 L.H., Daily Totals		$453.20		$649.88	$56.65	$81.23
Crew C-29	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$44.40	$66.25
1 Pressure Washer		97.35		107.08	12.17	13.39
8 L.H., Daily Totals		$452.55		$637.09	$56.57	$79.64

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew C-30	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$44.40	$66.25
1 Concrete Mixer, 10 C.F.		147.15		161.87	18.39	20.23
8 L.H., Daily Totals		$502.35		$691.87	$62.79	$86.48
Crew C-31	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Cement Finisher	$51.80	$414.40	$75.90	$607.20	$51.80	$75.90
1 Grout Pump		321.75		353.93	40.22	44.24
8 L.H., Daily Totals		$736.15		$961.13	$92.02	$120.14
Crew C-32	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Cement Finisher	$51.80	$414.40	$75.90	$607.20	$48.10	$71.08
1 Laborer	44.40	355.20	66.25	530.00		
1 Crack Chaser Saw, Gas, 6 H.P.		73.25		80.58		
1 Vacuum Pick-Up System		74.95		82.44	9.26	10.19
16 L.H., Daily Totals		$917.80		$1300.22	$57.36	$81.26
Crew D-1	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Bricklayer	$53.70	$429.60	$80.90	$647.20	$48.70	$73.38
1 Bricklayer Helper	43.70	349.60	65.85	526.80		
16 L.H., Daily Totals		$779.20		$1174.00	$48.70	$73.38
Crew D-2	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
3 Bricklayers	$53.70	$1288.80	$80.90	$1941.60	$50.15	$75.50
2 Bricklayer Helpers	43.70	699.20	65.85	1053.60		
.5 Carpenter	54.70	218.80	81.65	326.60		
44 L.H., Daily Totals		$2206.80		$3321.80	$50.15	$75.50
Crew D-3	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
3 Bricklayers	$53.70	$1288.80	$80.90	$1941.60	$49.94	$75.20
2 Bricklayer Helpers	43.70	699.20	65.85	1053.60		
.25 Carpenter	54.70	109.40	81.65	163.30		
42 L.H., Daily Totals		$2097.40		$3158.50	$49.94	$75.20
Crew D-4	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Bricklayer	$53.70	$429.60	$80.90	$647.20	$49.15	$73.83
2 Bricklayer Helpers	43.70	699.20	65.85	1053.60		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Grout Pump, 50 C.F./hr.		190.35		209.38	5.95	6.54
32 L.H., Daily Totals		$1763.15		$2571.78	$55.10	$80.37
Crew D-5	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Bricklayer	53.70	429.60	80.90	647.20	53.70	80.90
8 L.H., Daily Totals		$429.60		$647.20	$53.70	$80.90
Crew D-6	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
3 Bricklayers	$53.70	$1288.80	$80.90	$1941.60	$48.94	$73.71
3 Bricklayer Helpers	43.70	1048.80	65.85	1580.40		
.25 Carpenter	54.70	109.40	81.65	163.30		
50 L.H., Daily Totals		$2447.00		$3685.30	$48.94	$73.71
Crew D-7	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Tile Layer	$51.70	$413.60	$75.55	$604.40	$46.65	$68.17
1 Tile Layer Helper	41.60	332.80	60.80	486.40		
16 L.H., Daily Totals		$746.40		$1090.80	$46.65	$68.17
Crew D-8	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
3 Bricklayers	$53.70	$1288.80	$80.90	$1941.60	$49.70	$74.88
2 Bricklayer Helpers	43.70	699.20	65.85	1053.60		
40 L.H., Daily Totals		$1988.00		$2995.20	$49.70	$74.88

Crews - Standard

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew D-9	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
3 Bricklayers	$53.70	$1288.80	$80.90	$1941.60	$48.70	$73.38
3 Bricklayer Helpers	43.70	1048.80	65.85	1580.40		
48 L.H., Daily Totals		$2337.60		$3522.00	$48.70	$73.38
Crew D-10	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Bricklayer Foreman (outside)	$55.70	$445.60	$83.90	$671.20	$53.64	$80.55
1 Bricklayer	53.70	429.60	80.90	647.20		
1 Bricklayer Helper	43.70	349.60	65.85	526.80		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 S.P. Crane, 4x4, 12 Ton		432.65		475.92	13.52	14.87
32 L.H., Daily Totals		$2149.05		$3053.51	$67.16	$95.42
Crew D-11	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Bricklayer Foreman (outside)	$55.70	$445.60	$83.90	$671.20	$51.03	$76.88
1 Bricklayer	53.70	429.60	80.90	647.20		
1 Bricklayer Helper	43.70	349.60	65.85	526.80		
24 L.H., Daily Totals		$1224.80		$1845.20	$51.03	$76.88
Crew D-12	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Bricklayer Foreman (outside)	$55.70	$445.60	$83.90	$671.20	$49.20	$74.13
1 Bricklayer	53.70	429.60	80.90	647.20		
2 Bricklayer Helpers	43.70	699.20	65.85	1053.60		
32 L.H., Daily Totals		$1574.40		$2372.00	$49.20	$74.13
Crew D-13	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Bricklayer Foreman (outside)	$55.70	$445.60	$83.90	$671.20	$52.16	$78.28
1 Bricklayer	53.70	429.60	80.90	647.20		
2 Bricklayer Helpers	43.70	699.20	65.85	1053.60		
1 Carpenter	54.70	437.60	81.65	653.20		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 S.P. Crane, 4x4, 12 Ton		432.65		475.92	9.01	9.91
48 L.H., Daily Totals		$2936.25		$4233.52	$61.17	$88.20
Crew D-14	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
3 Bricklayers	$53.70	$1288.80	$80.90	$1941.60	$51.20	$77.14
1 Bricklayer Helper	43.70	349.60	65.85	526.80		
32 L.H., Daily Totals		$1638.40		$2468.40	$51.20	$77.14
Crew E-1	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Welder Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$59.37	$90.80
1 Welder	60.30	482.40	93.30	746.40		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Welder, Gas Engine, 300 amp		148.75		163.63	6.20	6.82
24 L.H., Daily Totals		$1573.55		$2342.82	$65.56	$97.62
Crew E-2	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Struc. Steel Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$59.64	$91.34
4 Struc. Steel Workers	60.30	1929.60	93.30	2985.60		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Lattice Boom Crane, 90 Ton		1713.00		1884.30	30.59	33.65
56 L.H., Daily Totals		$5052.60		$6999.50	$90.22	$124.99
Crew E-3	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Struc. Steel Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$60.97	$94.33
1 Struc. Steel Worker	60.30	482.40	93.30	746.40		
1 Welder	60.30	482.40	93.30	746.40		
1 Welder, Gas Engine, 300 amp		148.75		163.63	6.20	6.82
24 L.H., Daily Totals		$1611.95		$2427.63	$67.16	$101.15

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew E-3A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Struc. Steel Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$60.97	$94.33
1 Struc. Steel Worker	60.30	482.40	93.30	746.40		
1 Welder	60.30	482.40	93.30	746.40		
1 Welder, Gas Engine, 300 amp		148.75		163.63		
1 Telescoping Boom Lift, to 40'		281.90		310.09	17.94	19.74
24 L.H., Daily Totals		$1893.85		$2737.72	$78.91	$114.07
Crew E-4	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Struc. Steel Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$60.80	$94.08
3 Struc. Steel Workers	60.30	1447.20	93.30	2239.20		
1 Welder, Gas Engine, 300 amp		148.75		163.63	4.65	5.11
32 L.H., Daily Totals		$2094.35		$3174.03	$65.45	$99.19
Crew E-5	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Struc. Steel Foremen (outside)	$62.30	$996.80	$96.40	$1542.40	$60.03	$92.24
5 Struc. Steel Workers	60.30	2412.00	93.30	3732.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Welder	60.30	482.40	93.30	746.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Lattice Boom Crane, 90 Ton		1713.00		1884.30		
1 Welder, Gas Engine, 300 amp		148.75		163.63	23.27	25.60
80 L.H., Daily Totals		$6664.55		$9427.13	$83.31	$117.84
Crew E-6	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
3 Struc. Steel Foremen (outside)	$62.30	$1495.20	$96.40	$2313.60	$59.96	$92.17
9 Struc. Steel Workers	60.30	4341.60	93.30	6717.60		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Welder	60.30	482.40	93.30	746.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Lattice Boom Crane, 90 Ton		1713.00		1884.30		
1 Welder, Gas Engine, 300 amp		148.75		163.63		
1 Air Compressor, 160 cfm		212.30		233.53		
2 Impact Wrenches		90.30		99.33	16.91	18.60
128 L.H., Daily Totals		$9839.15		$14178.39	$76.87	$110.77
Crew E-7	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Struc. Steel Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$60.03	$92.24
4 Struc. Steel Workers	60.30	1929.60	93.30	2985.60		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Welder Foreman (outside)	62.30	498.40	96.40	771.20		
2 Welders	60.30	964.80	93.30	1492.80		
1 Lattice Boom Crane, 90 Ton		1713.00		1884.30		
2 Welder, Gas Engine, 300 amp		297.50		327.25	25.13	27.64
80 L.H., Daily Totals		$6813.30		$9590.75	$85.17	$119.88
Crew E-8	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Struc. Steel Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$59.73	$91.67
4 Struc. Steel Workers	60.30	1929.60	93.30	2985.60		
1 Welder Foreman (outside)	62.30	498.40	96.40	771.20		
4 Welders	60.30	1929.60	93.30	2985.60		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Lattice Boom Crane, 90 Ton		1713.00		1884.30		
4 Welder, Gas Engine, 300 amp		595.00		654.50	22.19	24.41
104 L.H., Daily Totals		$8519.60		$12072.40	$81.92	$116.08

Crews - Standard

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew E-9	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Struc. Steel Foremen (outside)	$62.30	$996.80	$96.40	$1542.40	$59.96	$92.17
5 Struc. Steel Workers	60.30	2412.00	93.30	3732.00		
1 Welder Foreman (outside)	62.30	498.40	96.40	771.20		
5 Welders	60.30	2412.00	93.30	3732.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Lattice Boom Crane, 90 Ton		1713.00		1884.30		
5 Welder, Gas Engine, 300 amp		743.75		818.13	19.19	21.11
128 L.H., Daily Totals		$10131.55		$14500.03	$79.15	$113.28
Crew E-10	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Welder Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$61.30	$94.85
1 Welder	60.30	482.40	93.30	746.40		
1 Welder, Gas Engine, 300 amp		148.75		163.63		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05	62.42	68.67
16 L.H., Daily Totals		$1979.60		$2616.28	$123.72	$163.52
Crew E-11	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Painters, Struc. Steel	$47.20	$755.20	$75.80	$1212.80	$48.58	$75.14
1 Building Laborer	44.40	355.20	66.25	530.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Air Compressor, 250 cfm		202.85		223.13		
1 Sandblaster, Portable, 3 C.F.		83.85		92.23		
1 Set Sand Blasting Accessories		15.55		17.11	9.45	10.39
32 L.H., Daily Totals		$1856.65		$2736.88	$58.02	$85.53
Crew E-11A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Painters, Struc. Steel	$47.20	$755.20	$75.80	$1212.80	$48.58	$75.14
1 Building Laborer	44.40	355.20	66.25	530.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Air Compressor, 250 cfm		202.85		223.13		
1 Sandblaster, Portable, 3 C.F.		83.85		92.23		
1 Set Sand Blasting Accessories		15.55		17.11		
1 Telescoping Boom Lift, to 60'		292.45		321.69	18.58	20.44
32 L.H., Daily Totals		$2149.10		$3058.57	$67.16	$95.58
Crew E-11B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Painters, Struc. Steel	$47.20	$755.20	$75.80	$1212.80	$46.27	$72.62
1 Building Laborer	44.40	355.20	66.25	530.00		
2 Paint Sprayer, 8 C.F.M.		88.40		97.24		
1 Telescoping Boom Lift, to 60'		292.45		321.69	15.87	17.46
24 L.H., Daily Totals		$1491.25		$2161.74	$62.14	$90.07
Crew E-12	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Welder Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$58.90	$89.55
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Welder, Gas Engine, 300 amp		148.75		163.63	9.30	10.23
16 L.H., Daily Totals		$1091.15		$1596.43	$68.20	$99.78
Crew E-13	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Welder Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$60.03	$91.83
.5 Equip. Oper. (light)	55.50	222.00	82.70	330.80		
1 Welder, Gas Engine, 300 amp		148.75		163.63	12.40	13.64
12 L.H., Daily Totals		$869.15		$1265.63	$72.43	$105.47
Crew E-14	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Welder Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$62.30	$96.40
1 Welder, Gas Engine, 300 amp		148.75		163.63	18.59	20.45
8 L.H., Daily Totals		$647.15		$934.83	$80.89	$116.85

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew E-16	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Welder Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$61.30	$94.85
1 Welder	60.30	482.40	93.30	746.40		
1 Welder, Gas Engine, 300 amp		148.75		163.63	9.30	10.23
16 L.H., Daily Totals		$1129.55		$1681.22	$70.60	$105.08
Crew E-17	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Struc. Steel Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$61.30	$94.85
1 Structural Steel Worker	60.30	482.40	93.30	746.40		
16 L.H., Daily Totals		$980.80		$1517.60	$61.30	$94.85
Crew E-18	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Struc. Steel Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$60.44	$92.84
3 Structural Steel Workers	60.30	1447.20	93.30	2239.20		
1 Equipment Operator (med.)	59.00	472.00	87.90	703.20		
1 Lattice Boom Crane, 20 Ton		1526.00		1678.60	38.15	41.97
40 L.H., Daily Totals		$3943.60		$5392.20	$98.59	$134.81
Crew E-19	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Struc. Steel Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$59.37	$90.80
1 Structural Steel Worker	60.30	482.40	93.30	746.40		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Lattice Boom Crane, 20 Ton		1526.00		1678.60	63.58	69.94
24 L.H., Daily Totals		$2950.80		$3857.80	$122.95	$160.74
Crew E-20	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Struc. Steel Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$59.72	$91.59
5 Structural Steel Workers	60.30	2412.00	93.30	3732.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Lattice Boom Crane, 40 Ton		2127.00		2339.70	33.23	36.56
64 L.H., Daily Totals		$5949.00		$8201.30	$92.95	$128.15
Crew E-22	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Skilled Worker Foreman (out)	$59.10	$472.80	$88.90	$711.20	$57.77	$86.90
2 Skilled Workers	57.10	913.60	85.90	1374.40		
24 L.H., Daily Totals		$1386.40		$2085.60	$57.77	$86.90
Crew E-24	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
3 Structural Steel Workers	$60.30	$1447.20	$93.30	$2239.20	$59.98	$91.95
1 Equipment Operator (med.)	59.00	472.00	87.90	703.20		
1 Hyd. Crane, 25 Ton		586.70		645.37	18.33	20.17
32 L.H., Daily Totals		$2505.90		$3587.77	$78.31	$112.12
Crew E-25	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Welder Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$62.30	$96.40
1 Cutting Torch		12.95		14.24	1.62	1.78
8 L.H., Daily Totals		$511.35		$785.45	$63.92	$98.18
Crew E-26	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Struc. Steel Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$61.64	$94.84
1 Struc. Steel Worker	60.30	482.40	93.30	746.40		
1 Welder	60.30	482.40	93.30	746.40		
.25 Electrician	63.70	127.40	94.65	189.30		
.25 Plumber	67.70	135.40	101.05	202.10		
1 Welder, Gas Engine, 300 amp		148.75		163.63	5.31	5.84
28 L.H., Daily Totals		$1874.75		$2819.03	$66.96	$100.68

Crews - Standard

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew E-27	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Struc. Steel Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$59.72	$91.59
5 Struc. Steel Workers	60.30	2412.00	93.30	3732.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Hyd. Crane, 12 Ton		475.80		523.38		
1 Hyd. Crane, 80 Ton		1458.00		1603.80	30.22	33.24
64 L.H., Daily Totals		$5755.80		$7988.78	$89.93	$124.82
Crew F-3	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
4 Carpenters	$54.70	$1750.40	$81.65	$2612.80	$56.05	$83.63
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Hyd. Crane, 12 Ton		475.80		523.38	11.90	13.08
40 L.H., Daily Totals		$2717.80		$3868.58	$67.94	$96.71
Crew F-4	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
4 Carpenters	$54.70	$1750.40	$81.65	$2612.80	$55.46	$82.73
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Hyd. Crane, 55 Ton		990.15		1089.17	20.63	22.69
48 L.H., Daily Totals		$3652.15		$5060.36	$76.09	$105.42
Crew F-5	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Carpenter Foreman (outside)	$56.70	$453.60	$84.60	$676.80	$55.20	$82.39
3 Carpenters	54.70	1312.80	81.65	1959.60		
32 L.H., Daily Totals		$1766.40		$2636.40	$55.20	$82.39
Crew F-6	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Carpenters	$54.70	$875.20	$81.65	$1306.40	$51.93	$77.47
2 Building Laborers	44.40	710.40	66.25	1060.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Hyd. Crane, 12 Ton		475.80		523.38	11.90	13.08
40 L.H., Daily Totals		$2553.00		$3622.18	$63.83	$90.55
Crew F-7	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Carpenters	$54.70	$875.20	$81.65	$1306.40	$49.55	$73.95
2 Building Laborers	44.40	710.40	66.25	1060.00		
32 L.H., Daily Totals		$1585.60		$2366.40	$49.55	$73.95
Crew G-1	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Roofer Foreman (outside)	$50.20	$401.60	$81.35	$650.80	$44.99	$72.92
4 Roofers Composition	48.20	1542.40	78.15	2500.80		
2 Roofer Helpers	35.95	575.20	58.25	932.00		
1 Application Equipment		194.80		214.28		
1 Tar Kettle/Pot		209.95		230.94		
1 Crew Truck		168.15		184.97	10.23	11.25
56 L.H., Daily Totals		$3092.10		$4713.79	$55.22	$84.17
Crew G-2	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Plasterer	$49.85	$398.80	$74.25	$594.00	$46.27	$68.95
1 Plasterer Helper	44.55	356.40	66.35	530.80		
1 Building Laborer	44.40	355.20	66.25	530.00		
1 Grout Pump, 50 C.F./hr.		190.35		209.38	7.93	8.72
24 L.H., Daily Totals		$1300.75		$1864.18	$54.20	$77.67

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew G-2A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Roofer Composition	$48.20	$385.60	$78.15	$625.20	$42.85	$67.55
1 Roofer Helper	35.95	287.60	58.25	466.00		
1 Building Laborer	44.40	355.20	66.25	530.00		
1 Foam Spray Rig, Trailer-Mtd.		530.15		583.16		
1 Pickup Truck, 3/4 Ton		112.20		123.42	26.76	29.44
24 L.H., Daily Totals		$1670.75		$2327.78	$69.61	$96.99
Crew G-3	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Sheet Metal Workers	$65.45	$1047.20	$98.70	$1579.20	$54.92	$82.47
2 Building Laborers	44.40	710.40	66.25	1060.00		
32 L.H., Daily Totals		$1757.60		$2639.20	$54.92	$82.47
Crew G-4	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$45.07	$67.25
2 Building Laborers	44.40	710.40	66.25	1060.00		
1 Flatbed Truck, Gas, 1.5 Ton		198.50		218.35		
1 Air Compressor, 160 cfm		212.30		233.53	17.12	18.83
24 L.H., Daily Totals		$1492.40		$2065.88	$62.18	$86.08
Crew G-5	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Roofer Foreman (outside)	$50.20	$401.60	$81.35	$650.80	$43.70	$70.83
2 Roofers Composition	48.20	771.20	78.15	1250.40		
2 Roofer Helpers	35.95	575.20	58.25	932.00		
1 Application Equipment		194.80		214.28	4.87	5.36
40 L.H., Daily Totals		$1942.80		$3047.48	$48.57	$76.19
Crew G-6A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Roofers Composition	$48.20	$771.20	$78.15	$1250.40	$48.20	$78.15
1 Small Compressor, Electric		39.30		43.23		
2 Pneumatic Nailers		55.40		60.94	5.92	6.51
16 L.H., Daily Totals		$865.90		$1354.57	$54.12	$84.66
Crew G-7	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Carpenter	$54.70	$437.60	$81.65	$653.20	$54.70	$81.65
1 Small Compressor, Electric		39.30		43.23		
1 Pneumatic Nailer		27.70		30.47	8.38	9.21
8 L.H., Daily Totals		$504.60		$726.90	$63.08	$90.86
Crew H-1	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Glaziers	$52.65	$842.40	$78.40	$1254.40	$56.48	$85.85
2 Struc. Steel Workers	60.30	964.80	93.30	1492.80		
32 L.H., Daily Totals		$1807.20		$2747.20	$56.48	$85.85
Crew H-2	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Glaziers	$52.65	$842.40	$78.40	$1254.40	$49.90	$74.35
1 Building Laborer	44.40	355.20	66.25	530.00		
24 L.H., Daily Totals		$1197.60		$1784.40	$49.90	$74.35
Crew H-3	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Glazier	$52.65	$421.20	$78.40	$627.20	$47.35	$71.03
1 Helper	42.05	336.40	63.65	509.20		
16 L.H., Daily Totals		$757.60		$1136.40	$47.35	$71.03
Crew H-4	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Carpenter	$54.70	$437.60	$81.65	$653.20	$51.44	$77.05
1 Carpenter Helper	42.05	336.40	63.65	509.20		
.5 Electrician	63.70	254.80	94.65	378.60		
20 L.H., Daily Totals		$1028.80		$1541.00	$51.44	$77.05

Crews - Standard

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew J-1	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
3 Plasterers	$49.85	$1196.40	$74.25	$1782.00	$47.73	$71.09
2 Plasterer Helpers	44.55	712.80	66.35	1061.60		
1 Mixing Machine, 6 C.F.		113.35		124.69	2.83	3.12
40 L.H., Daily Totals		$2022.55		$2968.28	$50.56	$74.21
Crew J-2	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
3 Plasterers	$49.85	$1196.40	$74.25	$1782.00	$48.79	$72.41
2 Plasterer Helpers	44.55	712.80	66.35	1061.60		
1 Lather	54.10	432.80	79.00	632.00		
1 Mixing Machine, 6 C.F.		113.35		124.69	2.36	2.60
48 L.H., Daily Totals		$2455.35		$3600.28	$51.15	$75.01
Crew J-3	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Terrazzo Worker	$51.75	$414.00	$75.60	$604.80	$47.65	$69.63
1 Terrazzo Helper	43.55	348.40	63.65	509.20		
1 Floor Grinder, 22 Path		96.05		105.66		
1 Terrazzo Mixer		162.90		179.19	16.18	17.80
16 L.H., Daily Totals		$1021.35		$1398.85	$63.83	$87.43
Crew J-4	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Cement Finishers	$51.80	$828.80	$75.90	$1214.40	$49.33	$72.68
1 Laborer	44.40	355.20	66.25	530.00		
1 Floor Grinder, 22 Path		96.05		105.66		
1 Floor Edger, 7 Path		44.05		48.45		
1 Vacuum Pick-Up System		74.95		82.44	8.96	9.86
24 L.H., Daily Totals		$1399.05		$1980.95	$58.29	$82.54
Crew J-4A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Cement Finishers	$51.80	$828.80	$75.90	$1214.40	$48.10	$71.08
2 Laborers	44.40	710.40	66.25	1060.00		
1 Floor Grinder, 22 Path		96.05		105.66		
1 Floor Edger, 7 Path		44.05		48.45		
1 Vacuum Pick-Up System		74.95		82.44		
1 Floor Auto Scrubber		179.55		197.51	12.33	13.56
32 L.H., Daily Totals		$1933.80		$2708.46	$60.43	$84.64
Crew J-4B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$44.40	$66.25
1 Floor Auto Scrubber		179.55		197.51	22.44	24.69
8 L.H., Daily Totals		$534.75		$727.51	$66.84	$90.94
Crew J-6	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Painters	$46.45	$743.20	$68.90	$1102.40	$48.20	$71.69
1 Building Laborer	44.40	355.20	66.25	530.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Air Compressor, 250 cfm		202.85		223.13		
1 Sandblaster, Portable, 3 C.F.		83.85		92.23		
1 Set Sand Blasting Accessories		15.55		17.11	9.45	10.39
32 L.H., Daily Totals		$1844.65		$2626.47	$57.65	$82.08
Crew J-7	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Painters	$46.45	$743.20	$68.90	$1102.40	$46.45	$68.90
1 Floor Belt Sander		50.20		55.22		
1 Floor Sanding Edger		25.20		27.72	4.71	5.18
16 L.H., Daily Totals		$818.60		$1185.34	$51.16	$74.08

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew K-1	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Carpenter	$54.70	$437.60	$81.65	$653.20	$51.75	$77.33
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05	53.13	58.44
16 L.H., Daily Totals		$1678.05		$2172.26	$104.88	$135.77
Crew K-2	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Struc. Steel Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$57.13	$87.57
1 Struc. Steel Worker	60.30	482.40	93.30	746.40		
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05	35.42	38.96
24 L.H., Daily Totals		$2221.25		$3036.66	$92.55	$126.53
Crew L-1	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Electrician	$63.70	$509.60	$94.65	$757.20	$65.70	$97.85
1 Plumber	67.70	541.60	101.05	808.40		
16 L.H., Daily Totals		$1051.20		$1565.60	$65.70	$97.85
Crew L-2	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Carpenter	$54.70	$437.60	$81.65	$653.20	$48.38	$72.65
1 Carpenter Helper	42.05	336.40	63.65	509.20		
16 L.H., Daily Totals		$774.00		$1162.40	$48.38	$72.65
Crew L-3	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Carpenter	$54.70	$437.60	$81.65	$653.20	$59.64	$89.16
.5 Electrician	63.70	254.80	94.65	378.60		
.5 Sheet Metal Worker	65.45	261.80	98.70	394.80		
16 L.H., Daily Totals		$954.20		$1426.60	$59.64	$89.16
Crew L-3A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Carpenter Foreman (outside)	$56.70	$453.60	$84.60	$676.80	$59.62	$89.30
.5 Sheet Metal Worker	65.45	261.80	98.70	394.80		
12 L.H., Daily Totals		$715.40		$1071.60	$59.62	$89.30
Crew L-4	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Skilled Workers	$57.10	$913.60	$85.90	$1374.40	$52.08	$78.48
1 Helper	42.05	336.40	63.65	509.20		
24 L.H., Daily Totals		$1250.00		$1883.60	$52.08	$78.48
Crew L-5	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Struc. Steel Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$60.75	$93.49
5 Struc. Steel Workers	60.30	2412.00	93.30	3732.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Hyd. Crane, 25 Ton		586.70		645.37	10.48	11.52
56 L.H., Daily Totals		$3988.70		$5880.97	$71.23	$105.02
Crew L-5A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Struc. Steel Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$61.09	$93.64
2 Structural Steel Workers	60.30	964.80	93.30	1492.80		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 S.P. Crane, 4x4, 25 Ton		1155.00		1270.50	36.09	39.70
32 L.H., Daily Totals		$3109.80		$4266.90	$97.18	$133.34

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew L-5B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Struc. Steel Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$62.33	$94.01
2 Structural Steel Workers	60.30	964.80	93.30	1492.80		
2 Electricians	63.70	1019.20	94.65	1514.40		
2 Steamfitters/Pipefitters	68.35	1093.60	102.00	1632.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Hyd. Crane, 80 Ton		1458.00		1603.80	20.25	22.27
72 L.H., Daily Totals		$5945.60		$8372.60	$82.58	$116.29
Crew L-6	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Plumber	$67.70	$541.60	$101.05	$808.40	$66.37	$98.92
.5 Electrician	63.70	254.80	94.65	378.60		
12 L.H., Daily Totals		$796.40		$1187.00	$66.37	$98.92
Crew L-7	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Carpenters	$54.70	$875.20	$81.65	$1306.40	$53.04	$79.11
1 Building Laborer	44.40	355.20	66.25	530.00		
.5 Electrician	63.70	254.80	94.65	378.60		
28 L.H., Daily Totals		$1485.20		$2215.00	$53.04	$79.11
Crew L-8	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Carpenters	$54.70	$875.20	$81.65	$1306.40	$57.30	$85.53
.5 Plumber	67.70	270.80	101.05	404.20		
20 L.H., Daily Totals		$1146.00		$1710.60	$57.30	$85.53
Crew L-9	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (inside)	$44.90	$359.20	$67.00	$536.00	$50.19	$75.58
2 Building Laborers	44.40	710.40	66.25	1060.00		
1 Struc. Steel Worker	60.30	482.40	93.30	746.40		
.5 Electrician	63.70	254.80	94.65	378.60		
36 L.H., Daily Totals		$1806.80		$2721.00	$50.19	$75.58
Crew L-10	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Struc. Steel Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$61.35	$93.75
1 Structural Steel Worker	60.30	482.40	93.30	746.40		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Hyd. Crane, 12 Ton		475.80		523.38	19.82	21.81
24 L.H., Daily Totals		$1948.20		$2773.38	$81.17	$115.56
Crew L-11	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Wreckers	$44.40	$710.40	$67.40	$1078.40	$51.44	$77.26
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Hyd. Excavator, 2.5 C.Y.		1567.00		1723.70		
1 Loader, Skid Steer, 78 H.P.		446.30		490.93	62.92	69.21
32 L.H., Daily Totals		$3659.30		$4687.03	$114.35	$146.47
Crew M-1	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
3 Elevator Constructors	$90.30	$2167.20	$133.80	$3211.20	$85.79	$127.11
1 Elevator Apprentice	72.25	578.00	107.05	856.40		
5 Hand Tools		50.50		55.55	1.58	1.74
32 L.H., Daily Totals		$2795.70		$4123.15	$87.37	$128.85

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew M-3	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Electrician Foreman (outside)	$65.70	$525.60	$97.65	$781.20	$67.62	$100.41
1 Common Laborer	44.40	355.20	66.25	530.00		
.25 Equipment Operator (med.)	59.00	118.00	87.90	175.80		
1 Elevator Constructor	90.30	722.40	133.80	1070.40		
1 Elevator Apprentice	72.25	578.00	107.05	856.40		
.25 S.P. Crane, 4x4, 20 Ton		143.59		157.95	4.22	4.65
34 L.H., Daily Totals		$2442.79		$3571.75	$71.85	$105.05
Crew M-4	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Electrician Foreman (outside)	$65.70	$525.60	$97.65	$781.20	$66.92	$99.38
1 Common Laborer	44.40	355.20	66.25	530.00		
.25 Equipment Operator, Crane	61.45	122.90	91.55	183.10		
.25 Equip. Oper. (oiler)	52.50	105.00	78.25	156.50		
1 Elevator Constructor	90.30	722.40	133.80	1070.40		
1 Elevator Apprentice	72.25	578.00	107.05	856.40		
.25 S.P. Crane, 4x4, 40 Ton		190.45		209.50	5.29	5.82
36 L.H., Daily Totals		$2599.55		$3787.09	$72.21	$105.20
Crew Q-1	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Plumber	$67.70	$541.60	$101.05	$808.40	$60.92	$90.92
1 Plumber Apprentice	54.15	433.20	80.80	646.40		
16 L.H., Daily Totals		$974.80		$1454.80	$60.92	$90.92
Crew Q-1A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
.25 Plumber Foreman (outside)	$69.70	$139.40	$104.00	$208.00	$68.10	$101.64
1 Plumber	67.70	541.60	101.05	808.40		
10 L.H., Daily Totals		$681.00		$1016.40	$68.10	$101.64
Crew Q-1C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Plumber	$67.70	$541.60	$101.05	$808.40	$60.28	$89.92
1 Plumber Apprentice	54.15	433.20	80.80	646.40		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Trencher, Chain Type, 8' D		1894.00		2083.40	78.92	86.81
24 L.H., Daily Totals		$3340.80		$4241.40	$139.20	$176.72
Crew Q-2	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Plumbers	$67.70	$1083.20	$101.05	$1616.80	$63.18	$94.30
1 Plumber Apprentice	54.15	433.20	80.80	646.40		
24 L.H., Daily Totals		$1516.40		$2263.20	$63.18	$94.30
Crew Q-3	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Plumber Foreman (inside)	$68.20	$545.60	$101.80	$814.40	$64.44	$96.17
2 Plumbers	67.70	1083.20	101.05	1616.80		
1 Plumber Apprentice	54.15	433.20	80.80	646.40		
32 L.H., Daily Totals		$2062.00		$3077.60	$64.44	$96.17
Crew Q-4	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Plumber Foreman (inside)	$68.20	$545.60	$101.80	$814.40	$64.44	$96.17
1 Plumber	67.70	541.60	101.05	808.40		
1 Welder (plumber)	67.70	541.60	101.05	808.40		
1 Plumber Apprentice	54.15	433.20	80.80	646.40		
1 Welder, Electric, 300 amp		107.55		118.31	3.36	3.70
32 L.H., Daily Totals		$2169.55		$3195.91	$67.80	$99.87
Crew Q-5	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Steamfitter	$68.35	$546.80	$102.00	$816.00	$61.52	$91.83
1 Steamfitter Apprentice	54.70	437.60	81.65	653.20		
16 L.H., Daily Totals		$984.40		$1469.20	$61.52	$91.83

Crews - Standard

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew Q-6	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Steamfitters	$68.35	$1093.60	$102.00	$1632.00	$63.80	$95.22
1 Steamfitter Apprentice	54.70	437.60	81.65	653.20		
24 L.H., Daily Totals		$1531.20		$2285.20	$63.80	$95.22
Crew Q-7	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Steamfitter Foreman (inside)	$68.85	$550.80	$102.75	$822.00	$65.06	$97.10
2 Steamfitters	68.35	1093.60	102.00	1632.00		
1 Steamfitter Apprentice	54.70	437.60	81.65	653.20		
32 L.H., Daily Totals		$2082.00		$3107.20	$65.06	$97.10
Crew Q-8	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Steamfitter Foreman (inside)	$68.85	$550.80	$102.75	$822.00	$65.06	$97.10
1 Steamfitter	68.35	546.80	102.00	816.00		
1 Welder (steamfitter)	68.35	546.80	102.00	816.00		
1 Steamfitter Apprentice	54.70	437.60	81.65	653.20		
1 Welder, Electric, 300 amp		107.55		118.31	3.36	3.70
32 L.H., Daily Totals		$2189.55		$3225.51	$68.42	$100.80
Crew Q-9	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Sheet Metal Worker	$65.45	$523.60	$98.70	$789.60	$58.90	$88.83
1 Sheet Metal Apprentice	52.35	418.80	78.95	631.60		
16 L.H., Daily Totals		$942.40		$1421.20	$58.90	$88.83
Crew Q-10	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Sheet Metal Workers	$65.45	$1047.20	$98.70	$1579.20	$61.08	$92.12
1 Sheet Metal Apprentice	52.35	418.80	78.95	631.60		
24 L.H., Daily Totals		$1466.00		$2210.80	$61.08	$92.12
Crew Q-11	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Sheet Metal Foreman (inside)	$65.95	$527.60	$99.50	$796.00	$62.30	$93.96
2 Sheet Metal Workers	65.45	1047.20	98.70	1579.20		
1 Sheet Metal Apprentice	52.35	418.80	78.95	631.60		
32 L.H., Daily Totals		$1993.60		$3006.80	$62.30	$93.96
Crew Q-12	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Sprinkler Installer	$66.50	$532.00	$99.35	$794.80	$59.85	$89.42
1 Sprinkler Apprentice	53.20	425.60	79.50	636.00		
16 L.H., Daily Totals		$957.60		$1430.80	$59.85	$89.42
Crew Q-13	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Sprinkler Foreman (inside)	$67.00	$536.00	$100.10	$800.80	$63.30	$94.58
2 Sprinkler Installers	66.50	1064.00	99.35	1589.60		
1 Sprinkler Apprentice	53.20	425.60	79.50	636.00		
32 L.H., Daily Totals		$2025.60		$3026.40	$63.30	$94.58
Crew Q-14	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Asbestos Worker	$60.95	$487.60	$93.25	$746.00	$54.85	$83.90
1 Asbestos Apprentice	48.75	390.00	74.55	596.40		
16 L.H., Daily Totals		$877.60		$1342.40	$54.85	$83.90
Crew Q-15	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Plumber	$67.70	$541.60	$101.05	$808.40	$60.92	$90.92
1 Plumber Apprentice	54.15	433.20	80.80	646.40		
1 Welder, Electric, 300 amp		107.55		118.31	6.72	7.39
16 L.H., Daily Totals		$1082.35		$1573.11	$67.65	$98.32

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew Q-16	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Plumbers	$67.70	$1083.20	$101.05	$1616.80	$63.18	$94.30
1 Plumber Apprentice	54.15	433.20	80.80	646.40		
1 Welder, Electric, 300 amp		107.55		118.31	4.48	4.93
24 L.H., Daily Totals		$1623.95		$2381.51	$67.66	$99.23
Crew Q-17	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Steamfitter	$68.35	$546.80	$102.00	$816.00	$61.52	$91.83
1 Steamfitter Apprentice	54.70	437.60	81.65	653.20		
1 Welder, Electric, 300 amp		107.55		118.31	6.72	7.39
16 L.H., Daily Totals		$1091.95		$1587.51	$68.25	$99.22
Crew Q-17A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Steamfitter	$68.35	$546.80	$102.00	$816.00	$61.50	$91.73
1 Steamfitter Apprentice	54.70	437.60	81.65	653.20		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Hyd. Crane, 12 Ton		475.80		523.38		
1 Welder, Electric, 300 amp		107.55		118.31	24.31	26.74
24 L.H., Daily Totals		$2059.35		$2843.28	$85.81	$118.47
Crew Q-18	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Steamfitters	$68.35	$1093.60	$102.00	$1632.00	$63.80	$95.22
1 Steamfitter Apprentice	54.70	437.60	81.65	653.20		
1 Welder, Electric, 300 amp		107.55		118.31	4.48	4.93
24 L.H., Daily Totals		$1638.75		$2403.51	$68.28	$100.15
Crew Q-19	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Steamfitter	$68.35	$546.80	$102.00	$816.00	$62.25	$92.77
1 Steamfitter Apprentice	54.70	437.60	81.65	653.20		
1 Electrician	63.70	509.60	94.65	757.20		
24 L.H., Daily Totals		$1494.00		$2226.40	$62.25	$92.77
Crew Q-20	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Sheet Metal Worker	$65.45	$523.60	$98.70	$789.60	$59.86	$89.99
1 Sheet Metal Apprentice	52.35	418.80	78.95	631.60		
.5 Electrician	63.70	254.80	94.65	378.60		
20 L.H., Daily Totals		$1197.20		$1799.80	$59.86	$89.99
Crew Q-21	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Steamfitters	$68.35	$1093.60	$102.00	$1632.00	$63.77	$95.08
1 Steamfitter Apprentice	54.70	437.60	81.65	653.20		
1 Electrician	63.70	509.60	94.65	757.20		
32 L.H., Daily Totals		$2040.80		$3042.40	$63.77	$95.08
Crew Q-22	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Plumber	$67.70	$541.60	$101.05	$808.40	$60.92	$90.92
1 Plumber Apprentice	54.15	433.20	80.80	646.40		
1 Hyd. Crane, 12 Ton		475.80		523.38	29.74	32.71
16 L.H., Daily Totals		$1450.60		$1978.18	$90.66	$123.64
Crew Q-22A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Plumber	$67.70	$541.60	$101.05	$808.40	$56.92	$84.91
1 Plumber Apprentice	54.15	433.20	80.80	646.40		
1 Laborer	44.40	355.20	66.25	530.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Hyd. Crane, 12 Ton		475.80		523.38	14.87	16.36
32 L.H., Daily Totals		$2297.40		$3240.58	$71.79	$101.27

Crews - Standard

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew Q-23	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Plumber Foreman (outside)	$69.70	$557.60	$104.00	$832.00	$65.47	$97.65
1 Plumber	67.70	541.60	101.05	808.40		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Lattice Boom Crane, 20 Ton		1526.00		1678.60	63.58	69.94
24 L.H., Daily Totals		$3097.20		$4022.20	$129.05	$167.59
Crew R-1	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Electrician Foreman	$64.20	$513.60	$95.40	$763.20	$59.53	$88.46
3 Electricians	63.70	1528.80	94.65	2271.60		
2 Electrician Apprentices	50.95	815.20	75.70	1211.20		
48 L.H., Daily Totals		$2857.60		$4246.00	$59.53	$88.46
Crew R-1A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Electrician	$63.70	$509.60	$94.65	$757.20	$57.33	$85.17
1 Electrician Apprentice	50.95	407.60	75.70	605.60		
16 L.H., Daily Totals		$917.20		$1362.80	$57.33	$85.17
Crew R-1B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Electrician	$63.70	$509.60	$94.65	$757.20	$55.20	$82.02
2 Electrician Apprentices	50.95	815.20	75.70	1211.20		
24 L.H., Daily Totals		$1324.80		$1968.40	$55.20	$82.02
Crew R-1C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Electricians	$63.70	$1019.20	$94.65	$1514.40	$57.33	$85.17
2 Electrician Apprentices	50.95	815.20	75.70	1211.20		
1 Portable cable puller, 8000 lb.		102.65		112.92	3.21	3.53
32 L.H., Daily Totals		$1937.05		$2838.51	$60.53	$88.70
Crew R-2	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Electrician Foreman	$64.20	$513.60	$95.40	$763.20	$59.81	$88.90
3 Electricians	63.70	1528.80	94.65	2271.60		
2 Electrician Apprentices	50.95	815.20	75.70	1211.20		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 S.P. Crane, 4x4, 5 Ton		381.95		420.14	6.82	7.50
56 L.H., Daily Totals		$3731.15		$5398.55	$66.63	$96.40
Crew R-3	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Electrician Foreman	$64.20	$513.60	$95.40	$763.20	$63.45	$94.33
1 Electrician	63.70	509.60	94.65	757.20		
.5 Equip. Oper. (crane)	61.45	245.80	91.55	366.20		
.5 S.P. Crane, 4x4, 5 Ton		190.97		210.07	9.55	10.50
20 L.H., Daily Totals		$1459.97		$2096.67	$73.00	$104.83
Crew R-4	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Struc. Steel Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$61.38	$94.19
3 Struc. Steel Workers	60.30	1447.20	93.30	2239.20		
1 Electrician	63.70	509.60	94.65	757.20		
1 Welder, Gas Engine, 300 amp		148.75		163.63	3.72	4.09
40 L.H., Daily Totals		$2603.95		$3931.22	$65.10	$98.28

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew R-5	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Electrician Foreman	$64.20	$513.60	$95.40	$763.20	$55.87	$83.45
4 Electrician Linemen	63.70	2038.40	94.65	3028.80		
2 Electrician Operators	63.70	1019.20	94.65	1514.40		
4 Electrician Groundmen	42.05	1345.60	63.65	2036.80		
1 Crew Truck		168.15		184.97		
1 Flatbed Truck, 20,000 GVW		204.05		224.46		
1 Pickup Truck, 3/4 Ton		112.20		123.42		
.2 Hyd. Crane, 55 Ton		198.03		217.83		
.2 Hyd. Crane, 12 Ton		95.16		104.68		
.2 Earth Auger, Truck-Mtd.		40.51		44.56		
1 Tractor w/Winch		377.65		415.42	13.59	14.95
88 L.H., Daily Totals		$6112.55		$8658.52	$69.46	$98.39
Crew R-6	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Electrician Foreman	$64.20	$513.60	$95.40	$763.20	$55.87	$83.45
4 Electrician Linemen	63.70	2038.40	94.65	3028.80		
2 Electrician Operators	63.70	1019.20	94.65	1514.40		
4 Electrician Groundmen	42.05	1345.60	63.65	2036.80		
1 Crew Truck		168.15		184.97		
1 Flatbed Truck, 20,000 GVW		204.05		224.46		
1 Pickup Truck, 3/4 Ton		112.20		123.42		
.2 Hyd. Crane, 55 Ton		198.03		217.83		
.2 Hyd. Crane, 12 Ton		95.16		104.68		
.2 Earth Auger, Truck-Mtd.		40.51		44.56		
1 Tractor w/Winch		377.65		415.42		
3 Cable Trailers		194.25		213.68		
.5 Tensioning Rig		55.75		61.33		
.5 Cable Pulling Rig		306.65		337.32	19.91	21.91
88 L.H., Daily Totals		$6669.20		$9270.84	$75.79	$105.35
Crew R-7	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Electrician Foreman	$64.20	$513.60	$95.40	$763.20	$45.74	$68.94
5 Electrician Groundmen	42.05	1682.00	63.65	2546.00		
1 Crew Truck		168.15		184.97	3.50	3.85
48 L.H., Daily Totals		$2363.75		$3494.17	$49.24	$72.80
Crew R-8	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Electrician Foreman	$64.20	$513.60	$95.40	$763.20	$56.57	$84.44
3 Electrician Linemen	63.70	1528.80	94.65	2271.60		
2 Electrician Groundmen	42.05	672.80	63.65	1018.40		
1 Pickup Truck, 3/4 Ton		112.20		123.42		
1 Crew Truck		168.15		184.97	5.84	6.42
48 L.H., Daily Totals		$2995.55		$4361.59	$62.41	$90.87
Crew R-9	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Electrician Foreman	$64.20	$513.60	$95.40	$763.20	$52.94	$79.24
1 Electrician Lineman	63.70	509.60	94.65	757.20		
2 Electrician Operators	63.70	1019.20	94.65	1514.40		
4 Electrician Groundmen	42.05	1345.60	63.65	2036.80		
1 Pickup Truck, 3/4 Ton		112.20		123.42		
1 Crew Truck		168.15		184.97	4.38	4.82
64 L.H., Daily Totals		$3668.35		$5379.98	$57.32	$84.06
Crew R-10	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Electrician Foreman	$64.20	$513.60	$95.40	$763.20	$60.17	$89.61
4 Electrician Linemen	63.70	2038.40	94.65	3028.80		
1 Electrician Groundman	42.05	336.40	63.65	509.20		
1 Crew Truck		168.15		184.97		
3 Tram Cars		219.60		241.56	8.08	8.89
48 L.H., Daily Totals		$3276.15		$4727.73	$68.25	$98.49

Crews - Standard

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew R-11	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Electrician Foreman	$64.20	$513.60	$95.40	$763.20	$60.69	$90.26
4 Electricians	63.70	2038.40	94.65	3028.80		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Common Laborer	44.40	355.20	66.25	530.00		
1 Crew Truck		168.15		184.97		
1 Hyd. Crane, 12 Ton		475.80		523.38	11.50	12.65
56 L.H., Daily Totals		$4042.75		$5762.74	$72.19	$102.91
Crew R-12	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Carpenter Foreman (inside)	$55.20	$441.60	$82.40	$659.20	$51.90	$77.75
4 Carpenters	54.70	1750.40	81.65	2612.80		
4 Common Laborers	44.40	1420.80	66.25	2120.00		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Steel Worker	60.30	482.40	93.30	746.40		
1 Dozer, 200 H.P.		1520.00		1672.00		
1 Pickup Truck, 3/4 Ton		112.20		123.42	18.55	20.40
88 L.H., Daily Totals		$6199.40		$8637.02	$70.45	$98.15
Crew R-13	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Electrician Foreman	$64.20	$513.60	$95.40	$763.20	$61.55	$91.52
3 Electricians	63.70	1528.80	94.65	2271.60		
.25 Equip. Oper. (crane)	61.45	122.90	91.55	183.10		
1 Equipment Oiler	52.50	420.00	78.25	626.00		
.25 Hydraulic Crane, 33 Ton		245.79		270.37	5.85	6.44
42 L.H., Daily Totals		$2831.09		$4114.27	$67.41	$97.96
Crew R-15	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Electrician Foreman	$64.20	$513.60	$95.40	$763.20	$62.42	$92.78
4 Electricians	63.70	2038.40	94.65	3028.80		
1 Equipment Oper. (light)	55.50	444.00	82.70	661.60		
1 Telescoping Boom Lift, to 40'		281.90		310.09	5.87	6.46
48 L.H., Daily Totals		$3277.90		$4763.69	$68.29	$99.24
Crew R-15A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Electrician Foreman	$64.20	$513.60	$95.40	$763.20	$55.98	$83.32
2 Electricians	63.70	1019.20	94.65	1514.40		
2 Common Laborers	44.40	710.40	66.25	1060.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Telescoping Boom Lift, to 40'		281.90		310.09	5.87	6.46
48 L.H., Daily Totals		$2969.10		$4309.29	$61.86	$89.78
Crew R-18	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
.25 Electrician Foreman	$64.20	$128.40	$95.40	$190.80	$55.89	$83.05
1 Electrician	63.70	509.60	94.65	757.20		
2 Electrician Apprentices	50.95	815.20	75.70	1211.20		
26 L.H., Daily Totals		$1453.20		$2159.20	$55.89	$83.05
Crew R-19	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
.5 Electrician Foreman	$64.20	$256.80	$95.40	$381.60	$63.80	$94.80
2 Electricians	63.70	1019.20	94.65	1514.40		
20 L.H., Daily Totals		$1276.00		$1896.00	$63.80	$94.80
Crew R-21	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Electrician Foreman	$64.20	$513.60	$95.40	$763.20	$63.71	$94.67
3 Electricians	63.70	1528.80	94.65	2271.60		
.1 Equip. Oper. (medium)	59.00	47.20	87.90	70.32		
.1 S.P. Crane, 4x4, 25 Ton		115.50		127.05	3.52	3.87
32.8 L.H., Daily Totals		$2205.10		$3232.17	$67.23	$98.54

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew R-22	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
.66 Electrician Foreman	$64.20	$338.98	$95.40	$503.71	$58.30	$86.62
2 Electricians	63.70	1019.20	94.65	1514.40		
2 Electrician Apprentices	50.95	815.20	75.70	1211.20		
37.28 L.H., Daily Totals		$2173.38		$3229.31	$58.30	$86.62
Crew R-30	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
.25 Electrician Foreman (outside)	$65.70	$131.40	$97.65	$195.30	$51.98	$77.40
1 Electrician	63.70	509.60	94.65	757.20		
2 Laborers (Semi-Skilled)	44.40	710.40	66.25	1060.00		
26 L.H., Daily Totals		$1351.40		$2012.50	$51.98	$77.40
Crew R-31	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Electrician	$63.70	$509.60	$94.65	$757.20	$63.70	$94.65
1 Core Drill, Electric, 2.5 H.P.		62.65		68.92	7.83	8.61
8 L.H., Daily Totals		$572.25		$826.12	$71.53	$103.26
Crew W-41E	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
.5 Plumber Foreman (outside)	$69.70	$278.80	$104.00	$416.00	$58.78	$87.72
1 Plumber	67.70	541.60	101.05	808.40		
1 Laborer	44.40	355.20	66.25	530.00		
20 L.H., Daily Totals		$1175.60		$1754.40	$58.78	$87.72

Attachment C.4
Caterpillar Handbook

Caterpillar Performance Handbook

Edition 29

CATERPILLAR®

CONSTRUCTION & MINING TRUCKS
CONSTRUCTION & MINING TRACTORS

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Features:

- **Caterpillar four-stroke-cycle diesels** … turbocharged, aftercooled, adjustment-free fuel system (direct injection).
- **Electronically-controlled automatic transmission** … speed sensing device automatically shifts transmission between 1st and gear selected by operator.
- **Truck Production Management System (TPMS)** utilizes strut pressure sensors and an on-board microprocessor to determine payload weight, cycle segment times, delay times, actual clock time and date of each cycle.
- **Vital Information Management System (VIMS)** Monitors all vital machine functions. Keeps operator informed of current machine operating conditions, helps reduce downtime and allows service personnel easy access to data for fast accurate diagnosis. VIMS includes Production Management System.
- **Electronic Unit Injection (EUI)** in the 776D-793C and **Hydraulic Electronic Unit Injection (HEUI)** on 769D-775D electronically maintains fuel settings, provides automatic altitude and air filter restriction compensation, automatic variable timing, improved diagnostics and increased fuel efficiency.
- **Oil cooled disc brakes** provide retarding, service, parking, and secondary braking in one sealed, fade-resistant, maintenance-free unit. 769D-777D front brakes are caliper disc, can be switched out of the service system when not needed but activate as part of the secondary system. (Front oil-cooled brakes optional on 777D.) 784C-793C front brakes are oil-cooled disc.
- **Automatic Retarder Control (ARC)** electronically controls braking on grade to maintain faster downhill speeds and consistently higher engine speed.
- **Full hydraulic steering,** with front suspension cylinders serving as kingpins.
- **Four independent,** self-contained, oil-pneumatic suspension cylinders absorb loading and road shocks. Wide spacing for stability.
- **Dual slope body** has V-bottom for load balance and retention. Low loading height and center of gravity.
- **Quarry trucks** have single-slope flat floor for smooth, metered dumping into crushers or hoppers. Optional flat floor body available for 769D, 773D.
- **Integral Roll Over Protective Structure (ROPS)** cab standard on all models.
- **Separate hydraulic systems** prevents cross contamination.

Tractor Features:

- **Yoke type hitch** oscillates four ways to reduce frame stresses. Rugged turn stops prevent excessive wagon rotation either direction.
- **Rear platform** functions as a power train guard and provides safe, stable work area. Fenders and mud flaps protect from material thrown by tires.

NOTE: Listed features may be standard on some models. Optional on others. Contact your Caterpillar Dealer for specific information.

MODEL	769D		769D		771D	
Body Type	**Flat Floor**		**Dual Slope**		**Quarry**	
Gross Vehicle Weight	68 180 kg	**150,000 lb**	68 180 kg	**150,000 lb**	73 970 kg	**163,100 lb**
Chassis Weight*	22 950 kg	**50,600 lb**	22 950 kg	**50,600 lb**	22 950 kg	**50,600 lb**
Body Weight	7800 kg	**17,200 lb**	7330 kg	**16,170 lb**	10 350 kg	**22,820 lb**
Maximum Payload**	37 430 kg	**82,533 lb**	37 900 kg	**83,570 lb**	40 670 kg	**89,680 lb**
Standard Liner Weight	3300 kg	**7280 lb**	3160 kg	**6970 lb**	**—**	
Payload with Standard Liner	34 130 kg	**75,250 lb**	34 740 kg	**76,600 lb**	**—**	
Capacity:						
Struck (SAE)	16.5 m^3	**21.6 yd^3**	17 m^3	**22.2 yd^3**	20.2 m^3	**26.4 yd^3**
Heaped (2:1) (SAE)	24.2 m^3	**31.7 yd^3**	24.2 m^3	**31.7 yd^3**	27.5 m^3	**36 yd^3**
Distribution Empty:						
Front	**49.7%**		**49.8%**		**46.3%**	
Rear	**50.3%**		**50.2%**		**53.7%**	
Distribution Loaded:						
Front	**33.2%**		**33.3%**		**32.9%**	
Rear	**66.8%**		**66.7%**		**67.1%**	
Engine Model	**3408E**		**3408E**		**3408E**	
Number of Cylinders	**8**		**8**		**8**	
Bore	137 mm	**5.4"**	137 mm	**5.4"**	137 mm	**5.4"**
Stroke	152 mm	**6"**	152 mm	**6"**	152 mm	**6"**
Displacement	18 L	**1099 in^3**	18 L	**1099 in^3**	18 L	**1099 in^3**
Flywheel Power	362 kW	**485 hp**	362 kW	**485 hp**	362 kW	**485 hp**
Gross Power	380 kW	**510 hp**	380 kW	**510 hp**	380 kW	**510 hp**
Standard Tires	**18.00R33(E-4)**		**18.00R33(E-4)**		**18.00R33(E-4)**	
Machine Clearance Turning Circle	19.8 m	**65'0"**	19.8 m	**65'0"**	19.8 m	**65'0"**
Fuel Tank Refill Capacity	530 L	**140 U.S. gal**	530 L	**140 U.S. gal**	530 L	**140 U.S. gal**
Top Speed (Loaded)	75 km/h	**47 mph**	75 km/h	**47 mph**	56 km/h	**35 mph**
GENERAL DIMENSIONS (Empty):						
Height to Canopy Rock Guard Rail	4.07 m	**13'4"**	4.03 m	**13'3"**	4.02 m	**13'2"**
Wheelbase	3.71 m	**12'2"**	3.71 m	**12'2"**	3.71 m	**12'2"**
Overall Length	8.73 m	**28'7"**	8.57 m	**28'1"**	8.73 m	**28'7"**
Loading Height (Empty)	3.19 m	**10'6"**	3.14 m	**10'4"**	3.40 m	**11'2"**
Height at Full Dump	7.75 m	**25'5"**	7.71 m	**25'3"**	7.74 m	**25'5"**
Body Length (Target Length)	5.43 m	**17'10"**	5.28 m	**17'4"**	5.52 m	**18'1"**
Width (Operating)	5.01 m	**16'5"**	5.01 m	**16'5"**	5.01 m	**16'5"**
Width (Shipping)***	3.95 m	**12'11"**	3.95 m	**12'11"**	3.95 m	**12'11"**
Front Tire Tread	3.10 m	**10'2"**	3.10 m	**10'2"**	3.10 m	**10'2"**

*Weights include lubricants, coolants, and 10% fuel.
**Maximum rating requires selection of proper tires and is dependent on selection of optional equipment. Gross vehicle weight should not be exceeded.
***Disassembled.

Caterpillar Performance Handbook

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CAT®

CATERPILLAR PERFORMANCE HANDBOOK

a publication by Caterpillar Inc., Peoria, Illinois, U.S.A.

JANUARY 2011

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Performance information in this booklet is intended for estimating purposes only. Because of the many variables peculiar to individual jobs (including material characteristics, operator efficiency, underfoot conditions, altitude, etc.), neither Caterpillar Inc. nor its dealers warrant that the machines described will perform as estimated.

NOTE: Always refer to the appropriate Operation and Maintenance Manual for specific product information.

Materials and specifications are subject to change without notice.

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TOWED SCRAPERS

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Wheel Tractor-Scrapers

Specifications
- Tandem Powered
- Push-Pull

MODEL	627G		637G		657G	
Flywheel Power: Tractor	246/272 kW	**330/365 hp**	345/373 kW	**462/500 hp**	421/447 kW	**564/600 hp**
Scraper	178/198 kW	**239/266 hp**	198/211 kW	**266/283 hp**	306/337 kW	**410/451 hp**
Approx. Operating Weight (Empty)◄	37 922 kg	**83,604 lb**	51 963 kg	**114,559 lb**	68 384 kg	**150,760 lb**
Scraper Capacity: Struck	12 m³	**15.7 yd³**	18.3 m³	**24 yd³**	24.5 m³	**32 yd³**
Heaped	17 m³	**22 yd³**	26 m³	**34 yd³**	33.6 m³	**44 yd³**
Rated Load	23 950 kg	**52,800 lb**	37 013 kg	**81,600 lb**	47 174 kg	**104,000 lb**
Weight Distribution — Empty: Front	**59%**		**59%**		**58%**	
Rear	**41%**		**41%**		**42%**	
Weight Distribution — Loaded: Front	**50%**		**50%**		**50%**	
Rear	**50%**		**50%**		**50%**	
Engine Model: Tractor	**C15 ACERT**		**C18 ACERT**		**C18 ACERT**	
Scraper	**C9 ACERT**		**C9 ACERT**		**C15 ACERT**	
Rated Engine RPM: Tractor	**1800**		**1800**		**1800**	
Scraper	**2000**		**2000**		**1800**	
Displacement: Tractor	15.2 L	**928 in³**	18.1 L	**1105 in³**	18.1 L	**1105 in³**
Scraper	8.8 L	**538 in³**	8.8 L	**538 in³**	15.2 L	**928 in³**
Top Speed (Loaded)	51 km/h	**32 mph**	53 km/h	**33 mph**	53 km/h	**33 mph**
180° Curb-to-Curb Turning Width	11.7 m	**38'5"**	12.2 m	**40'1"**	14.2 m	**46'7"**
Tires — Tractor Drive	**33.25R29******E3**		**37.25R35******E3**		**40.5/75R39******E3**	
Scraper	**33.25R29******E3**		**37.25R35******E3**		**40.5/75R39******E3**	
Width of Cut	3.02 m	**9'11"**	3.51 m	**11'6"**	3.85 m	**12'8"**
Maximum Depth of Cut	333 mm	**13.1"**	437 mm	**17"**	440 mm	**17.3"**
Maximum Depth of Spread	522 mm	**20.6"**	480 mm	**18.9"**	660 mm	**26"**
Fuel Tank Refill Capacity: Tractor	**—**		**—**		**—**	
Scraper	1105 L	**292 U.S. gal**	1268 L	**335 U.S. gal**	1597 L	**424 U.S. gal**
GENERAL DIMENSIONS:						
Height to Top of Scraper	3.81 m	**12'6"**	4.18 m	**13'9"**	4.62 m	**15'2"**
Wheelbase	7.72 m	**25'4"**	8.77 m	**28'9"**	9.96 m	**32'8"**
Overall Length	12.88 m	**42'3"**	14.71 m	**48'3"**	16.2 m	**53'1"**
Overall Width	3.58 m	**11'9"**	3.94 m **	**12'11"**	4.35 m	**14'4"**
Shipping Width (Draft Arm on Inside of Bowl)	**—**		3.63 m *	**11'11"**	3.91 m **	**12'10"**
Scraper Tread	2.23 m	**7'4"**	2.46 m	**8'1"**	2.81 m	**9'3"**
Tractor Tread	2.20 m	**7'3"**	2.46 m	**8'1"**	2.63 m	**8'8"**
PUSH-PULL GENERAL DIMENSIONS:						
Operating Weight (Empty)◄	39 443 kg	**86,957 lb**	54 057 kg	**119,175 lb**	72 804 kg	**160,505 lb**
Overall Length	15.2 m	**49'7"**	16.64 m	**54'7"**	18.01 m	**59'1"**
Weight Distribution — Empty: Front	**59%**		**60%**		**58%**	
Rear	**41%**		**40%**		**42%**	
Weight Distribution — Loaded: Front	**51%**		**51%**		**51%**	
Rear	**49%**		**49%**		**49%**	

*Optional Shipping Configuration.
**Standard Shipping Configuration.
◄ Operating weight includes standard machine, coolant, lubricants, full fuel tank, and operator.

MODEL	637G			657G		
Flywheel Power: Tractor	345/373 kW		**462/500 hp**	421/447 kW		**564/600 hp**
Scraper	198/211 kW		**266/283 hp**	306/337 kW		**410/451 hp**
Approx. Operating Weight (Empty)	54 050 kg		**118,909 lb**	72 190 kg		**158,817 lb**
Scraper Capacity: Struck	31 m^3		**41 yd^3**	45 m^3		**59 yd^3**
Heaped	38 m^3		**50 yd^3**	56 m^3		**73 yd^3**
Rated Load	34 473 kg		**76,000 lb**	49 895 kg		**110,000 lb**
Approx. Operating Weight (Loaded)	88 409 kg		**194,909 lb**	121 933 kg		**268,817 lb**
Top Speed (Loaded)	53 km/h		**33 mph**	53 km/h		**33 mph**
180° Curb-to-Curb Turning Width	13.7 m		**44'10"**	15.6 m		**51'3"**
GENERAL DIMENSIONS:						
Height to Top of Scraper	4.18 m		**13'9"**	4.62 m		**15'2"**
Wheelbase	9.53 m		**31'3"**	11.01 m		**36'1"**
Overall Length	15.47 m		**50'9"**	17.21 m		**56'5"**
Overall Width	3.94 m	**	**12'11"**	4.35 m		**14'4"**
Shipping Width (Draft Arm on Inside of Bowl)	3.63 m	*	**11'11"**	3.91 m	**	**12'10"**
Scraper Tread	2.46 m		**8'1"**	2.81 m		**9'3"**
Tractor Tread	2.46 m		**8'1"**	2.63 m		**8'8"**

*Optional Shipping Configuration.
**Standard Shipping Configuration.

Coal Bowl

Coal Bowl Wheel Tractor-Scrapers are typically used for building and maintaining coal stockpiles and hauling coal to the supply system at coal power plants. The self-loading capability, large capacity, coal pile compaction, and high speed of Coal Bowl Wheel Tractor-Scrapers make them the tool of choice for moving coal both short and long distances. Coal Bowl Wheel Tractor-Scrapers are available in the 637G and 657G tandem engine models.

Coal Bowl Advantages:

- Load hoppers
- Manage coal stockpiles
- Compaction reduces risk of spontaneous combustion in coal stockpile
- Exclusively designed large capacity coal bowls

Notes:

- The 637G Coal Scraper is 736 mm **(29.0")** longer, the bowl sides are 476 mm **(18.7")** taller, and the apron is 499 mm **(19.6")** taller than its earthmoving counterpart.
- The 657G Coal Scraper is 1072 mm **(42.2")** longer, the bowl sides are 1010 mm **(39.8")** taller, the apron is 677 mm **(26.7")** taller, and the ejector is 944 mm **(37.2")** taller than its earthmoving counterpart.

WHEEL LOADERS
INTEGRATED TOOLCARRIERS

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WHEEL LOADERS

Features:

- **Cat heavy duty diesel engine.**
- **Productive operator environment. Excellent visibility.**
- **Automatic lift and bucket controls.**
- **Adjustable suspension seat and steering column.**
- **Four wheel enclosed wet disc brakes.**
- **Automatic power shift transmissions.** Allows operator to select automatic or manual mode.
- **Hydrostatic drive on 906H, 908H and 914G.**
- **Transmission neutralizer switch (924H, 924Hz, 928Hz, 930H, 938H-980H).**
- **Computerized machine function monitoring.**
- **Command control steering** with integrated transmission controls and electro-hydraulic controls … 950H-980H.
- **Lock up clutch on 990H and 994F (optional on 988H).**
- **Impeller clutch on 988H, 990H, 992K, 993K and 994F.**
- **Tilting hood … 938H-980H.**
- **Brake wear indicator.**
- **Limited slip differentials.**
- **Differential locks … 938H.**
- **Automatic Ride Control suspension system.** Operator select “on”, “off” or “automatic”.
- **Payload control system.**
- **Optional Fusion™ coupler system** for work tool interchangeability with pin-on performance. Work tools can interchange across the entire SWL/MWL/IT line.

Listed features may be standard on some models, optional or unavailable on others. Contact your Cat dealer for specific information.

MODEL	972H		980H		988H		990H	
Flywheel Power: Net	214 kW	**287 hp**	260 kW	**349 hp**	373 kW	**501 hp**	468 kW	**627 hp**
Gross	229 kW	**307 hp**	293 kW	**392 hp**	414 kW	**555 hp**	512 kW	**687 hp**
Rated Payload*	—		—		11.4 t	**12.5 T**	15 t	**16.5 T**
Gross Rated Bucket Payload*	—		—		16 300 kg	**36,000 lb**	22 700 kg	**50,000 lb**
Engine Model	**C13 ATAAC**		**C15 ATAAC**		**C18 ACERT**		**C27 ACERT**	
Rated Engine RPM	**1800**		**1800**		**1800**		**2000**	
Bore	130 mm	**5.1"**	137 mm	**5.4"**	145 mm	**5.7"**	137 mm	**5.4"**
Stroke	157 mm	**6.2"**	171 mm	**6.75"**	183 mm	**7.2"**	152 mm	**6"**
No. Cylinders	**6**		**6**		**6**		**12**	
Displacement	12.5 L	**763 in³**	15.2 L	**928 in³**	18.1 L	**1104.5 in³**	27.1 L	**1666 in³**
Speeds Forward	**km/h**	**mph**	**km/h**	**mph**	**km/h**	**mph**	**km/h**	**mph**
1st	7.2	**4.5**	6.6	**4.1**	6.7	**4.2**	7.0	**4.3**
2nd	12.6	**7.8**	11.8	**7.3**	11.8	**7.3**	12.1	**7.5**
3rd	21.4	**13.3**	20.7	**12.9**	20.8	**12.9**	20.8	**13.0**
4th	36.9	**22.9**	36.3	**22.6**	36.0	**22.3**	—	
Speeds Reverse								
1st	8.2	**5.1**	7.6	**4.7**	7.6	**4.7**	7.7	**4.8**
2nd	14.2	**8.8**	13.5	**8.4**	13.5	**8.4**	13.4	**8.3**
3rd	24.3	**15.1**	23.6	**14.7**	23.7	**14.7**	22.9	**14.2**
4th	38.8	**24.0**	41.5	**25.8**	—		—	
Hydraulic Cycle Time, Rated Load in Bucket:	**Seconds**		**Seconds**		**Seconds**		**Seconds**	
Raise	**5.9**		**6.0**		**9.4**		**9.2**	
Dump	**2.1**		**2.1**		**2.4**		**2.9**	
Lower (Empty, Float Down)	**2.4**		**3.4**		**3.8**		**3.8**	
Total	**10.4**		**11.5**		**15.6**		**15.9**	
Tread Width	2.23 m	**7'4"**	2.44 m	**8'0"**	2.59 m	**8'6"**	3.1 m	**10'2"**
Width Over Tires	3.00 m	**9'10"**	3.23 m	**10'7"**	3.54 m	**11'7"**	4.1 m	**13'5"**
Ground Clearance	494 mm	**20"**	442 mm	**17.4"**	549 mm	**22"**	478 mm	**18.8"**
Fuel Tank Capacity	380 L	**100 U.S. gal**	479 L	**127 U.S. gal**	712 L	**188 U.S. gal**	1074 L	**284 U.S. gal**
Hydraulic Tank Capacity	110 L	**29 U.S. gal**	125 L	**33 U.S. gal**	267 L	**70 U.S. gal**	174 L†	**46 U.S. gal**
Hydraulic System Capacity (includes tank)	200 L	**52 U.S. gal**	250 L	**66 U.S. gal**	470 L	**124 U.S. gal**	435 L†	**115 U.S. gal**

*Changes in bucket weight, including field installed wear iron, can impact rated payload. Consult your Cat dealer for assistance in selecting and configuring the proper bucket for the application. The Cat Large Wheel Loader Payload Policy is a guideline intended to maximize wheel loader structural and component life. The Cat Payload Policy is that the "Gross Bucket plus Payload Capacity" is the MAXIMUM weight that should be carried on the end of the Lift Arm/Boom.

†990H has a separate hydraulic system for steering and engine cooling fan. System (including tank) 194 L **(51 U.S. gal)**, tank only 132 L **(35 U.S. gal)**.

Wheel Loaders (cont'd)

Model	Product Ident. No. Prefix	Years Built	Flywheel Horse-power	Approx. Shipping Wt. kg (lb)	Rated Capacity m³ (yd³)	Breakout Force kg (lb)	Width Over Tires m (ft)	Ground Clearance mm (in)	Max. Reach at max. height mm (ft)	Dump Clearance at max. height m (ft)	Maximum Speeds km/h (mph) Fwd.	Rev.	Remarks
988	87A	63-76	325	35 800	4.6-5.4	21 380	3.20	570	1450	3.33	30.6	30.6	
				(79,000)	**(6.0-7.0)**	**(47,130)**	**(10'7")**	**(22.5")**	**(4'9")**	**(10'11")**	**(19.0)**	**(19.0)**	
988B	50W	76-93	375	43 365	5.4-6.3	36 330	3.52	474	2150	3.19	36.2	41.4	3408 Engine
				(95,600)	**(7.0-8.25)**	**(80,100)**	**(11'7")**	**(18")**	**(7'1")**	**(10'5")**	**(22.5)**	**(25.7)**	Z Bar Linkage
988F	8YG	93-95	400	43 540	5.4-6.1	37 363	3.52	496	1830	3.21	35.1	23.5	Bucket/HP increase
				(95,900)	**(7.0-8.0)**	**(82,371)**	**(11'7")**	**(19")**	**(6'0")**	**(10'6")**	**(21.8)**	**(14.6)**	STIC Steer
988F	2ZR	95-00	475	45 678	6.1-6.9	37 400	3.52	496	1611	3.22	35.1	23.5	3048E HEUI Engine
Series II				**(100,492)**	**(8.0-9.0)**	**(82,282)**	**(11'7")**	**(1'7")**	**(5'3")**	**(10'7")**	**(21.8)**	**(14.6)**	Axle Shaft Brakes
988G	2TW	01	475	50 040	6.3-7.0	46 950	3.47	549	2113	4.0	38.7	22.3	6 Bar Linkage
				(110,320)	**(8.2-9.2)**	**(103,500)**	**(11'5")**	**(21.6")**	**(6'11")**	**(13'1")**	**(24.0)**	**(13.8)**	"G" Series
988G	BNH	01-05	475	50 040	6.3-7.0	46 950	3.47	549	2113	4.0	38.6	25.1	6 Bar Linkage
				(110,320)	**(8.2-9.2)**	**(103,500)**	**(11'5")**	**(21.6")**	**(6'11")**	**(13'11")**	**(24.0)**	**(15.6)**	"G" Series
988H	BXY	05	501	49 546	6.4-7.0	378.4	3.47	549	5.85	3466	36	23.7	3.88 Meter Linkage
				(109,249)	**(8.33-9.2)**	**(85,068)**	**(11'5")**	**(22")**	**(19'2")**	**(11'37")**	**(22.3)**	**(14.7)**	
990	7HK	93-95	610	72 910	8.6	59 776	4.13	552	2070	3.99	22.5	25.0	ICTC &
				(160,600)	**(11.2)**	**(131,784)**	**(13'6")**	**(21.7")**	**(6'10")**	**(13'1")**	**(14.0)**	**(15.5)**	New Model
990	4FR	96-05	625	72 200	8.4-9.2	63 100	4.0	490	1990	4.05	22.5	25.0	HEUI Engine
Series II				**(159,170)**	**(11-12)**	**(138,800)**	**(13'1")**	**(19.3")**	**(6'6")**	**(13'3")**	**(14.0)**	**(15.5)**	
990H	BWX	05	627	77 842	8.6-9.2	602	4.16	478	8.07	4220	22.4	24.8	Standard Lift
				(171,642)	**(11.25-12)**	**(135,429)**	**(13'3")**	**(18'8")**	**(26'6")**	**(13'10")**	**(13.92)**	**(15.41)**	8.6 m³/**11.2 yd³**
													Bucket
992	25K	68-73	550	47 670	7.65	36 900	3.93	530	2820	4.52	35.6	38.5	
				(105,100)	**(10.0)**	**(81,360)**	**(12'11")**	**(21")**	**(8'3")**	**(14'10")**	**(22.1)**	**(23.8)**	
992B	25K	73-77	550	64 320	7.65	29 330	—	—	1930	4.34	40.2	43.6	
				(141,800)	**(10.0)**	**(84,660)**	**—**	**—**	**(6'4")**	**(14'3")**	**(25.0)**	**(27.1)**	
992C	42X	77-81	690	85 640	9.6	66 240	4.55	533	2310	4.17	21.1	23.3	3412 PCT Engine
				(188,800)	**(12.5)**	**(146,030)**	**(14'11")**	**(21")**	**(7'7")**	**(13'8")**	**(13.1)**	**(14.5)**	Z Bar Linkage
992C	49Z	81-92	690	88 430	10.4	66 285	4.50	544	2310	4.17	21.0	22.9	3412 DIT Engine
				(194,950)	**(13.5)**	**(146,132)**	**(14'9")**	**(21")**	**(7'7")**	**(13'8")**	**(13.0)**	**(14.2)**	
992D	7MJ	92-97	710	88 690	10.7	62 670	4.50	544	2300	4.17	21.0	22.9	
				(195,125)	**(14.0)**	**(137,870)**	**(14'9")**	**(21")**	**(7'7")**	**(13'8")**	**(13.0)**	**(14.2)**	
992G	7HR	98-00	800	91 540	11.5-12.3	62 650	4.5	691	2300	4.6	20.2	22.7	6 Bar Linkage
				(201,810)	**(15-16)**	**(137,840)**	**(14'9")**	**(27.2")**	**(7'7")**	**(15'3")**	**(12.5)**	**(14.1)**	"G" Series
992K	H4C	07	801	97 294	10.7-12.3	584.66	—	682	9313	4480	20.6	22.4	10.7 m³/**14 yd³**
				(214,535)	**(14-16)**	**(128,917)**	**—**	**(2'2")**	**(30'6")**	**(14'8")**	**(12.8)**	**(13.9)**	Bucket
993K	Z9K	07	945	133 637	12.8-14.5	709	4.93	783	9313	4849	20.1	12.5	12.8 m³/**16.7 yd³**
				(294,800)	**(16.7-19)**	**(159,500)**	**(16'2")**	**(30'8")**	**(30'7")**	**(15'11")**	**(22.1)**	**(13.7)**	Bucket
994	9YF	90-98	1250	177 000	10.3	103 420	5.20	662	2692	6.20	24.7	26.6	
				(390,300)	**(13.4)**	**(228,000)**	**(17'1")**	**(26")**	**(8'10")**	**(20'4")**	**(15.0)**	**(16.5)**	

CATERPILLAR PERFORMANCE HANDBOOK

a publication by Caterpillar, Peoria, Illinois, U.S.A.

JUNE 2018

Performance information in this booklet is intended for estimating purposes only. Because of the many variables peculiar to individual jobs (including material characteristics, operator efficiency, underfoot conditions, altitude, etc.), neither Caterpillar nor its dealers warrant that the machines described will perform as estimated.

NOTE: Always refer to the appropriate Operation and Maintenance Manual for specific product information.

Materials and specifications are subject to change without notice.

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ARTICULATED TRUCKS

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Features:

- **Cat® engines with ACERT™ Technology** meet U.S. EPA Tier 4 Final/EU Stage IV/Japan 2014 (Tier 4 Final), or Tier 2/Stage II/Japan 2001 (Tier 2) equivalent emission standards. The four core elements of meeting these standards are:

  I) Common Rail;

  II) Electronics, ADEM™ A4;

  III) Fuel delivery, Mechanical-activated Electronic Unit Injection (MEUI™ A-C);

  IV) Air Management, Wastegate Turbocharging, Air to Air Aftercooling (ATAAC) with the proven technology of a crossflow cylinder head.

- **Cat electronically controlled transmissions** … Transmissions purpose built and designed for articulated trucks and their applications. Advanced Productivity Electronic Control Strategy (APECS) delivering smooth shifting transmissions with improved acceleration and high productivity. Providing complete integration with the engines for efficient power delivery as well as offering advanced diagnostic and troubleshooting capabilities.

- **Articulating and fully oscillating hitch** … Links front and rear frames for exceptional maneuverability and traction on uneven terrain while eliminating damaging twisting of the frames. Bolted hitch design allows optimum material choices for the cast hitch head and the hard-wearing tube. Bolted design allows easier rebuild and repair.

- **Three-point front suspension** … Three-point front suspension with long-stroke, low-pressure suspension cylinders provide unparalleled ride quality for operator comfort and higher average haul speeds. Front and rear suspension together with the hitch provide for excellent traction in all conditions.

- **Wide, long and low dump body design** … For excellent loadability and high fill factors, excellent machine stability and load retention as well as a good match for other Cat loading systems. Diverging flow design also gives excellent material ejection.

- **Standard ROPS/FOPS, low sound level cab** … Two man cab common across the range. Large cab with excellent visibility, ergonomic control layout and plentiful storage.

- **High capacity low pressure tires in single formation** … For superior traction and flotation in poor underfoot conditions.

- **Bare Chassis offerings** … For certain applications the Caterpillar OEM Solutions Group offers non-dumper/ Bare Chassis arrangements.

  Bare Chassis arrangements applications could include: water, service (fuel and lube), high capacity body (waste, coal, etc.), open body (log, pipe, etc.), container carrier, hook lift, tow, cable reel, etc. Please refer to specific OEM for additional information.

Specifications
• Tier 4 Final/Stage IV/Japan 2014 (Tier 4 Final)

MODEL	725C2		730C2		730C2 EJ	
Gross Power — SAE J1995	239 kW	**320 hp**	280 kW	**375 hp**	280 kW	**375 hp**
Net Power — SAE J1349	234 kW	**314 hp**	274 kW	**367 hp**	274 kW	**367 hp**
Net Power — ISO 14396	236 kW	**316 hp**	276 kW	**370 hp**	276 kW	**370 hp**
Operating Weight (Empty)*	23 040 kg	**50,795 lb**	23 725 kg	**52,305 lb**	26 395 kg	**57,277 lb**
Top Speed (Loaded)	55 km/h	**34 mph**	55 km/h	**34 mph**	55 km/h	**34 mph**
Gross Machine Weight	47 040 kg	**103,707 lb**	51 725 kg	**114,034 lb**	54 515 kg	**119,270 lb**
Distribution Empty:						
Front	**63%**		**62%**		**59%**	
Center	**19%**		**19%**		**21%**	
Rear	**18%**		**19%**		**20%**	
Distribution Loaded:						
Front	**36%**		**34%**		**30%**	
Center	**32%**		**33%**		**35%**	
Rear	**32%**		**33%**		**35%**	
Max. Capacity**	24.0 t	**26.5 T**	28 t	**31 T**	28 t	**31 T**
Struck (SAE)	11 m^3	**14.4 yd^3**	13.3 m^3	**17.4 yd^3**	13.5 m^3	**17.7 yd^3**
Heaped (2:1) (SAE)	15 m^3	**19.6 yd^3**	17.5 m^3	**23 yd^3**	16.9 m^3	**22.1 yd^3**
Tailgate Heaped SAE 2:1	15.6 m^3	**20.4 yd^3**	18.8 m^3	**24.6 yd^3**	**—**	
Tailgate Struck	11.1 m^3	**14.5 yd^3**	13.9 m^3	**18.2 yd^3**	**—**	
Engine Model	**C9.3 ACERT**		**C13 ACERT**		**C13 ACERT**	
No. Cylinders	**6**		**6**		**6**	
Bore	115 mm	**4.53"**	130 mm	**5.12"**	130 mm	**5.12"**
Stroke	149 mm	**5.87"**	157 mm	**6.18"**	157 mm	**6.18"**
Displacement	9.3 L	**567 in^3**	12.5 L	**763 in^3**	12.5 L	**763 in^3**
Tires	**23.5R25**		**23.5R25**		**750/65/R26**	
Clearance Radius	8075 mm	**317.9"**	8075 mm	**317.9"**	8075 mm	**317.9"**
Fuel Tank Refill Capacity	412 L	**108.8 U.S. gal**	412 L	**108.8 U.S. gal**	412 L	**108.8 U.S. gal**
DEF Tank Capacity	20 L	**5.3 U.S. gal**	20 L	**5.3 U.S. gal**	20 L	**5.3 U.S. gal**
General Dimensions (Empty):						
Height to Cab Top	3482 mm	**137.1"**	3482 mm	**137.1"**	3461 mm	**136"**
Overall Length	10 547 mm	**415.2"**	10 555 mm	**415.6"**	10 376 mm	**408.5"**
Loading Height (Empty)	2725 mm	**107.3"**	2911 mm	**114.6"**	3025 mm	**119.1"**
Height at Full Dump	6306 mm	**248.3"**	6464 mm	**254.5"**	**—**	
Body Length	5696 mm	**224.3"**	5783 mm	**227.7"**	5340 mm	**210.2"**
Width (Operating — Over Mirrors)	3704 mm	**145.8"**	3704 mm	**145.8"**	3704 mm	**145.8"**

*Includes coolant, lubricant and full fuel tank.
**Rating dependent on optional equipment. Maximum gross weight (empty weight plus payload) should not be exceeded.

1-2

MODEL	725C2		730C2		730C2 EJ	
Gross Power — SAE J1995	239 kW	**320 hp**	280 kW	**375 hp**	280 kW	**375 hp**
Net Power — SAE J1349	234 kW	**314 hp**	274 kW	**367 hp**	274 kW	**367 hp**
Net Power — ISO 14396	236 kW	**316 hp**	276 kW	**370 hp**	276 kW	**370 hp**
Operating Weight (Empty)*	22 775 kg	**50,211 lb**	23 305 kg	**51,378 lb**	25 980 kg	**57,277 lb**
Top Speed (Loaded)	55 km/h	**34 mph**	55 km/h	**34 mph**	55 km/h	**34 mph**
Gross Machine Weight	46 775 kg	**103,121 lb**	51 305 kg	**113,107 lb**	54 100 kg	**119,270 lb**
Distribution Empty:						
Front	**62%**		**62%**		**58%**	
Center	**19%**		**19%**		**21%**	
Rear	**19%**		**19%**		**21%**	
Distribution Loaded:						
Front	**35%**		**34%**		**29%**	
Center	**33%**		**33%**		**36%**	
Rear	**32%**		**33%**		**35%**	
Max. Capacity**	24.0 t	**26.5 T**	28 t	**31 T**	28 t	**31 T**
Struck (SAE)	11 m^3	**14.4 yd^3**	13.3 m^3	**17.4 yd^3**	13.5 m^3	**17.7 yd^3**
Heaped (2:1) (SAE)	15 m^3	**19.6 yd^3**	17.5 m^3	**23 yd^3**	16.9 m^3	**22.1 yd^3**
Tailgate Heaped SAE 2:1	15.6 m^3	**20.4 yd^3**	18.8 m^3	**24.6 yd^3**	**—**	
Tailgate Struck	11.1 m^3	**14.5 yd^3**	13.9 m^3	**18.2 yd^3**	**—**	
Engine Model	**C9.3 ACERT**		**C13 ACERT**		**C13 ACERT**	
No. Cylinders	**6**		**6**		**6**	
Bore	115 mm	**4.53"**	130 mm	**5.12"**	130 mm	**5.12"**
Stroke	149 mm	**5.87"**	157 mm	**6.18"**	157 mm	**6.18"**
Displacement	9.3 L	**567 in^3**	12.5 L	**763 in^3**	12.5 L	**763 in^3**
Tires	**23.5R25**		**23.5R25**		**750/65/R26**	
Clearance Radius	8075 mm	**317.9"**	8075 mm	**317.9"**	8075 mm	**317.9"**
Fuel Tank Refill Capacity	412 L	**108.8 U.S. gal**	412 L	**108.8 U.S. gal**	412 L	**108.8 U.S. gal**
General Dimensions (Empty):						
Height to Cab Top	3482 mm	**137.1"**	3482 mm	**137.1"**	3461 mm	**136"**
Overall Length	10 547 mm	**415.2"**	10 555 mm	**415.6"**	10 376 mm	**408.5"**
Loading Height (Empty)	2725 mm	**107.3"**	2911 mm	**114.6"**	3025 mm	**119.1"**
Height at Full Dump	6306 mm	**248.3"**	6464 mm	**254.5"**	**—**	
Body Length	5696 mm	**224.3"**	5783 mm	**227.7"**	5340 mm	**210.2"**
Width (Operating — Over Mirrors)	3704 mm	**145.8"**	3704 mm	**145.8"**	3704 mm	**145.8"**

*Includes coolant, lubricant and full fuel tank.
**Rating dependent on optional equipment. Maximum gross weight (empty weight plus payload) should not be exceeded.

HYDRAULIC EXCAVATORS

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Cycle Time Estimating Chart

Model		308E2 CR SB	311D LRR	312D, 312D L	315D L	319D L, 319D LN	M314F, M315D2	M316F, M317D2, M318F	M320F, M320D2	M322F, M322D2
Bucket Size	L	220	450	520	520	800	610	750	900	1050
	yd³	**0.30**	**0.59**	**0.68**	**0.68**	**1.05**	**0.80**	**0.98**	**1.18**	**1.37**
Soil Type		←		Packed Earth		→	←	Sand/Gravel		→
Digging Depth	m	1.8	1.5	1.8	3.0	3.0	3.0	3.0	3.0	3.0
	ft	**6'0"**	**5'0"**	**6'0"**	**10'0"**	**10'0"**	**10'0"**	**10'0"**	**10'0"**	**10'0"**
Load Bucket	min	0.08	0.07	0.07	0.07	0.09	0.05	0.06	0.06	0.08
Swing Loaded	min	0.03	0.06	0.06	0.08	0.09	0.05	0.05	0.06	0.06
Dump Bucket	min	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04
Swing Empty	min	0.08	0.05	0.05	0.06	0.07	0.04	0.04	0.05	0.05
Total Cycle Time	min	0.22	0.21	0.21	0.24	0.28	0.17	0.18	0.20	0.23

Cycle Time Estimating Chart

Model		320D2	320D RR, 321D CR, 323D2	324D	328D LCR	329D	336D	349D2, 349E, 349F	365C L	385C
Bucket Size	L	800	800	1000	N/A	1100	1400	2400	1900	3760
	yd³	**1.05**	**1.05**	**1.31**		**1.44**	**1.83**	**3.0**	**2.5**	**5.0**
Soil Type		←				Hard Clay				→
Digging Depth	m	2.3	2.3	3.2	N/A	3.2	3.4	4.0	4.2	5.6
	ft	**8**	**8**	**10**		**10**	**11**	**13**	**14**	**18**
Load Bucket	min	0.09	0.09	0.09	N/A	0.09	0.09	0.13	0.10	0.19
Swing Loaded	min	0.06	0.06	0.06	N/A	0.06	0.07	0.07	0.09	0.06
Dump Bucket	min	0.03	0.03	0.04	N/A	0.04	0.04	0.02	0.04	0.03
Swing Empty	min	0.05	0.05	0.06	N/A	0.06	0.07	0.06	0.07	0.07
Total Cycle Time	min	0.23	0.23	0.25	N/A	0.25	0.27	0.28	0.30	0.35

N/A = Not Applicable

MINING & OFF-HIGHWAY TRUCKS

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MODEL	785C		785D		789D	
Body Type	**Dual Slope**		**Dual Slope**		**Dual Slope**	
Target Gross Machine Weight §	249 476 kg	**550,000 lb**	249 476 kg	**550,000 lb**	324 319 kg	**715,000 lb**
Basic Machine Weight*	59 385 kg	**130,922 lb**	46 240 kg	**101,942 lb**	48 554 kg	**107,043 lb**
Attachments**	21 602 kg	**47,624 lb**	35 781 kg	**78,885 lb**	52 249 kg	**115,190 lb**
Body Weight without Liners***	22 997 kg	**50,700 lb**	22 997 kg	**50,700 lb**	26 606 kg	**58,656 lb**
Full Liner	8113 kg	**17,886 lb**	8113 kg	**17,886 lb**	9692 kg	**21,367 lb**
Operating Machine Weight	112 097 kg	**247,132 lb**	113 131 kg	**249,412 lb**	137 101 kg	**302,256 lb**
Debris (3% of Operating Machine Weight)	3363 kg	**7414 lb**	3394 kg	**7482 lb**	4113 kg	**9068 lb**
Empty Operating Weight	115 460 kg	**254,546 lb**	116 525 kg	**256,894 lb**	141 214 kg	**311,324 lb**
Target Payload §	134.0 m tons	**147.7 tons**	133.0 m tons	**146.6 tons**	183.1 m tons	**201.8 tons**
Capacity:						
Heaped (2:1) (SAE) Base Body	78 m^3	**102 yd^3**	78 m^3	**102 yd^3**	108 m^3	**141 yd^3**
Heaped (2:1) (SAE) with Std. Sideboards	91 m^3	**119 yd^3**	91 m^3	**119 yd^3**	125 m^3	**161 yd^3**
Distribution Empty:						
Front	**45%**		**45.5%**		**46%**	
Rear	**55%**		**54.5%**		**54%**	
Distribution Loaded:						
Front	**33.3%**		**33.3%**		**33%**	
Rear	**66.7%**		**66.7%**		**66%**	
Engine Model	**3512B EUI**		**3512C HD-EUI**		**3516C HD**	
Number of Cylinders	**12**		**12**		**16**	
Bore	170 mm	**6.7"**	170 mm	**6.7"**	170 mm	**6.7 in**
Stroke	190 mm	**7.5"**	215 mm	**8.46"**	210 mm	**8.3 in**
Displacement	51.8 L	**3158 in^3**	58.56 L	**3574 in^3**	78.1 L	**4766 in^3**
Net Power	979 kW	**1313 hp**	979 kW	**1313 hp**	1468 kW	**1969 hp**
Gross Power	1082 kW	**1450 hp**	1082 kW	**1450 hp**	1566 kW	**2100 hp**
Standard Tires	**33.00R51**		**33.00R51**		**37.00R57**	
Machine Clearance Turning Circle	30.6 m	**100'5"**	33.2 m	**108'11"**	30.23 m	**99'2"**
Fuel Tank Refill Capacity	1893 L	**500 U.S. gal**	1893 L	**500 U.S. gal**	2082 L	**550 U.S. gal**
Top Speed (Loaded)	56.5 km/h	**35.1 mph**	56.5 km/h	**35.1 mph**	57.2 km/h	**35.5 mph**
GENERAL DIMENSIONS (Empty):						
Height to Canopy Rock Guard Rail	5.77 m	**19'0"**	5.68 m	**18'7"**	6.50 m	**21'4"**
Wheelbase	5.18 m	**17'0"**	5.18 m	**17'0"**	5.70 m	**18'8"**
Overall Length (Base Body)	11.02 m	**36'3"**	11.55 m	**37'9"**	12.72 m	**41'9"**
Loading Height (Base Body)	4.97 m	**16'4"**	4.97 m	**16'4"**	5.60 m	**18'4"**
Height at Full Dump	11.21 m	**36'10"**	11.81 m	**38'9"**	13.20 m	**43'4"**
Body Length (Target Length)	7.65 m	**25'2"**	7.65 m	**25'2"**	8.29 m	**27'3"**
Width (Operating)	6.64 m	**21'10"**	7.06 m	**23'2"**	7.65 m	**25'1"**
Width (Shipping)****	3.91 m	**12'10"**	3.91 m	**12'10"**	3.84 m	**12'7"**
Front Tire Tread	4.85 m	**15'11"**	4.85 m	**15'11"**	5.37 m	**17'8"**

*See Weight Definitions and Relations on page 18 of this section. Note: No mandatory or optional attachments or fuel.
**Typical selection of mandatory and optional attachments.
***Data provided is for a representative body and liner package. Several dual slope, flat floor, and mine specific design (MSD) bodies and liner packages are available. All weights, capacities, and dimensions are dependent on the machine configuration (body type, attachments, tires, and optional equipment selected).
****Disassembled.
§Reference Caterpillar's latest 10/10/20 Payload Policy for information on gross machine operating weight and target payload.
NOTE: Contact Mining Representative to use Caterpillar Weight Configurator for application specific weights.

USE OF BRAKE PERFORMANCE CURVES

The speed that can be maintained when the machine is descending a grade with retarder applied can be determined from the retarder curves in this section when gross machine weight and total effective grade are known. Select appropriate grade distance chart that covers total downhill haul; don't break haul into individual segments.

To determine brake performance: Read from gross weight down to the percent effective grade. (Effective grade equals actual % grade *minus* 1% for each 10 kg/metric ton (20 lb/U.S. ton) of rolling resistance.) From this weight-effective grade point, read horizontally to the curve with the highest obtainable speed range, then down to maximum descent speed brakes can safely handle without exceeding cooling capacity. When braking, engine RPM should be maintained at the highest possible level without overspeeding. If cooling oil overheats, reduce ground speed to allow transmission to shift to next lower speed range.

Brake Performance Curves are made in compliance with ISO 10268 and applicable to Sea Level and 32° C (90° F) temperature. Contact Factory for Application Specific Performance.

USE OF RIMPULL-SPEED-GRADEABILITY CURVES

For best results, use Caterpillar Fleet Production and Cost Analysis (FPC) to simulate cycle time, fuel burn, and production for Application Specific Performance inquiries. Contact Factory Representative or visit catminer.cat.com/stb for more information.

(See Wheel Tractor Scraper Section)

Total Effective Grade (or Total Resistance) is grade assistance *minus* rolling resistance.

10 kg/metric ton (20 lb/U.S. ton) = 1% adverse grade.

Example —

With a favorable grade of 20% and rolling resis- tance of 50 kg/metric ton (100 lb/U.S. ton), find Total Effective Grade.

(50 kg/metric ton) = 50 ÷ 10 = 5% Effective Grade
(from Rolling Resistance)
100 lb/ton = 100 ÷ 20 = 5% Effective Grade
20% (grade) – 5% (resistance) =
15% Total Effective Grade

TYPICAL FIXED TIMES FOR HAULING UNITS

Wait time, delays and operator efficiency all impact cycle time. Minimizing truck exchange time can have a significant effect on productivity.

Fixed time for hauling units include:
1. Truck load time (various with loading tool)
2. Truck maneuver in load area (Truck exchange) (Typically 0.6-0.8 min.)
3. Maneuver and dump time at dump point (Typically 1.0-1.2 min.)

Total cycle time is the combination of:
1. The above fixed time
2. Hauling time (Loaded)
3. Return time (Empty)

Example — assume load tool spots hauler with full bucket

		988F	5130B
cycle times		.60	.45
First pass	(dump time)	.10 min.	.05 min.
2 passes	(full cycle)	.70	.50
3 passes	"	1.30	.95
4 passes	"	1.90	1.40
5 passes	"	2.50	1.85
6 passes	"	3.10	2.30
7 passes	"	3.70	2.75
8 passes	"	4.30	3.20
9 passes	"	4.90	3.65
10 passes	"	5.40	4.10

NOTE: Other sizes of loading tools will have different cycle times. See Wheel Loader section for **average** cycle times for truck loading.

MOTOR GRADERS

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INDUSTRIES SERVED

The motor grader is one of the most versatile work tools in the Cat® product line. The M Series machines are used in numerous applications within a wide range of industries. The major industries using Cat motor graders, along with the typical applications within each, are summarized below.

- **Heavy Construction**
  - Highway Construction
  - Paving/Resurfacing
  - Airport Construction
  - Railroad Construction
  - Dam and Levee Construction
  - Haul Road Maintenance
- **Governmental**
  - Road Maintenance
  - Road Construction
  - Ditch Building/Cleaning
  - Snow Removal
- **Building Construction**
  - Residential Construction
  - Commercial Construction
  - Industrial Construction
  - Sewer and Water Systems
- **Industrial**
  - Waste Disposal
  - Pipeline Construction
- **Mining**
  - Haul Road Maintenance
  - Snow Removal
- **Forestry**
  - Access Road Construction
  - Forest Development
  - Snow Removal
  - Haul Road Maintenance
- **Geographic Versions —** Cat motor graders were specifically designed to meet the needs of different geographic regions and regulations. K/K2 Series for less regulated locations and M/M2/M3 Series are available with an assortment of standard features and optional equipment. All motor graders feature advanced electronically controlled Cat engines, power train components, hydraulics and machine structures.

FEATURES, M Series Motor Graders:

Building on the strong heritage of the H Series, the M Series delivers multiple technological breakthroughs, setting the new standard for motor graders. The H Series has been the industry standard in a variety of heavy construction, mining, road building and governmental applications. The M Series continues this tradition, incorporating revolutionary, customer-driven enhancements by:

- Improving ease of operation and operation training time
- Offering best-in-class operator station and unmatched visibility
- Delivering maximum productivity
- Improving availability and decreasing maintenance time

The M Series line includes eleven models: 120, 120 AWD, 140, 140 AWD, 160, 160 AWD, 12, 12 AWD, 14, 16, 24. The 120 through 14 meet construction, road building, and governmental applications. The All Wheel Drive models improve traction in poor underfoot conditions such as snow, mud, and sand. The 16 and 24 meet the specialized needs of large mining customers.

- **Operation Station:** The 120 through 16 models feature a revolutionary cab design that provides unmatched comfort, visibility, storage and ease of use, which can enhance operator confidence and productivity. The interior noise level is maintained between 70 and 74 dB(A) with the doors and windows closed.

  Ease of Operation. The revolutionary joystick controls and exceptional visibility make operating easier without sacrificing control. The intuitive joystick control pattern allows both new and experienced operators to become productive quickly. Logical grouping of hydraulic functions in the joysticks allow any operator to easily control several functions at the same time. This allows the operator to be more productive and remain comfortable throughout the work shift.

  Advanced Joystick Controls. Two electro-hydraulic joysticks reduce hand and wrist movement as much as 78% compared to conventional lever controls for greatly enhanced operator efficiency. The intuitive pattern is easy to learn and provides the precise implement control to allow both new and experienced operators to become productive quickly. Logical grouping of hydraulic functions in the joysticks allow any operator to control several functions at the same time for more productivity.

  Visibility. The 120 through 16 models boast excellent visibility to the work area, made possible with angled cab doors, a tapered engine enclosure and a patented sloped rear window. Ample glass area and carefully placed components provide excellent visibility to enhance operator confidence and productivity in all motor grader applications. The cab design gives the operator an exceptional view forward to the blade, working surface and front tires. The black glare-reducing paint on the front frame and engine enclosure enhances visibility.

- **Drawbar, Circle and Moldboard:** The 120 through 16 models provide a broad range of extended blade positions particularly beneficial in mid-range bank sloping, ditch cutting and ditch cleaning. A long wheel base allows for an aggressive blade angle permitting material to roll more freely, reducing power requirements. Top-accessible drawbar wear inserts and the shimless moldboard retention system make DCM adjustments fast and simple, delivering more precise material control while lowering operating costs.

  Top-Adjust Drawbar Wear Strips. The patented top-adjust wear strips dramatically reduce drawbar/circle adjustment time. By removing the access plates on top of the drawbar, shims and wear strips can easily be added or replaced. This feature reduces service downtime and lowers overall machine operating costs.

  Shimless Moldboard Retention System. The unique shimless moldboard retention system reduces the potential for blade chatter. Adjusting screws keep the moldboard's wear strips aligned for precise blade control and dramatic reductions in service time.

- **Power Train:** Integrated, electronically controlled systems, deliver smooth reliable performance with reduced operating costs.

  Smooth Shifting Transmission. The transmission design combines several key innovations to ensure smooth, powerful shifts throughout the gear range.

  Advanced Productivity Electronics Control Strategy (APECS). APECS utilizes an electronic control strategy to read the input from sensors to shift the transmission at the optimal point. Event based shifting allows operators to experience faster, smoother and more consistent shifts. Note: M Series 3 Only.

  Electronically Controlled Shifting. The full Electronic Clutch Pressure Control (ECPC) system optimizes inching modulation and smoothes shifting between all gears and directional changes. This provides outstanding control and also extends the life of the transmission by reducing stress on gears.

  Load Compensation. This standard feature ensures consistent shift quality regardless of blade or machine load.

  Hydraulic Brakes. The oil bathed, multi-disc service brakes are hydraulically actuated, providing smooth predictable braking and lower operating costs. With brakes located at each tandem wheel, the Cat motor graders offer the largest total brake surface area in the industry, delivering dependable stopping power and longer brake life.

- **Engine:** The Cat motor grader combines power management with ACERT™ Technology to deliver maximum power and efficiency while reducing the environmental impact.

  ACERT Technology. ACERT Technology allows Cat engines to supply more power per unit of displacement without causing premature wear. This breakthrough technology reduces emissions during the combustion process by using advanced technology in the air and fuel systems, in conjunction with integrated electronics. ACERT Technology enhances overall engine performance while dramatically reducing exhaust emissions.

  Power Management. Power Management utilizes Variable Horse Power (VHP) and Variable Horse Power Plus (VHP Plus) to optimize motor grader performance. VHP delivers additional power in the working gear while balancing fuel consumption, traction and horsepower. VHP Plus, delivers additional power in each forward gear 5th through 8th for increased speed on grade and performance.

  Exhaust Emission Standards. The Cat ACERT Technology engines in the M Series Motor Graders meet U.S. EPA Tier 3/EU Stage IIIA equivalent/Japan 2006 (Tier 3) emission standards. The M Series 2 machines meet U.S. EPA Tier 4 Interim/EU Stage IIIB/Japan 2011 (Tier 4 Interim) equivalent emission standards. The M Series 3 machines meet U.S. EPA Tier 4 Final/EU Stage IV/Japan 2014 (Tier 4 Final) emission standards.

- **Hydraulics:** Electro-hydraulics enable advanced machine controls with precise and predictable movements.

  Advanced Electro-Hydraulic System. The Cat motor grader product line incorporates a state-of-the-art electro-hydraulic system. This technology is the foundation for revolutionary changes of the machine and implement controls. Advanced joystick controls provide unmatched controllability with precise, predictable hydraulic movements and the reliability you expect from Cat products.

  Load Sensing Hydraulics (PPPC). The time proven load-sensing system and the advanced Proportional Priority Pressure-Compensating (PPPC, or "triple-PC") electro-hydraulic valves are designed to provide superior implement control and enhanced machine performance in all applications. Continuous matching of hydraulic flow and pressure to power demands creates less heat and reduces power consumption.

- **Serviceability:**

  Grouped Service Points. Grouped daily service points in the left side service center help ensure proper maintenance and inspection routines.

  Extended Service Intervals. Extended service intervals, such as 500-hour engine oil changes and 4000-hour hydraulic oil changes, reduce machine service time and increase availability.

  Ecology Drains. Conveniently located ecology drains shorten service times and help keep the environment safe by preventing spills.

  Diagnostics and Monitoring. Cat Messenger and Cat Message are offered as standard equipment to enhance diagnostic capabilities by displaying machine system errors and fault codes. Cat Electronic Technician is a two way communication tool that provides easy access to stored diagnostic data and lets technicians configure machine parameters through the Cat Data Link. Product Link™ provides a communication flow of vital machine data and location. Cat motor graders integrate Cat Messenger, Cat Electronic Technician, and S•O•S℠ analysis for easy monitoring and fast troubleshooting, keeping your machine up and running. Note: Cat Messenger is standard on M Series and M Series 2 only. Cat Message is standard on M Series 3 only.

- **Safety.** Safety is an integral part of all machine and system designs. Cat motor graders provide a safe working environment for both the operator and ground personnel. ROPS and FOPS structures meeting current SAE and ISO requirements are standard on all Global machines. Back-up alarms are a standard feature.

  Operator Presence System. The Operator Presence System keeps the parking brake engaged until the operator is seated for safe operation.

  Secondary Steering System. The standard secondary steering system automatically engages in case of a drop in steering pressure, allowing the operator to steer the machine to a stop.

  Speed Sensitive Steering. The steering software automatically provides an infinitely variable ratio between the joystick and the steer tires, resulting in less sensitive steering as the groundspeed increases.

  Hydraulic Lockout. A simple switch located in the cab disables all implement functions while still providing machine steering control. This safety feature is especially useful while the machine is roading.

  Circle Drive Slip Clutch. This standard feature protects the drawbar, circle and moldboard from shock loads when the end of the blade encounters immovable objects. It also reduces the possibility of abrupt directional changes in poor traction conditions, protecting the machine, operator and surroundings.

  Blade Lift Accumulators. This optional feature uses accumulators to help absorb impact loads to the moldboard by allowing vertical blade travel. Blade lift accumulators reduce unnecessary wear and help to avoid unintended machine movement for increased operator safety.

  Drop-Down Rear Lights. Optional drop-down lights fold out from the rear of the machine. This creates a wider, lower profile, to be better aligned with passenger cars.

  Rearview Camera. Visibility is further enhanced with an optional Work Area Vision System (WAVS) LCD color monitor in the cab.

- **Automatic Differential Lock/Unlock.** The Auto Diff-Lock feature automatically unlocks the differential during a turn, re-locks when straight, for easier operation and improved power train protection.

- **Swing Out Cooling Fan.** This standard feature allows for easy access to the cooling cores reducing time required for clean out. The latched door requires no tools for opening and closing. Note: M Series 2 and M Series 3 Only.

APPLICATIONS, Motor Graders:

The broad line of Cat motor graders allows the customer to choose a motor grader that best fits the intended application. Below is a summary of the typical motor grader applications.

Finish Grading

This application involves preparing a roadway or site surface for future paving or other construction activity. The material being moved is usually a hard, dry base material on a solid underfoot. Finish blading is the motor grader application that requires the highest degree of accuracy. Thus, it is primarily done at low operating speeds — usually less than 5 km/h (3 mph)
— in gears 1 and 2. To ensure a smooth, even finished surface, one gear is usually maintained for a given pass. Pass lengths during this application are usually less than 600 m (2000 feet) for road construction and 150 m (500 feet) for site development. Most finish blading is performed by contractors in the Heavy Construction and Building Construction industries.

Heavy Blading

This application involves cutting, moving, and mixing material, usually in the initial stages of surface preparation. A variety of material types are moved in this manner, and the blade tip position varies accordingly. Full blade loads are usually experienced during heavy blading, since moving material is the primary goal. Pass lengths within this application vary, but are usually less than 600 m (2000 feet). Unlike finish blading, the speed of the machine is dependent on the load being moved when heavy blading material. Typical operating speeds are from 0-10 km/h (0 to 6 mph). Therefore, gears 2 through 4 are frequently used in this application. Most heavy blad- ing activity is performed by contractors in the Heavy Construction, Governmental, Industrial, and Forestry industries.

Site Preparation

This application involves any material cutting, moving, and mixing necessary to prepare a residential, commercial, or industrial site for construction. A variety of materials are encountered in this application. Blade loads vary depending on the activity being performed. Both heavy blading and finish blading are performed when preparing a site. Pass lengths are typically in the range of 30-300 m (100 to 1000 feet). Typical operating speeds for site preparation vary depending on whether heavy blading or finish blading activities are being performed. Most site preparation activities are performed by contractors in the Building Construction industry.

Road Maintenance

This application involves reshaping dirt or gravel roads to maintain a crown or superelevation, or restoring the surface itself. This generally involves secondary roads maintained by governmental bodies such as townships and counties. Materials being moved in this application vary from extremely hard dirt bases to moist gravel surfaces. The typical blade load falls between that of finish blading and heavy blading. Pass lengths are frequently longer than 600 m (2000 feet) and can extend for miles. The general speed range for this application is 5-16 km/h (3 to 10 mph), correspond- ing to gears 2 (heavy dirt) through 5 (soft gravel). As with finish blading, accuracy of the graded surface is the primary concern in this application. Thus, frequent shifts should be avoided whenever possible. A gear should be chosen and maintained unless there is a sig- nificant change in the material being moved. Most road maintenance activities are performed by the Govern- mental industry.

Haul Road Maintenance

This application of the motor grader involves reshaping haul roads at mining, construction, or forestry work sites, usually for the purpose of maintaining smooth travel surfaces for equipment. Materials being moved while maintaining haul roads vary widely. Typical blade loads are about one-third to half of full capacity. Haul roads that experience large hauling units travelling on soft material may require heavy blade loads in order to reshape the road surface. Pass lengths vary depending on the application but can extend for miles on remote forestry or large mine haul roads. The general speed range for haul road maintenance is heavily dependent on the material being moved as well as the grade of the haul road. Many mine sites are in mountainous areas, requiring haul roads with steep grades. Generally, haul-road maintenance is performed at speeds similar to those required for general road maintenance 5-16 km/h (3 to 10 mph).

A travel surface that allows for the safe and efficient movement of machinery is the ultimate goal with this motor grader application. Very precise roadway elevations and slopes are desired but less crucial than when finish blading. Most haul road maintenance activities are performed by the Mining, Heavy Construction, and Forestry industries.

Side/Bank Slope Work

This application involves preparing side slopes or bank slopes along roadways by placing the moldboard on a sloped surface. Slopes of up to a 2:1 angle can be cut using a motor grader. Often the motor grader is operated on the level surface adjacent to the slope, and the moldboard is extended outward to the sloped surface. Fine soils are generally encountered in this application of the motor grader. Blade loads are usually less than half of the full blade capacity, and pass lengths are seldom longer than 600 m (2000 feet). A smooth-graded sloped surface is the primary concern in this application so frequent shifts should be avoided. The typical speed range is 0-6 km/h (0 to 4 mph), corresponding to a gear selection of 1 to 3. The nominal speed is heavily dependent on the type of material being moved and on the slope of the surface. Most side/bank slope work is performed by the Heavy Construction and Governmental industries.

Ditch Building/Cleaning

This application involves cutting “V” and flat-bottom ditches for drainage purposes and rebuilding them when necessary. Due to excessive rain and/or poor material, ditches often need cleaning and reshaping. When building ditches, materials with a wide range of densities are encountered. Blade loads vary accordingly, from half to full-blade capacity. Pass lengths are usually less than 600 m (2000 feet). The primary objective is to move material in a manner that yields a ditch with the desired slope. Ditch building often involves cutting and moving material of high density. Therefore, typical speed ranges vary. Most ditch building work, however, is performed in gears 1 through 3, corresponding to a maximum speed of about 8 km/h (5 mph). Ditch cleaning usually involves blading moist materials underneath a sod cover. Blade loads are usually less than half of full blade capacity when cleaning ditches, and pass lengths are similar to those encountered in ditch building. Typical maximum speeds for this activity are similar to that of ditch building, but less of a blade load is experienced. Ditch building and cleaning activities are usually performed by the Heavy Construction and Governmental industries.

Ripping/Scarifying

This application involves conditioning hard, rough soils before they are bladed. Shanks on the ripper and/ or scarifier are pushed into the ground, thus breaking up otherwise hard surfaces. Hard materials such as asphalt can also be loosened in order to make grading operations less damaging to the moldboard. Rippers and scarifiers can also be used to mix aggregates together. The materials being ripped/ scarified are usually hard and dry. Rippers generally penetrate 150-300 mm (6 to 12 inches) into the ground, while scarifiers typically penetrate to a depth of 25-200 mm (1 to 8 inches). Pass lengths are generally less than 600 m (2000 feet) for both activities. Since the material being ripped/scarified is generally hard, the typical maximum speed for this application is about 6 km/h (4 mph) gears 1-2. If the ripper/scarifier is used for mixing aggregates, the typical operating range becomes 6-20 km/h (4 to 12 mph) gears 3-6. Most ripping/scarifying activities are performed by the Heavy Construction and Governmental industries.

Snow Removal

Snow removal is the process of cutting and removing snow or ice from the roadway. In addition to the standard motor grader moldboard, other attachments such as a snow wing, V-plow, one-way plow, or reversible plow can be used to remove the snow. The moldboard itself is the most commonly used attachment for snow plowing. It is used in areas where snow depths are low, the terrain is relatively flat, and where excessive drifting does not occur. A snow wing is a moldboard that attaches to the machine's right side. The wing's curvature lifts the snow and "wings" it off the plowed surface. The snow wing is often used in conjunction with the stan- dard moldboard, where the moldboard cuts the mate- rial and feeds it onto the wing. V-plows are mounted in front of the motor grader and are designed to dig into and lift packed snow. The typical speed range for snow removal is 10-30 km/h (6 to 18 mph), corresponding to a gear range of 3 to 7. Snow plowing often involves lower speeds than snow removal. The typical operating range for snow plowing is 8-19 km/h (5 to 12 mph) gears 2 to 4. The majority of Snow Removal/Plowing operations are performed by the Governmental, Mining, and Forestry industries.

TRUCK TO MOTOR GRADER MATCH

	740	770	775	777	785	789	793	797
12/140/160								
14								
16								
18								
24								

NOTE: Calculations based on 30 degree blade angle, standard moldboard width.
May not be applicable in all applications depending on haul road damage.
Rule of thumb 2.5 times the truck width.

MODEL	14M3		16M3	
Base Power — Net	178 kW	**238 hp**	216 kW	**290 hp**
VHP Range — Net	178-213 kW	**238-285 hp**	216-259 kW	**290-348 hp**
VHP Plus Range — Net	180-215 kW	**241-289 hp**	—	
Operating Weight*	25 968 kg	**57,250 lb**	32 411 kg	**71,454 lb**
Engine Model	**C13 ACERT**		**C13 ACERT**	
Rated Engine RPM	**1850**		**2000**	
No. of Cylinders	**6**		**6**	
Displacement	12.5 L	**763 in³**	12.5 L	**763 in³**
Max. Torque:				
Tier 4 Final[1]	1542 N·m	**1137 lb-ft**	1771 N·m	**1306 lb-ft**
Tier 2 and Tier 3 Equivalent[2]	1542 N·m	**1137 lb-ft**	1721 N·m	**1270 lb-ft**
No. of Speeds Forward/Reverse	**8/6**		**8/6**	
Top Speed: Forward	50.5 km/h	**31.4 mph**	51.7 km/h	**32.1 mph**
Reverse	39.9 km/h	**24.8 mph**	40.8 km/h	**25.3 mph**
Std. Tires — Front and Rear	**20.5R25**		**23.5R25**	
Front Axle/Steering:				
Oscillation Angle	**32°**		**35°**	
Wheel Lean Angle — Left/Right	**17.1°/17.1°**		**18°/17°**	
Steering Angle	**50°**		**47.5°**	
Articulation Angle	**20°**		**20°**	
Minimum Turning Radius**	7.9 m	**25'11"**	9.3 m	**30'6"**
No. Circle Support Shoes	**6**		**6**	
Hydraulics:				
Pump Type	**Variable Piston**		**Variable Piston**	
Max. Pump Flow	257 L/min	**68 gpm**	280 L/min	**74 gpm**
Tank Capacity	64 L	**16.9 U.S. gal**	70 L	**18.5 U.S. gal**
Implement Pressure: Max.	24 100 kPa	**3495 psi**	24 750 kPa	**3590 psi**
Min.	3400 kPa	**493 psi**	3400 kPa	**493 psi**
Interior Sound Level/SAE J919:				
Tier 4 Final/EU Certified[1]	**73 dB(A)**		**71 dB(A)**	
Tier 2 and Tier 3 Equivalent[2]	**73 dB(A)**		**72 dB(A)**	
Electrical:				
System Size	**24V**		**24V**	
Std. Battery CCA @ 0° F	**1125**		**1400**	
Std. Alternator	**150**		**150**	
GENERAL DIMENSIONS:				
Height (to top of ROPS)	3566 mm	**140.4"**	3719 mm	**146.4"**
Overall Length	9677 mm	**381"**	10 593 mm	**417"**
With Ripper and Pushplate	10 899 mm	**429.1"**	12 051 mm	**474.4"**
Wheelbase	6616 mm	**260.5"**	7365 mm	**290"**
Blade Base	2880 mm	**113.4"**	3066 mm	**120.7"**
Overall Width (at top of front tires)	3050 mm	**120.1"**	3411 mm	**134.3"**
Standard Blade: Length	4267 mm	**14'0"**	4877 mm	**16'0"**
Height	585 mm	**23.0"**	787 mm	**31.0"**
Thickness	25.4 mm	**1.0"**	25 mm	**1.0"**
Lift Above Ground	438 mm	**17.2"**	400 mm	**15.7"**
Max. Shoulder Reach:***				
Frame Straight — Left	3460 mm	**136.2"**	2311 mm	**91"**
Frame Straight — Right	3350 mm	**131.9"**	2311 mm	**91"**
Fuel Tank Capacity	416 L	**109.9 U.S. gal**	496 L	**131 U.S. gal**

*__Operating Weight__ — based on standard machine configuration with full fuel tank, coolant, lubricants and operator.
**__Minimum Turning Radius__ — combining the use of articulated frame steering, front wheel steer and unlocked differential.
***Applicable for the standard blade with hydraulic sideshift and tip control. Maximum shoulder reach is obtainable to the right.
[1]Meets Tier 4 Final/Stage IV/Japan 2014 (Tier 4 Final) emission standards.
[2]Meets Tier 2/Stage II/Japan 2001 (Tier 2) equivalent and Tier 3/Stage IIIA/Japan 2006 (Tier 3) equivalent emission standards.

TRAVEL SPEEDS @ MAXIMUM RPM WITH STD. TIRES (M/M2/M3 SERIES)

Gear		1		2		3		4		5		6		7		8	
		km/h	mph	km/h	mph	km/h	mph	km/h	mph	km/h	mph	km/h	mph	km/h	mph	km/h	mph
120M	Forward	4.1	**2.6**	5.6	**3.5**	8.2	**5.1**	11.2	**7.0**	17.5	**10.8**	23.7	**14.8**	32.7	**20.3**	47.5	**29.5**
	Reverse	3.3	**2.0**	6.1	**3.8**	8.9	**5.5**	13.8	**8.6**	25.8	**16.0**	37.5	**23.3**	—	**—**	—	**—**
120M2	Forward	4.0	**2.5**	5.4	**3.4**	7.8	**4.8**	10.8	**6.7**	16.8	**10.4**	22.8	**14.2**	31.4	**19.5**	45.7	**28.4**
	Reverse	3.1	**1.9**	5.9	**3.9**	8.5	**5.3**	13.2	**8.2**	24.8	**15.4**	36.1	**22.4**	—	**—**	—	**—**
12M	Forward	4.0	**2.5**	5.5	**3.4**	8.0	**5.0**	11.0	**6.8**	17.1	**10.6**	23.3	**14.5**	32.0	**19.9**	46.6	**29.0**
	Reverse	3.2	**2.0**	6.0	**3.7**	8.7	**5.4**	13.5	**8.4**	25.3	**15.7**	36.8	**22.9**	—	**—**	—	**—**
12M2	Forward	4.1	**2.5**	5.5	**3.4**	8.0	**5.0**	11.0	**6.9**	17.1	**10.6**	23.3	**14.5**	32.0	**19.9**	46.6	**29.0**
	Reverse	3.2	**2.0**	6.0	**3.7**	8.7	**5.4**	13.5	**8.4**	25.3	**15.7**	36.8	**22.9**	—	**—**	—	**—**
12M3	Forward	4.1	**2.5**	5.5	**3.4**	8.0	**5.0**	11.0	**6.9**	17.1	**10.6**	23.3	**14.5**	32.0	**19.9**	46.6	**29.0**
	Reverse	3.2	**2.0**	6.0	**3.7**	8.7	**5.4**	13.5	**8.4**	25.3	**15.7**	36.8	**23.0**	—	**—**	—	**—**
140M	Forward	4.0	**2.5**	5.5	**3.4**	8.0	**5.0**	11.0	**6.9**	17.1	**10.6**	23.3	**14.5**	32.0	**19.9**	46.6	**29.0**
	Reverse	3.2	**2.0**	6.0	**3.7**	8.7	**5.4**	13.5	**8.4**	25.3	**15.7**	36.8	**22.9**	—	**—**	—	**—**
140M2	Forward	4.1	**2.5**	5.5	**3.4**	8.0	**5.0**	11.0	**6.9**	17.1	**10.6**	23.3	**14.5**	32.0	**19.9**	46.6	**29.0**
	Reverse	3.2	**2.0**	6.0	**3.7**	8.7	**5.4**	13.5	**8.4**	25.3	**15.7**	36.8	**22.9**	—	**—**	—	**—**
140M3	Forward	4.1	**2.5**	5.5	**3.4**	8.0	**5.0**	11.0	**6.9**	17.1	**10.6**	23.3	**14.5**	32.0	**19.9**	46.6	**29.0**
	Reverse	3.2	**2.0**	6.0	**3.7**	8.7	**5.4**	13.5	**8.4**	25.3	**15.7**	36.8	**23.0**	—	**—**	—	**—**
160M	Forward	4.1	**2.5**	5.6	**3.5**	8.1	**5.0**	11.2	**7.0**	17.4	**10.8**	23.7	**14.7**	32.6	**20.3**	47.4	**29.5**
	Reverse	3.3	**2.0**	6.1	**3.8**	8.8	**5.5**	13.7	**8.5**	25.7	**16.0**	37.4	**23.3**	—	**—**	—	**—**
160M2	Forward	4.1	**2.6**	5.6	**3.5**	8.1	**5.1**	11.2	**7.0**	17.4	**10.8**	23.7	**14.7**	32.6	**20.3**	47.4	**29.5**
	Reverse	3.3	**2.0**	6.1	**3.8**	8.9	**5.5**	13.7	**8.5**	25.7	**16.0**	37.4	**23.3**	—	**—**	—	**—**
160M3	Forward	4.1	**2.6**	5.6	**3.5**	8.1	**5.1**	11.2	**7.0**	17.4	**10.8**	23.7	**14.7**	32.6	**20.3**	47.4	**29.5**
	Reverse	3.3	**2.0**	6.1	**3.8**	8.8	**5.5**	13.7	**8.5**	25.7	**16.0**	37.4	**23.3**	—	**—**	—	**—**
14M3	Forward	4.4	**2.7**	5.9	**3.7**	8.6	**5.3**	11.8	**7.4**	18.4	**11.4**	24.9	**15.5**	34.3	**21.3**	49.9	**31.0**
	Reverse	3.4	**2.1**	6.4	**4.0**	9.4	**5.8**	14.5	**9.0**	27.0	**16.8**	39.4	**24.5**	—	**—**	—	**—**
16M3	Forward	4.5	**2.8**	6.1	**3.8**	8.9	**5.5**	12.3	**7.6**	19.0	**11.8**	25.8	**16.0**	35.5	**22.0**	51.7	**32.1**
	Reverse	3.6	**2.2**	6.6	**4.1**	9.7	**6.0**	15.0	**9.3**	28.0	**17.4**	40.8	**25.3**	—	**—**	—	**—**
18M3	Forward	4.5	**2.8**	6.1	**3.8**	8.9	**5.5**	12.3	**7.6**	19.0	**11.8**	25.8	**16.0**	35.5	**22.0**	51.7	**32.1**
	Reverse	3.6	**2.2**	6.6	**4.1**	9.7	**6.0**	15.0	**9.3**	28.0	**17.4**	40.8	**25.3**	—	**—**	—	**—**
24M	Forward	3.7	**2.3**	5.7	**3.6**	9.7	**6.0**	15.1	**9.4**	28.0	**17.4**	43.4	**27.0**	—	**—**	—	**—**
	Reverse	5.5	**3.4**	14.5	**9.0**	41.6	**25.8**	—	**—**	—	**—**	—	**—**	—	**—**	—	**—**

NOTE: 120M speeds were calculated with a 628 mm **(24.7")** tire at 2000 rpm rated speed.
120M2 speeds were calculated with a 620 mm **(24.4")** tire at high idle, 2150 rpm.
12M2-160M2 speeds were calculated with a 655 mm **(25.8")** tire at high idle, 2150 rpm.
12M3-160M3 speeds were calculated with a 655 mm **(25.8")** tire at 2000 rpm rated speed.

PRODUCTION

The motor grader is used in a variety of applications in a variety of industries. Therefore, there are many ways to measure its operating capacity, or production. One method expresses a motor grader's production in relation to the area covered by the moldboard.

Formula:

$$A = S \times (L_e - L_o) \times 1000 \times E \quad \text{(Metric)}$$
$$A = S \times (L_e - L_o) \times 5280 \times E \quad \text{(English)}$$

where A: Hourly operating area (m^2/h or ft^2/h)
S: Operating speed (km/h or mph)
L_e: Effective blade length (m or ft)
L_o: Width of overlap (m or ft)
E: Job efficiency

Operating Speeds:

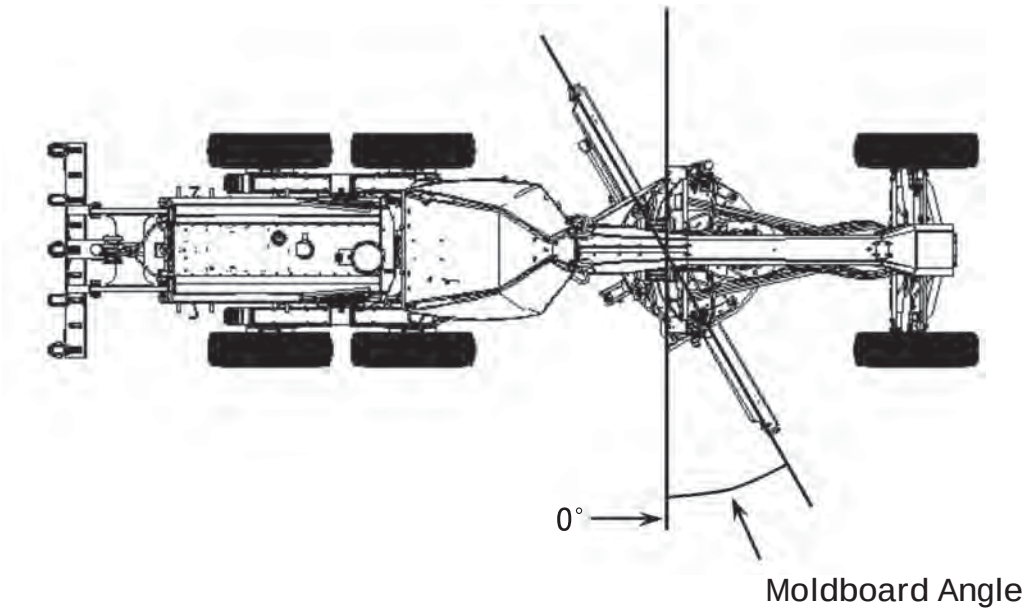
Typical operating speeds by application

Finish Grading:	0-4 km/h	(0-2.5 mph)
Heavy Blading:	0-9 km/h	(0-6 mph)
Ditch Repair:	0-5 km/h	(0-3 mph)
Ripping:	0-5 km/h	(0-3 mph)
Road Maintenance:	5-16 km/h	(3-9.5 mph)
Haul Road Maintenance:	5-16 km/h	(3-9.5 mph)
Snow Plowing:	7-21 km/h	(4-13 mph)
Snow Winging:	15-28 km/h	(9-17 mph)

Effective Blade Length:

Since the moldboard is usually angled when moving material, an effective blade length must be computed to account for this angle. This is the actual width of material swept by the moldboard.

NOTE: Angles are measured as shown below. The effective length becomes shorter as the angle increases.



Moldboard Length, m (ft)	Effective Length, m (ft) 30 degree blade angle	Effective Length, m (ft) 45 degree blade angle
3.658 **(12)**	3.17 **(10.4)**	2.59 **(8.5)**
4.267 **(14)**	3.70 **(12.1)**	3.02 **(9.9)**
4.877 **(16)**	4.22 **(13.9)**	3.45 **(11.3)**
7.315 **(24)**	6.33 **(20.8)**	5.17 **(17.0)**

For other blade lengths and carrying angles:
Effective length = COS [Radians (Blade L)] 3 Blade Length

Width of Overlap:

The width of overlap is generally 0.6 m (2.0 ft). This overlap accounts for the need to keep the tires out of the windrow on the return pass.

Job Efficiency:

Job efficiencies vary based on job conditions, operator skill, etc.

A good estimation for efficiency is approximately 0.70 to 0.85, but actual operating conditions should be used to determine the best value.

Example problem:

A Cat motor grader with a 3.66 m (12 ft) moldboard is performing road maintenance on a township road. The machine is working at an average speed of 13 km/h (8 mph) with a moldboard carry angle of 30 degrees. What is the motor grader's production based on coverage area?

Note: Due to the long passes involved in road maintenance — fewer turnarounds — a higher job efficiency of 0.90 is chosen.

Solution:

From the table, the effective blade length is 3.17 m (10.4 ft).

Metric

Production, A = 13 km/h × (3.17 m − 0.6 m) × 1000 × 0.90
= **30 069 m²/hr (3.07 hectares/hr)**

English

Production, A = 8 mph × (10.4 ft − 2.0 ft) × 5280 × 0.90
= **319,334 ft²/hr (7.33 acres/hr)**

To pinpoint the theoretical number of motor graders required to properly maintain your haul roads, based on your specific mining applications, please download the haul road maintenance calculator on *https://catminer.cat.com.*

Haul road maintenance impacts cycle time, tire, frame and drive train components, safety and ultimately your cost per ton. To achieve optimal truck productivity, your haul roads must be properly maintained.

Moderate:
- Road Maintenance
- Pad Cleaning
- Rock Clearing
- Shoulder Sweeping

Difficult:
- Ripping
- Spreading Dump Material
- Road Profiling/Reshaping

BLADE PULL

This specification is also known as drawbar pull. This spec can be calculated as follows:

Variables:

Rear weight of machine = Wr

Tire traction coefficient = T (Look up the table entitled "Coefficient of Traction Factors")

Wr × T = Blade Pull

Example problem:

Calculate the blade pull for a 140M Global Version version machine operating in a quarry pit...

Metric

RW = 10 501 kg

T = 0.65

10 501 × 0.65 = 6825.65

English

RW = 23,151 lb

T = 0.65

23,151 × 0.65 = 15,048.15

BLADE DOWN PRESSURE

This spec can be calculated as follows:

Variables:

Blade to front axle length = BA

Wheel base length = WB

Weight on front wheels = FW

Blade down pressure = BD

$$\frac{\mathbf{WB}}{\mathbf{(WB - BA)}} \times \mathbf{FW = BD}$$

Example problem:

Calculate the blade down pressure for a 140M Global Version version machine...

Metric

BA = 2565 mm FW = 4223 kg

WB = 6086 mm BD = ?

$$\frac{\mathbf{6086}}{\mathbf{(6086 - 2565)}} \times \mathbf{4223 = 7299\ kg}$$

English

BA = 101 in FW = 9310 lb

WB = 240 in BD = ?

$$\frac{\mathbf{240}}{\mathbf{(240 - 101)}} \times \mathbf{9310 = 16{,}075\ lb}$$

This specification is only a minor indicator of a motor grader's productivity. It alone gives no measure of overall machine productivity. When considering motor grader production you need an optimum balance between the machine's front and rear weights. If a machine has too much weight on the front axle, it might have a high blade down pressure spec. It will, however, lack the essential rear weight and traction needed to push through the load. Too much weight in the rear and it will not have the necessary weight in the front during heavy cuts to maintain proper steering control.

Cat machines are built with this optimum balance in mind. A Cat motor grader is engineered with the proper weight distribution necessary for maximum productivity.

Effective Blade Length*

		Moldboard							
		3.66 m (12')		4.27 m (14')		4.88 m (16')		7.32 m (24')	
		m	ft	m	ft	m	ft	m	ft
Angle°	0°	3.66	**12.00**	4.27	**14.00**	4.88	**16.00**	7.32	**24.00**
	5°	3.64	**11.95**	4.25	**13.95**	4.86	**15.94**	7.29	**23.91**
	10°	3.60	**11.82**	4.20	**13.79**	4.80	**15.76**	7.21	**23.64**
	15°	3.53	**11.59**	4.12	**13.52**	4.71	**15.45**	7.07	**23.18**
	20°	3.44	**11.28**	4.01	**13.16**	4.58	**15.04**	6.87	**22.55**
	25°	3.32	**10.88**	3.87	**12.69**	4.42	**14.50**	6.63	**21.75**
	30°	3.17	**10.39**	3.69	**12.12**	4.22	**13.86**	6.33	**20.78**
	35°	3.00	**9.83**	3.50	**11.47**	4.00	**13.11**	5.99	**19.66**
	40°	2.80	**9.19**	3.27	**10.72**	3.74	**12.26**	5.61	**18.39**
	45°	2.59	**8.49**	3.02	**9.90**	3.45	**11.31**	5.17	**16.97**

*Effective blade length is the amount of blade coverage the machine is capable of when the blade is at a given angle.

EXTREME SLOPE OPERATION

There are two ways of defining slope work. The slope perpendicular to the machine's direction of travel is commonly referred to as "Side Sloping." The slope parallel to the machine's direction of travel — the machines ability to travel up or down terrain, is commonly referred to as "Gradeability."

Side Sloping capability for our Cat graders is somewhat subjective, but general agreement among professional operators is that working on a slope ratio of 2.5:1 (21.8 degrees) is the safe limit … an experienced operator may be able to operate on a 2:1 (28 degrees) slope. Many factors influence this limit such as operator experience, machine configuration, tires and soil conditions, but a 2.5:1 is achievable. Further, a 3:1 slope is the approximate maximum side slope a grader can work on in straight frame configuration. The steeper side slopes all require the machine be articulated to safely navigate the slope.

Gradeability is approximately 22 degrees. This is established by the grader's ability to stop without skidding the tires while moving downhill. The motor grader can, however, *climb* grades steeper than 22 degrees. The traction coefficient is the critical factor in determining whether a grader can safely navigate the slope. Caterpillar recommends that you never climb a slope steeper than you can safely descend.

Maximum lubrication angle: We have measured the graders on a tilt table and pump cavitation occurs around 30 degrees (58% or 1.7:1). This is beyond the grade or slope a motor grader can operate on.

When working side hills and slopes, consideration should be given to the following important points.

- **Speed of Travel —** At higher speeds, inertia forces tend to make the grader less stable.
- **Roughness of Terrain or Surface —** Ample allowance should be made where the terrain or surface is uneven.
- **Mounted Equipment —** Mounted attachments such as front plows, snow wings, rippers and other mounted equipment cause the tractor to balance differently.
- **Nature of Surface —** New earthen fills may give way with the weight of the grader. Rocky surfaces may promote side slipping of grader.
- **Excessive Loads or Side Draft —** This may cause wheel slippage, where the downhill tires "dig in," increasing the angle of grader.
- **Tire Selection and Maintenance —** Consideration should be given to proper tire selection and air pressure. For more information, consult Caterpillar publications — Motor Grader Tire Selection Guide and Operation and Maintenance Manual.
- **Drawbar, Circle and Blade Position —** The position of the blade can affect the stability of the machine.
- **Articulation Angle —** Articulation angle can affect the stability of the machine.
- **Wheel Lean Angle —** Wheel lean angle can affect the stability of the machine.

NOTE: Safe operation on steep slopes may require special machine maintenance as well as excellent operator skill and proper equipment setup for the specific application. Consult Caterpillar publications for further operating tips — Operation & Maintenance Manual, Motor Grader Application Guide, and the Grade Comparison Chart in the Tables section of this Performance Handbook.

Work Tool	120M/ 120M2	12M/ 12M2/ 12M3	140M/ 140M2/ 140M3	160M/ 160M2/ 160M3	16M3/ 18M3	14M3	24M
Lift Group	x	x	x	x	x	x	—
V-Plow	x	x	x	x	—	x	—
One Way Plow	x	x	x	x	—	x	—
Manual Reversible Plow	—	—	—	—	—	x	—
Hydraulic Reversible Plow	x	x	x	x	—	x	—
Snow Wing	x	x	x	x	—	x	—
Mid Mount Scarifier	x	x	x	—	—	—	—
Front Scarifier	x	x	x	x	—	x	—
Manual Angle Blade	x	x	x	x	—	x	—
Hydraulic Angle Blade	x	x	x	x	—	x	—
Straight Blade	x	x	x	x	x	x	—

This list is not all-inclusive.

See Price Lists, Cat Work Tools (Cat WT) Price List, and your Cat dealer for special attachment needs.

Attachments for Cat motor graders require additional hydraulics.

Most front-mounted attachments require a Quick Attach-Detach Parallel Lift Group.

TRACK LOADERS

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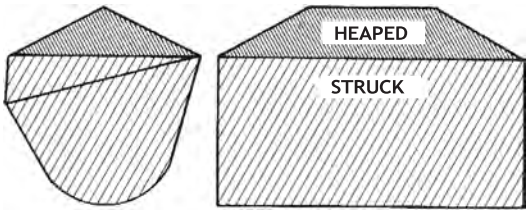
Features common to all D Series models (953D-963D-973D):

- **Improved serviceability.** All D Series Track-Type Loaders are equipped with a tiltable cab that allows complete service of the hydraulic system. Most daily maintenance checks are performed from the machine's right side, facilitating quick start up. Easy access to major components enhances serviceability and increase uptime.
- **Operator station.** Experience a high level of efficiency, comfort and productivity with the new D Series cab. The cab features a new gauge cluster, a fully air-suspension seat, the new seat mounted controls, an automatic air climate control and provides excellent visibility.
- **Messenger.** Messenger is a new electronic monitoring system with real time, visual feedback on engine and machine operating conditions. It provides information on diagnostic data, maintenance, and allows operating settings such as implement reactions.
- **Hydrostatic drive.** The closed loop hydrostatic drive with electronic control provides precise modulation for quick, smooth operation and superior maneuverability. Shorter cycle times, high efficiency, and excellent maneuverability results in increased productivity.

SAE BUCKET RATING



SAE Bucket Capacities

Struck capacity is that volume contained in a bucket after a load is leveled by drawing a straight edge resting on the cutting edge and the back of the bucket.

Heaped capacity is a struck capacity *plus* that additional material that would heap on the struck load at a 2:1 angle of repose with the struck line parallel to the ground.

SAE J742 (Oct. 79) specifies that the addition of any auxiliary spill guard to protect against spillage of material which might injure the operator will not be included in bucket capacity ratings. Buckets with irregular shaped cutting edges (vee edge) the strike plane should be drawn at one-third the distance of the protruding portion of the cutting edge. Cat rock buckets are built with integral see-through rock guards. Cat light material buckets come standard with bolt-on edges. These features which add to actual bucket capacity are included in published ratings.

Dump Height

SAE J732 JUN92 specifies that dump height is the vertical distance from the ground to the lowest point of the cutting edge with the bucket hinge pin at maximum height and the bucket at a 45° dump angle. Dump angle is the angle in degrees that the longest flat section of the inside bottom of the bucket will rotate below horizontal.

Static Tipping Load

The minimum weight at center of gravity of "SAE Rated" load in bucket which will rotate rear of machine to a point where, on track loaders, front rollers are clear of the track under the following conditions:

a. Loader on hard level surface and stationary.
b. Unit at standard operating weight.
c. Bucket at maximum rollback position.
d. Load at maximum forward position during raising cycle.
e. Unit with standard equipment as described in specifications unless otherwise noted under the heading.

Operating Load

In order to comply with SAE standard J818 MAY87, the operating load for track loaders should not exceed 35% of the Static Tipping load rating. See "Performance Data" of each machine in this handbook for increases to static tipping load by adding cab, counterweights, ripper-scarifier, etc.

SELECTING A MACHINE

Steps in selecting the proper size loader:

1. Determine production required or desired.
2. Determine loader cycle time and cycles per hour. A machine size must be assumed to select a basic cycle time.
3. Determine required payload per cycle in loose cubic yards and pounds (meters and kilograms).
4. Determine bucket size needed.
5. Make machine selection using bucket size and payload as criteria to meet production requirements.
6. Compare the loader cycle time used in calculations to the cycle time of the machine selected. If there is a difference, rework the process beginning at step 2.

1. Production Required

The production required of a track loader should be slightly greater than the production capability of the other critical units in the earth or material moving system. For example, if a hopper can handle 300 tons per hour, a loader capable of slightly more than 300 tons should be used. Required production should be carefully calculated so the proper machine and bucket selections are made.

2. Loader Cycle Times

Material type, pile height, and other factors may improve or reduce production, and should be added to or subtracted from the basic cycle time when applicable. When hauls are involved, obtain haul and return portions of the cycle from the estimated travel chart (this section). Add the haul and return times to the estimated basic cycle time to obtain total cycle time.

CYCLE TIME FACTORS

A basic cycle time (Load, Dump, Maneuver) of 0.25-0.35 minutes is average for a track loader [the basic cycle for large track loaders, 2 m^3 (2.6 yd^3) and up, can be slightly longer], but variations can be authenticated in the field. The following values for many variable elements are based on normal operations. Adding or subtracting any of the variable times will give the total basic cycle time.

Estimating Cycle Time

Cycle time of a track loader needs to be determined to find loads per hour. Total cycle time includes the following segments:

Load Time + Maneuver Time + Travel Time + Dump Time

Load Time —

Material	Minutes
Uniform aggregates	0.03-0.05
Moist mixed aggregates	0.03-0.06
Moist loam	0.03-0.07
Soil, boulders, roots	0.04-0.20
Cemented materials	0.05-0.20

Maneuver Time — includes basic travel, four changes of direction and turning time, and will be about 0.20 minutes with a competent operator.

Travel Time — in a load and carry operation is comprised of haul and return times which can be determined by the travel charts in this section.

Dump Time — is dictated by the size and strength of the dump target and varies from 0.00 to 0.10 minutes. Typical dump times into highway trucks are from 0.04 to 0.07 minutes.

NOTE: When comparing hydrostatic track loaders with former power shift models (using the production estimating method) two factors must be considered: (1) The hydrostatic track loaders on the average outcycle power shift models by up to 10 percent due to faster machine speed and easier operation. (2) Larger, rear engine hydrostatic track loaders incorporate Z-bar linkage, which provides substantially better bucket fill factors. The degree to which each factor affects estimated production should be left to the user's judgment depending on the particular job application and conditions.

Example: Moist loam is being excavated from a bank and loaded into trucks.

	Minutes
Load — moist loam	0.05
Maneuver Time	0.20
Travel — none required	0.00
Dump	0.05
Total Cycle	0.30 min. or 200 cycles per 60 min. hour

	Minutes added (+) or Subtracted (–) From Basic Cycle
Materials	
— Mixed	+0.02
— Up to 3 mm (1/8 in)	+0.02
— 3 mm (1/8 in) to 20 mm (3/4 in)	–0.02
— 20 mm (3/4 in) to 150 mm (6 in)	0.00
— 150 mm (6 in) and over	+0.03 and Up
— Bank or broken	+0.04 and Up
Pile	
— Conveyor or Dozer piled 3 m (10 ft) and up	0.00
— Conveyor or Dozer piled 3 m (10 ft) or less	+0.01
— Dumped by truck	+0.02
Miscellaneous	
— Common ownership of trucks and loaders	Up to –0.04
— Independently owned trucks	Up to +0.04
— Constant operation	Up to –0.04
— Inconsistent operation	Up to +0.04
— Small target	Up to +0.04
— Fragile target	Up to +0.05

Using actual job conditions and the above factors, total cycle time can be estimated. Convert total cycle time to cycles per hour.

$$\text{Cycles per hour at 100\% Efficiency} = \frac{60\ \text{Min}}{\text{Total Cycle Time in Minutes}}$$

Job efficiency is an important factor in machine selection. Efficiency is the actual number of minutes worked during an hour. Job efficiency accounts for operator breaks, and other work interruptions. See "Efficiency Considerations" in this section.

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Bucket Fill Factors

The following indicates the approximate amounts of material as a percent of rated bucket capacity which will actually be delivered per bucket per cycle. This is known as "Bucket Fill Factor."

Loose Material	Fill Factor
Mixed Moist Aggregates	95-110%
Uniform Aggregates up to 3 mm (1/8 in)	95-110
3 mm-9 mm (1/8 in-3/8 in)	90-110
12 mm-20 mm (1/2 in-3/4 in)	90-110
24 mm and over (1 in)	90-110
Blasted Rock	
Well	80-95%
Average	75-90
Poor	60-75
Other	
Rock Dirt Mixtures	100-120%
Moist Loam	100-120
Soil, Boulders, Roots	80-100
Cemented Materials	85-100

Fill factors on track loaders are affected by bucket penetration, breakout force, rack back angle, bucket profile and ground engaging tools such as bucket teeth and segments or bolt-on replaceable cutting edges.

GENERAL PURPOSE BUCKET W/TEETH & SEGMENTS MAXIMUM OPERATING CAPACITIES

MODEL	GENERAL PURPOSE BUCKET SIZE		MAXIMUM OPERATING CAPACITY	
	m^3	yd^3	kg	lb
953D/953K	1.85	**2.4**	3182	**7015**
963D/963K	2.45	**3.2**	4214	**9290**
973D	3.21	**4.2**	5521	**12,174**

LOADER PRODUCTION

Loader production equals quantity of material the bucket carries per load × number of bucket loads per hour.

Estimating Bucket Load

The quantity of material in a loader bucket is estimated by two methods, depending on whether the material being loaded is in a loose or bank state.

1. When the material is loose, as in stockpile loading, the bucket load is estimated in loose meters (or cubic yards) by a Bucket Fill Factor (see Tables Section or chart following this discussion). The quantity of material is determined as follows:
   Rated Bucket Capacity × Bucket Fill Factor = Bucket Payload in Loose m^3 (yd^3)

   For example, a 973 with a 3.2 m^3 (4.2 yd^3) General Purpose bucket loading moist loam material will carry:
   3.2 m^3 × 1.15 = 3.68 loose cubic meters
   (4.2 yd^3 × 1.15 = 4.83 loose cubic yards)

   Once the potential bucket load has been determined, check the static tipping load ratings on the specific machine to determine if bucket load is in fact a safe operating load. *(Safe operating load as defined by SAE for track loaders should not exceed 35% of static tipping load.)*

   Productivity in many applications is measured in tons. See Tables Section for material densities if conversion to tons is desired.
2. When material is in the bank state, as in excavation, productivity is measured in bank meters (cubic yards). Bucket load in Bm^3 (BCY) is estimated by applying one of the load factors from the Tables section to convert the excavated material in the bucket from Bm^3 (BCY) to Lm^3 (LCY) to allow for the digging and carrying characteristics of the material. The quantity of excavated material a bucket carries is then determined as follows:
   Rated Bucket Capacity × Load Factor × Bucket Fill Factor = Bucket Payload in Bm^3 (BCY)

   Example: a 953D with a 1.85 m^3 (2.4 yd^3) General Purpose bucket loading wet loam earth from bank:
   1.85 m^3 × 0.79 × 1.15 = 1.68 Bm^3
   (2.4 yd^3 × 0.79 × 1.15 = 2.18 BCY)

Estimating Production

Machine and job considerations include:

- Machine model and bucket size
- Material type, particle size, density and load factor (see Tables Section)
- Bucket fill factor
- Haul distance
- Underfoot conditions
- Altitude
- Dump target size, height, and type

Example:

Conditions —

Machine	953D
Bucket size	1.85 m^3 (2.4 yd^3)
Material	Moist Loam
Bucket fill factor	1.15
Haul length	30 m (100 ft)
Dump target	Pile
Travel in forward speed	

Cycle Time	Minutes
Load time	0.15
Maneuver time	0.20
Travel time (from curves)	0.40
Dump time	0.05
Total	0.80

Loads Per Hour —

$$\frac{60 \text{ min/hr}}{0.80 \text{ min/cycle}} = 75 \text{ cycles per hour @ } 100\% \text{ efficiency}$$

Load Per Cycle —

1.85 m^3 × 1.15 BFF = 2.13 Lm^3 × 0.81 LF = 1.72 Bm^3

(2.4 yd^3 × 1.15 BFF = 2.76 LCY × 0.81 LF = 2.24 BCY)

Hourly Production —

1.72 Bm^3 × 75 cycles/h = 129 Bm^3/h

(2.24 BCY × 75 cycles/hr = 168 BCY/hr)

More accurate production estimates can be made by recording actual machine cycle times in the same or similar application. Then visually verify the approximate bucket fill factor.

Efficiency Considerations

Loader capacity should always be matched to peak production requirements of the job. Actual "on-the-job" loader productivity will be influenced by factors such as operator skill, personal delays, job layout and other delays. Experience and knowledge of local conditions will be the best indicators of actual job efficiency.

Operation	Working Hour	Efficiency Factor
Day	50 min/Hr	0.83

An Alternative Machine Selection Method

Another method of selecting the right Track Loader and bucket to meet production requirements is by use of the nomographs on the following pages. The method is quicker and easier than the proceding example because it does not require as many calculations, yet the accuracy is about the same within the normal limits of input data.

Be careful when entering and reading data from the nomographs because some scales increase from bottom to top, while others are the reverse. Do not be overly concerned with the precision as affected by pencil line width or reading to the hundredth of a m^3 (yd^3). Remember that bucket fill factor, material density, and cycle time are at best close estimates.

Example problem

A track loader must produce 200 Lm^3 (262 LCY) per hour. Estimated cycle time is 0.5 minutes, working 50 minutes per hour. Bucket fill factor is 110% and the material density is 1600 kg/Lm^3 (2700 lb/LCY).

Determine bucket size, machine model and hourly production in tons and yards.

Solution

At full efficiency, it will cycle 120 times per hour. Since only an average 50 minutes are available, only 100 cycles will be completed per hour.

Starting on Scale A at 100 cycles per hour draw a straight line intersecting 200 m^3/hr (262 yd^3/hr) on Scale B and continuing the line on to Scale C giving 2.0 m^3 (2.62 yd^3) required payload.

Follow steps 1 through 7 on the next two pages.

● ● ●

TRACK-TYPE TRACTORS
Hydraulic Controls
Bulldozers
Rippers and Winches

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TRACK-TYPE TRACTORS

Features:

- **Cat® Diesel Engines** provide the power, high torque rise, reliability and performance you can depend on.
- **HEUI™** on D6R and D7R increases fuel efficiency, reduces smoke, improves cold starting and enhances diagnostic capabilities.
- **Mechanical Electronic Unit Injector (MEUI™)** on D8T, D9T, D10T2 and D11T excels in its ability to control injection pressure over the entire engine operating speed range. It combines the technical advancement of an electronic control system with the simplicity of direct mechanically controlled unit fuel injection. These features allow the engine to have complete control over injection timing, duration, and pressure.
- **Common Rail fuel injection system** on D3K2, D4K2, D5K2, D6K2, D5R2, D6N, D6T and D7E machines; optimizes performance and fuel consumption, minimizes heat rejection, and lowers emissions.

- **Oil cooled steering clutches and brakes** standard on D9R, D10T2 and D11T.
- **Finger Tip Controls (FTC)** of transmission, steering clutches and brakes on D10T2 and D11T.
- **Differential steering** allows infinitely variable turning radius. Standard on the D5R2, D6N, D6R2, D6T, D7R, D7E, D8R, D8T and D9T, allows the tractor to make a "power turn" keeping both tracks working for more traction and higher performance.
- **Electronic Hydrostatic Power Train System** on D3K2 through D6K2 allows power turns, stepless speed range, smooth modulation, dynamic hydrostatic braking, superior maneuverability and excellent controllability.
- **Electric Drive Power Train System** on D7E allows stepless speed range, smooth modulation, and excellent efficiency. When coupled with differential steer it provides superior maneuverability with locked-track pivot turn capability and excellent controllability.
- **Combined hand lever steering** located left of operator provides easier operation on D9R.
- **Standard Tractors** designed for heavy dozing and general grading.
- **XL Tractor D6T** offers higher horsepower and longer roller frames for increased finish grading capability, flotation and productivity.
- **Extra Wide (XW) gauge** on D6T length roller frame provides wider shoes for greater flotation and stability for steep slope grading.
- **Sealed and Lubricated Track** reduces pin and bushing wear for lower undercarriage repair costs. Sealed and lubricated track is standard on the D3K2, D4K2, and D5K2 while heavy duty track chain is available on D5R, D6K2, D6N, D6T, and D7E improves wear life and reduces pin/bore stretching and cracking.
- **SystemOne™ Undercarriage** extends undercarriage system life, improves reliability, and reduces owning and operating costs. Optional on D6T (all sources), D5R2, D6K2, D6N, D6R2, optional on D8T and D8R (all sources), D3K2, D4K2, D5K2.
- **Elevated sprockets** (not on D6K2 or D7E) eliminate final drive stress induced by roller frame movement and ground impact loads. Final drives pull chain only. Seals moved up out of dirt, sand and water for longer life. Blade visibility improved because operator sits higher.
- **Resilient mounted bogie undercarriage** on D8R, D8T, D9T, D10T2 and D11T reduces shock transmitted to tractor. Allows track to conform to rough ground for better traction.
- **Solid mounted undercarriage** standard on D3K2 through D5K2 provides stable platform for low impact, and high abrasion applications. Provides optimum finish grading performance.
- **Oscillating undercarriage** on D6K2 through D7E and optional on the D8R and D8T decreases ground shock to the machine and provides a smoother, more comfortable ride for the operator.
- **Accessible modular design** on D6N XL and up greatly reduces drive train removal and installation time resulting in reduced repair costs.
- **Tag link** on D7R, D8R/D8T and up; L-shaped push arms on D6N, D6T and D7E. Both designs allow closer mounting of dozer blades. This reduces total tractor length, improves maneuverability, balance, blade penetration and pryout.
- **Low ground pressure (LGP)** tractors offer greater flotation in soft, swampy conditions. Available on D3K2 through D8T.

MODEL	D6T		D6T XL	
Emission Standards	**Tier 3/Stage IIIA/ Japan 2006 (Tier 3) equivalent**		**Tier 3/Stage IIIA/ Japan 2006 (Tier 3) equivalent**	
Flywheel Power	149 kW	**200 hp**	149 kW	**200 hp**
Operating Weight:[1]				
Power Shift Differential Steer				
SU Blade	20 580 kg	**45,370 lb**	21 600 kg	**47,620 lb**
Engine Model	**C9 ACERT**		**C9 ACERT**	
Rated Engine RPM: Power Shift	**1850**		**1850**	
No. of Cylinders	**6**		**6**	
Bore	112 mm	**4.4"**	112 mm	**4.4"**
Stroke	149 mm	**5.9"**	149 mm	**5.9"**
Displacement	8.8 L	**537 in³**	8.8 L	**537 in³**
Track Rollers (Each Side)	**6**		**7**	
Width of Standard Track Shoe	560 mm	**22"**	560 mm	**22"**
Length of Track on Ground	2.61 m	**8'7"**	2.81 m	**9'3"**
Ground Contact Area (w/Std. Shoe)	2.92 m²	**4531 in²**	3.15 m²	**4878 in²**
Track Gauge	1.88 m	**74"**	1.88 m	**74"**
GENERAL DIMENSIONS:				
Height[2] (Stripped Top)[3]	2.40 m	**7'11"**	2.40 m	**7'11"**
Height[2] (To Top of ROPS Canopy)	3.11 m	**10'2"**	3.11 m	**10'2"**
Height[2] (To Top of ROPS Cab)	3.11 m	**10'2"**	3.11 m	**10'2"**
Overall Length (without Blade)	3.85 m	**12'7"**	3.85 m	**12'7"**
with SU Blade	5.08 m	**16'8"**	5.33 m	**17'6"**
with Angle Blade	5.00 m	**16'5"**	5.21 m	**17'1"**
Width (over Trunnion)	2.64 m	**8'8"**	2.64 m	**8'8"**
Width (w/o Trunnion — Std. Track)	2.44 m	**8'0"**	2.44 m	**8'0"**
Ground Clearance[2]	384 mm	**1'3"**	384 mm	**1'3"**
Blade Types and Widths:				
Angle Straight	4.16 m	**13'8"**	4.16 m	**13'8"**
Full 25° Angle	3.77 m	**12'5"**	3.77 m	**12'5"**
Semi-U	3.26 m	**10'8"**	3.26 m	**10'8"**
Fuel Tank Refill Capacity	425 L	**112 U.S. gal**	425 L	**112 U.S. gal**

[1] Operating weight includes cab, operator, lubricants, coolant, full fuel tank, standard track, hydraulic controls and fluid, SU blade, drawbar and counterweight.
[2] Dimensions measured from ground line. Add grouser height for total dimension on hard surfaces.
[3] Height (Stripped Top) — without ROPS canopy, exhaust, seat back or other easily removed encumbrances.

Track-Type Tractor Sustainability

Well matched engine and power train systems enhance productivity and fuel efficiency.

MODEL	D6T XL		D6T XW		D6T LGP	
Emission Standards	**Tier 4 Final/Stage IV/ Japan 2014 (Tier 4 Final)**		**Tier 4 Final/Stage IV/ Japan 2014 (Tier 4 Final)**		**Tier 4 Final/Stage IV/ Japan 2014 (Tier 4 Final)**	
Flywheel Power	151 kW	**202 hp**	151 kW	**202 hp**	151 kW	**202 hp**
Operating Weight:[1]						
Power Shift Differential Steer	20 985 kg	**46,263 lb**	21 788 kg	**48,034 lb**	22 902 kg	**50,490 lb**
VPAT	23 663 kg	**52,167 lb**	24 118 kg	**53,170 lb**	24 336 kg	**53,651 lb**
Engine Model	**C9.3 ACERT**		**C9.3 ACERT**		**C9.3 ACERT**	
Advertised Engine RPM	**2000**		**2000**		**2000**	
No. of Cylinders	**6**		**6**		**6**	
Bore	115 mm	**4.5"**	115 mm	**4.5"**	115 mm	**4.5"**
Stroke	149 mm	**5.9"**	149 mm	**5.9"**	149 mm	**5.9"**
Displacement	9.3 L	**567 in^3**	9.3 L	**567 in^3**	9.3 L	**567 in^3**
Track Rollers (Each Side)	**7**		**7**		**8**	
VPAT	**7**		**8**		**8**	
Width of Standard Track Shoe	560 mm	**22"**	760 mm	**30"**	915 mm	**36"**
VPAT	560 mm	**22"**	710 mm	**28"**	785 mm	**31"**
Length of Track on Ground	2.84 m	**9'5"**	2.84 m	**9'5"**	3.25 m	**10'9"**
VPAT	2.84 m	**9'5"**	3.25 m	**10'9"**	3.25 m	**10'9"**
Ground Contact Area (w/Std. Shoe)	3.54 m^2	**5489 in^2**	4.81 m^2	**7449 in^2**	6.53 m^2	**10,122 in^2**
VPAT	3.54 m^2	**5489 in^2**	5.10 m^2	**7909 in^2**	5.60 m^2	**8684 in^2**
Track Gauge	1.88 m	**74"**	2.03 m	**80"**	2.29 m	**90"**
VPAT	2.13 m	**84"**	2.29 m	**90"**	2.29 m	**90"**
GENERAL DIMENSIONS:						
Height[2] (Stripped Top[3])	2.46 m	**8'1"**	2.46 m	**8'1"**	2.51 m	**8'3"**
VPAT	2.46 m	**8'1"**	2.51 m	**8'3"**	2.51 m	**8'3"**
Height[2] (To Top of ROPS Canopy)	3.11 m	**10'2"**	3.11 m	**10'2"**	3.16 m	**10'4"**
VPAT	3.11 m	**10'2"**	3.16 m	**10'4"**	3.16 m	**10'4"**
Height[2] (To Top of ROPS Cab)	3.15 m	**10'4"**	3.15 m	**10'4"**	3.20 m	**10'6"**
VPAT	3.15 m	**10'4"**	3.20 m	**10'6"**	3.20 m	**10'6"**
Overall Length (without Blade)	3.89 m	**12'9"**	3.89 m	**12'9"**	4.25 m	**13'11"**
VPAT	3.89 m	**12'9"**	4.25 m	**13'11"**	4.25 m	**13'11"**
with S Blade	**—**		**—**		5.50 m	**18'1"**
with SU Blade	5.33 m	**17'6"**	5.33 m	**17'6"**	**—**	
with VPAT Blade	5.39 m	**17'8"**	5.53 m	**18'2"**	5.53 m	**18'2"**
with Angle Blade	5.21 m	**17'1"**	5.29 m	**17'4"**	5.81 m	**19'1"**
Width (over Trunnion)	2.69 m	**8'10"**	2.94 m	**9'8"**	3.48 m	**11'5"**
Width (w/o Trunnion — Std. Track)	2.59 m	**8'6"**	2.79 m	**9'2"**	3.20 m	**10'6"**
VPAT	2.72 m	**8'11"**	3.00 m	**9'10"**	3.14 m	**10'4"**
Ground Clearance[2]	372 mm	**1'3"**	372 mm	**1'3"**	406 mm	**1'4"**
VPAT	372 mm	**1'3"**	406 mm	**1'4"**	406 mm	**1'4"**
Blade Types and Widths:						
Straight	**—**		**—**		4.06 m	**13'4"**
Angle Straight	4.16 m	**13'8"**	4.52 m	**14'10"**	5.07 m	**16'8"**
Full 25° Angle	3.77 m	**12'5"**	4.11 m	**13'6"**	4.63 m	**15'2"**
Semi-U	3.26 m	**12'8"**	3.56 m	**11'8"**	**—**	
VPAT						
Straight	3.88 m	**12'9"**	4.16 m	**13'8"**	4.16 m	**13'8"**
Full 24° Angle	3.54 m	**11'7"**	3.79 m	**12'5"**	3.79 m	**12'5"**
Fuel Tank Refill Capacity	411 L	**109 U.S. gal**	411 L	**109 U.S. gal**	411 L	**109 U.S. gal**
DEF Tank Refill Capacity	17.1 L	**4.5 U.S. gal**	17.1 L	**4.5 U.S. gal**	17.1 L	**4.5 U.S. gal**

[1] Operating weight includes cab, operator, lubricants, coolant, full fuel tank, standard track, hydraulic controls and fluid, SU blade and drawbar.
[2] Dimensions measured from ground line. Add grouser height for total dimension on hard surfaces.
[3] Height (Stripped Top) — without ROPS canopy, exhaust, seat back or other easily removed encumbrances.

MODEL	D9R		D9T		D9T	
Emission Standards	—		**Tier 3/Stage IIIA/ Japan 2006 (Tier 3) equivalent[1]**		**Tier 4 Final/Stage IV/ Japan 2014 (Tier 4 Final)**	
Flywheel Power	302 kW	**405 hp**	306 kW	**410 hp**	325 kW	**436 hp**
Operating Weight:[2]						
Power Shift Clutch Brake	48 784 kg	**107,548 lb**	—		—	
Power Shift Differential Steer	—		47 872 kg	**105,539 lb**	48 361 kg	**106,618 lb**
Engine Model	**3408C SCAC**		**C18 ACERT**		**C18 ACERT**	
Rated Engine RPM	**1900**		**1833**		**1800**	
No. of Cylinders	**8**		**6**		**6**	
Bore	137 mm	**5.4"**	145 mm	**5.7"**	145 mm	**5.7"**
Stroke	152 mm	**6"**	183 mm	**7.2"**	183 mm	**7.2"**
Displacement	18 L	**1099 in^3**	18.1 L	**1106 in^3**	18.1 L	**1106 in^3**
Track Rollers (Each Side)	**8**		**8**		**8**	
Width of Standard Track Shoe	610 mm	**24"**	610 mm	**24"**	610 mm	**24"**
Length of Track on Ground	3.47 m	**11'5"**	3.47 m	**11'5"**	3.47 m	**11'5"**
Ground Contact Area (w/Std. Shoe)	4.24 m^2	**6569 in^2**	4.24 m^2	**6569 in^2**	4.24 m^2	**6569 in^2**
Track Gauge	2.25 m	**7'5"**	2.25 m	**7'5"**	2.25 m	**7'5"**
GENERAL DIMENSIONS:						
Height[3] (Stripped Top)[4]	3.69 m	**12'1"**	3.69 m	**12'1"**	3.69 m	**12'1"**
Height[3] (To Top of ROPS Canopy)	4.00 m	**13'1"**	4.00 m	**13'1"**	4.00 m	**13'1"**
Height[3] (To Top of FOPS Cab)	3.82 m	**12'6"**	3.82 m	**12'6"**	3.82 m	**12'6"**
Overall Length (with SU Blade)[5]	6.88 m	**22'6"**	6.88 m	**22'6"**	6.88 m	**22'6"**
(without Blade)	5.18 m	**17'0"**	5.18 m	**17'0"**	5.18 m	**17'0"**
(with SU Blade and Ripper)[5]	8.23 m	**27'0"**	8.23 m	**27'0"**	8.23 m	**27'0"**
(without Blade and Ripper)	4.91 m	**16'1"**	4.91 m	**16'1"**	4.91 m	**16'1"**
Width (over Trunnion)	3.30 m	**10'8"**	3.30 m	**10'8"**	3.30 m	**10'8"**
Width (w/o Trunnion — Std. Shoe)	2.88 m	**9'5"**	2.88 m	**9'5"**	2.88 m	**9'5"**
Ground Clearance[6]	496 mm	**1'7"**	496 mm	**1'7"**	496 mm	**1'7"**
Blade Types and Widths:						
Universal	4.65 m	**15'3"**	4.65 m	**15'3"**	4.65 m	**15'3"**
Semi-U	4.31 m	**14'2"**	4.31 m	**14'2"**	4.31 m	**14'2"**
Fuel Tank Refill Capacity	818 L	**216 U.S. gal**	889 L	**235 U.S. gal**	821 L	**217 U.S. gal**
DEF Tank Refill Capacity	—		—		36 L	**9.5 U.S. gal**

[1] Product available to meet Tier 2/Stage II/Japan 2001 (Tier 2) equivalent OR Tier 3/Stage IIIA/Japan 2006 (Tier 3) equivalent emission standards.
[2] Operating weight includes ROPS canopy, operator, lubricants, coolant, full fuel tank, hydraulic controls and fluids, semi universal blade with tilt, back-up alarm, seat belts, lights, and single shank ripper.
— D9R equipped with track guides, ROPS/FOPS cab, single shank ripper and SU blade.
[3] Dimensions measured from ground line. Add grouser height for total dimension on hard surfaces.
[4] Height (Stripped Top) — without ROPS canopy, exhaust, seat back or other easily removed encumbrances.
[5] Includes drawbar.
[6] Per ISO 6746 — Must add grouser height for total dimension on hard surfaces.

MODEL	D10T2		D11T		D11T CD	
Emission Standards	**Tier 4 Final/Stage IV/ Japan 2014 (Tier 4 Final)[1]**		**Tier 4 Final/Stage IV/ Japan 2014 (Tier 4 Final)[1]**		**Tier 4 Final/Stage IV/ Japan 2014 (Tier 4 Final)[1]**	
Flywheel Power	447 kW	**600 hp**	634 kW	**850 hp**	634 kW	**850 hp**
Reverse Gears	538 kW	**722 hp**	**—**		**—**	
Operating Weight:[2]						
Power Shift Clutch Brake	70 171 kg	**154,700 lb**	104 236 kg	**229,800 lb**	112 718 kg	**248,500 lb**
Engine Model	**C27 ACERT**		**C32 ACERT**		**C32 ACERT**	
Rated Engine RPM	**1800**		**1800**		**1800**	
No. of Cylinders	**12**		**12**		**12**	
Bore	137 mm	**5.4"**	145 mm	**5.71"**	145 mm	**5.71"**
Stroke	152 mm	**6"**	162 mm	**6.38"**	162 mm	**6.38"**
Displacement	27 L	**1648 in^3**	32.1 L	**1959 in^3**	32.1 L	**1959 in^3**
Track Rollers (Each Side)	**8**		**8**		**8**	
Width of Standard Track Shoe	610 mm	**24"**	710 mm	**28"**	915 mm	**36"**
Length of Track on Ground (Idler to Idler)	3.88 m	**12'9"**	4.44 m	**14'7"**	4.44 m	**14'7"**
Ground Contact Area (w/Std. Shoe)	4.74 m^2	**7347 in^2**	6.31 m^2	**9781 in^2**	8.13 m^2	**12,605 in^2**
Track Gauge	2.55 m	**8'4"**	2.89 m	**9'6"**	2.89 m	**9'6"**
GENERAL DIMENSIONS:						
Height (Stripped Top)[3]	3.222 m	**10'7"**	3.64 m	**11'11"**	3.64 m	**11'11"**
Height (To Top of ROPS Canopy)	4.41 m	**14'5"**	4.70 m	**15'5"**	4.70 m	**15'5"**
Height (To Top of FOPS Cab)	4.10 m	**13'5"**	4.39 m	**14'5"**	4.39 m	**14'5"**
Overall Length:						
(with SU Blade and SS Ripper)[4]	9.16 m	**30'1"**	10.59 m	**34'9"**	10.70 m	**35'1"**
(without Blade and Ripper)[5]	5.32 m	**17'5"**	6.16 m	**20'3"**	6.16 m	**20'3"**
Width (over Trunnion)	3.74 m	**12'3"**	4.38 m	**14'4"**	4.38 m	**14'4"**
Width (w/o Trunnion — Std. Shoe)	3.30 m	**10'10"**	3.78 m	**12'5"**	3.81 m	**12'6"**
Ground Clearance[6]	632 mm	**2'1"**	675 mm	**2'3"**	675 mm	**2'3"**
Blade Types and Widths:						
CarryDozer	**—**		**—**		6.71 m	**22'0"**
Universal	5.26 m	**17'3"**	6.36 m	**20'10"**	**—**	
Semi-U	4.94 m	**16'3"**	5.60 m	**18'4"**	**—**	
Fuel Tank Refill Capacity	1204 L	**314 U.S. gal**	1609 L	**425 U.S. gal**	1609 L	**425 U.S. gal**
Fuel Tank Refill Capacity (Extra Capacity)	**—**		1987 L	**505 U.S. gal**	1987 L	**505 U.S. gal**

[1] Product available to meet Tier 2/Stage II/Japan 2001 (Tier 2) equivalent OR Tier 4 Final/Stage IV/Japan 2014 (Tier 4 Final) emission standards.
[2] Operating weight includes coolant, lubricants, full fuel tank, ROPS, FOPS cab, SU ABR bulldozer (D10T2) or U ABR bulldozer (D11T), dual tilt, single-shank ripper with pin-puller, fast fuel, standard ES shoes, and operator.
D11T CD has 11 Carrydozer and single-shank Carrydozer ripper.
[3] Height (Stripped Top) — without ROPS canopy, cab, exhaust, lift cylinders, seat back or other easily removed encumbrances.
[4] Overall length of D11T CD includes Straight (CarryDozer) Blade and SS Ripper.
[5] Overall length of machine from front tag link trunnion to rigid drawbar and excludes track grouser height.
[6] Per ISO 6746 — Must add grouser height for total dimension on hard surfaces.

All dimensions are approximate.

TRAVEL SPEED

POWER SHIFT MODEL	D3K2[1] All Models		D3K2 All Models		D4K2[1] All Models		D4K2 All Models		D5K2[1] All Models		D5K2 All Models		D6K2 All Models	
HYDROSTATIC	km/h	mph	km/h	mph	km/h	mph	km/h	mph	km/h	mph	km/h	mph	km/h	mph
FORWARD	9.0	**5.6**	9.0	**5.6**	9.0	**5.6**	9.0	**5.6**	9.0	**5.6**	9.0	**5.6**	10.0	**6.2**
REVERSE	10.0	**6.2**	10.0	**6.2**	10.0	**6.2**	10.0	**6.2**	10.0	**6.2**	10.0	**6.2**	10.0	**6.2**

[1]Meets Tier 3/Stage IIIA/Japan 2006 (Tier 3) equivalent emission standards.

POWER SHIFT MODEL	D5R2 Powershift with AutoShift		D6R2 Powershift with AutoShift		D6T		D7E		D7E LGP		D7R	
FORWARD	km/h	mph	km/h	mph	km/h	mph	km/h	mph	km/h	mph	km/h	mph
1	3.3	**2.1**	3.8	**2.4**	3.8	**2.3**	—	**—**	—	**—**	3.52	**2.19**
1.5	4.2	**2.6**	4.8	**3.0**	—	**—**	—	**—**	—	**—**	—	**—**
2	5.8	**3.6**	6.5	**4.1**	6.5	**4.0**	—	**—**	—	**—**	6.10	**3.79**
2.5	7.3	**4.5**	8.4	**5.2**	—	**—**	—	**—**	—	**—**	—	**—**
3	10.1	**6.3**	11.5	**7.1**	11.3	**7.0**	—	**—**	—	**—**	10.54	**6.55**
REVERSE												
1	4.2	**2.6**	4.8	**3.0**	4.7	**2.9**	—	**—**	—	**—**	4.54	**2.82**
1.5	5.2	**3.2**	6.2	**3.9**	—	**—**	—	**—**	—	**—**	—	**—**
2	7.3	**4.5**	8.4	**5.2**	8.3	**5.1**	—	**—**	—	**—**	7.85	**4.88**
2.5	7.3	**4.5**	8.4	**5.2**	—	**—**	—	**—**	—	**—**	—	**—**
3	12.5	**7.8**	14.5	**9.1**	14.6	**9.0**	—	**—**	—	**—**	13.58	**8.44**
ELECTRIC												
FORWARD	—	**—**	—	**—**	—	**—**	11.3	**7.0**	11.3	**7.0**	—	**—**
REVERSE	—	**—**	—	**—**	—	**—**	11.3	**7.0**	11.3	**7.0**	—	**—**

GEAR	D6N* Powershift with AutoShift		D6N* Powershift with AutoShift — Sound Suppressed	
FORWARD	km/h	mph	km/h	mph
0.5	2.5	**1.6**	2.4	**1.5**
0.7	2.8	**1.7**	2.7	**1.6**
1.0	3.3	**2.1**	3.0	**1.9**
1.5	4.4	**2.7**	4.4	**2.7**
1.7	4.9	**3.0**	4.9	**3.0**
2.0	5.8	**3.6**	5.8	**3.6**
2.5	7.5	**4.7**	7.5	**4.7**
2.7	8.3	**5.2**	8.3	**5.2**
3.0	9.8	**6.1**	9.8	**6.1**
REVERSE				
0.5	3.1	**1.9**	2.9	**1.8**
0.7	3.4	**2.1**	3.1	**1.9**
1.0	4.1	**2.5**	3.5	**2.2**
1.5	5.4	**3.4**	5.4	**3.4**
1.7	6.0	**3.7**	6.0	**3.7**
2.0	7.1	**4.4**	7.1	**4.4**
2.5	9.5	**5.9**	9.5	**5.9**
2.7	10.5	**6.5**	10.5	**6.5**
	12.2	**7.6**	12.2	**7.6**

*MeetsTier 4 Final/Stage IV/Japan 2014 (Tier 4 Final) emission standards.

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TRAVEL SPEED

POWER SHIFT MODEL	Differential Steer D8R		D8T		D9R		D9T		D10T2		D11T/CD		D11T/CD High Altitude	
FORWARD	km/h	mph	km/h	mph	km/h	mph	km/h	mph	km/h	mph	km/h	mph	km/h	mph
1	3.5	**2.2**	3.4	**2.1**	3.8	**2.4**	3.9	**2.4**	4.0	**2.5**	3.9	**2.4**	4.0	**2.5**
2	6.2	**3.9**	6.0	**3.7**	6.8	**4.2**	6.8	**4.2**	7.2	**4.5**	6.8	**4.2**	7.0	**4.4**
3	10.8	**6.7**	10.6	**6.6**	11.9	**7.4**	11.7	**7.3**	12.7	**7.9**	11.8	**7.3**	12.0	**7.5**
REVERSE														
1	4.7	**2.9**	4.5	**2.8**	4.7	**2.9**	4.7	**2.9**	5.2	**3.2**	4.7	**2.9**	4.8	**3.0**
2	8.1	**5.0**	7.9	**4.9**	8.4	**5.2**	8.4	**5.2**	9.0	**5.6**	8.2	**5.1**	8.3	**5.2**
3	13.9	**8.6**	14.2	**8.8**	14.7	**9.1**	14.3	**8.9**	15.8	**9.8**	14.0	**8.7**	14.9	**9.0**

GEAR	D6T Powershift with AutoShift		D6T Powershift with AutoShift — Sound Suppressed	
FORWARD	km/h	mph	km/h	mph
0.5	2.7	**1.7**	2.7	**1.7**
0.7	3.3	**2.0**	3.2	**2.0**
1.0	3.7	**2.3**	3.2	**2.0**
1.5	4.7	**2.9**	4.7	**2.9**
1.7	5.7	**3.6**	5.7	**3.6**
2.0	6.5	**4.0**	6.3	**3.9**
2.5	8.2	**5.1**	8.2	**5.1**
2.7	10.0	**6.2**	10.0	**6.2**
3.0	11.3	**7.0**	10.9	**6.8**
REVERSE				
0.5	3.5	**2.2**	3.5	**2.2**
0.7	4.2	**2.6**	3.9	**2.4**
1.0	4.7	**2.9**	3.9	**2.4**
1.5	6.0	**3.7**	6.0	**3.7**
1.7	7.3	**4.5**	7.3	**4.5**
2.0	8.3	**5.1**	8.0	**5.0**
2.5	10.4	**6.5**	10.4	**6.5**
2.7	12.7	**7.9**	12.7	**7.9**
3.0	14.4	**9.0**	13.8	**8.6**

HYDRAULIC CONTROLS

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Features:

- **Designed and built for specific tractor applications.** Valves and components sized for exacting quality and performance.
- **Job requirements matched** through various arrangements.
- **Hydraulic blade and ripper controls:** Mechanical controls on G Series. Electro hydraulic controls on D6N and D6K2. Pilot blade and ripper controls on D6T Tier 3/Stage IIIA, Japan 2006 (Tier 3) equivalent with optional electro hydraulic blade control. Electro hydraulic blade and ripper controls on D6T Tier 4 Interim/ Stage IIIB/Japan 2011 (Tier 4 Interim) equivalent Mechanical controls on D9R. Electro hydraulic blade and ripper controls on D7E, D8T, D9T, D10T2, and D11T.
- **Full flow filters***… all oil completely filtered.
- **Dual tilt** — standard on D11T and D11T CD, attachment option on D7E, D8R, D8T, D9R, D9T, D10T2.

*Exception — D8R 2-pump.

BULLDOZERS

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Features:

- **Straight Bulldozers** — adjustable tilt angle controls blade penetration.
- **Variable cutting edge Power Angle and Tilt (VPAT)** — blade is available on the D3K2, D4K2, D5K2, D6K2, D6N, and D6T. The blade can be mechanically tipped forward for improved penetration or back for more productivity and easier finish grading.
- **Angling Bulldozers** — 25° right/left angling; C-frame allows mounting other tools.
- **Universal Bulldozers** — 25° wings provide increased capacity, less spillage.
- **Semi-Universal Bulldozers** — combines penetration ability of straight blade with increased load capacity provided by short 25° wings.
- **Wheel Dozer blades** are offered in straight and universal blade design with hydraulic pitch and tilt control.
- **Box-section construction** on blades adds rigidity and strength.
- **Cutting edges** are heat treated and reversible for extra life.

BLADE SELECTION

Properly matching tractor and dozer is a basic requirement for maximizing production. First consider the kind of work the tractor will be doing most of its life. Then evaluate:

- Material to be moved.
- Tractor limitations.

Materials to be moved

Most materials are dozeable. However, dozer performance will vary with material characteristics such as:
Particle Size and Shape — The larger the individual particle size, the harder it is for a cutting edge to penetrate. Particles with sharp edges resist the natural rolling action of a dozer blade. These particles require more horsepower to move than a similar volume of material with rounded edges.
Voids — Few voids or the absence of voids means the individual particles have most or all of their surface area in contact with other particles. This forms a bond which must be broken. A well graded material, which lacks voids, is generally heavy, and will be hard to remove from the bank state.
Water Content — In most materials the lack of moisture increases the bond between particles and makes the material difficult to remove from the bank state. A high moisture content makes dozing difficult because the material is heavy and requires more force to move. Optimum moisture reduces dust and offers the best condition for dozing ease and operator comfort.

The effect of freezing depends on the moisture content. When frozen, the material's bond strengthens as moisture content increases and temperature decreases. However, freezing a completely dry material does not change its characteristics.

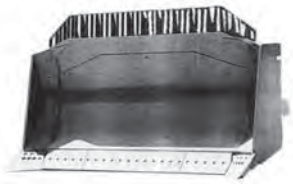
An indication of a blade's ability to penetrate and obtain a blade load is kW per meter (or horsepower per foot) of cutting edge. The higher the kW/meter (HP/foot), the more aggressive the blade. Kilowatt per Lm^3 (horsepower per loose cubic yard) indicates a blade's ability to push material. The higher the kW/Lm^3 (HP/LCY), the greater the blade's potential capability for carrying material at a greater speed.

Tractor Limitations

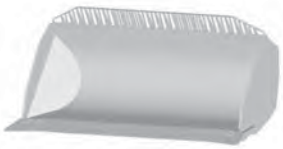
The weight and horsepower of the machine determines its ability to push. No tractor can exert more pounds push than the machine itself weighs and its power train can develop. Various terrain and underfoot conditions on the job limit the tractor's ability to use its weight and horsepower. The "approximate coefficient of traction factors" chart in the Tables Section presents these traction factors for common materials. To use the chart, take the total tractor weight (with attachments) times the factor to arrive at the maximum usable push the dozer can exert.

Production Dozing Tools

"U" — Universal blade — the large wings on this blade include one end bit and at least one section of cutting edge which make it efficient for moving big loads over long distances as in land reclamation, stockpile work, charging hoppers and trapping for loaders. As this blade has a lower kW/meter (HP/foot) of cutting edge than an "S" or "SU", penetration should not be a prime objective. With a lower kW/Lm^3 (HP/LCY) than an "S" or "SU", this blade is best for lighter or relatively easily dozed material. If equipped with tilt cylinders the U blade can be used to pry out, level, cut ditches and steer the tractor.



"SU" — The Semi-U blade combines the desirable characteristics of S and U-blades into one pack- age. It has increased capac- ity by the addition of short wings which include only the dozer end bits. The wings provide improved load retention capabilities while maintaining the blade's ability to penetrate and load quickly in tightly packed materials and to handle a wide variety of materials in production oriented applications. Tilt cylinder(s) increase both the productivity and versatility of this dozer. Equipped with a push plate, it is effectively used for push loading scrapers.



"CD" — The CD or Carry-Dozer Blade is available for the D11T CarryDozer only. It is built to the same high standard of structural integrity as the "U" and "SU" Dozers. The CD Blade has a unique "bucket" shape that allows it to carry several cubic yards or cubic meters of material in the blade. This acts as a disposable counterweight that allows the CarryDozer to push more material per pass than a standard D11T. The CarryDozer will not be as effective as the "U" or "SU" dozer in tightly packed or poorly shot material. It is also more sensitive to the carry- back in sticky materials.

General Purpose Dozing Tools

"S" — The Straight blade provides excellent versatility. Since it is physically smaller than the SU or U-blade, it is easier to maneuver and can handle a wider range of materials. It has a higher kW/ meter (HP/foot) of cutting edge than the SU or U-blade; consequently, the "S" is more aggressive in penetrating and obtaining a blade load. A tilt cylinder increases both the productivity and versatility of this dozer. With a high kW/Lm^3 (HP/LCY), the S-blade can handle heavy material easily.

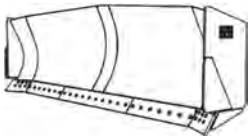
Power Angle and Tilt Blade — Versatility is its key feature with its ability to perform a variety of site development to general dozing work as well as heavy-duty applications. Angle and tilt control is with 2 levers on some machines, 1 lever on others.

Variable Power Angle and Tilt (VPAT) blade can be mechanically tipped forward for improved penetration or shedding sticky material and backward for finish grading and improved productivity.

Special Application Dozing Tools

Caterpillar provides specialty bulldozers for specific applications. The blades are designed to increase production while performing certain tasks. Following are the most popular special applications blades.

Variable Radius (VR) Blades



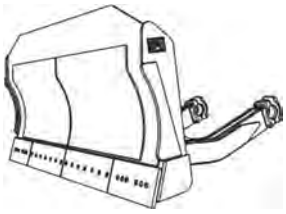
Variable Radius Semi-U Blades are excellent tools for land improvement, soil conservation, site development or general construction. They combine the penetration ability of a Semi-U Blade with the load retention and high capacity of a U-blade.

They provide the aggressive cutting action needed for digging, while having the material retention characteristics needed for moving high volumes over a distance. This is accomplished through a moldboard which varies in radius from the edge to the center. This creates a rolling action in the material being moved, pushing it to the center of the blade for better retention. The extended side wings, angled to thirty degrees, further increase the capacity over a standard blade.

Angle Blade (A-Blade)

"A" — Or Angling blade can be positioned straight or angled 25 degrees to either side. It is designed for side-casting, pioneering roads, backfilling, cutting ditches and other similar tasks. It can reduce the amount of maneuvering required to do these jobs. Its "C" frame can be used for attachments such as pushing, land clearing, or snow removal tools. A-blades are not recommended for rock or severe applications.

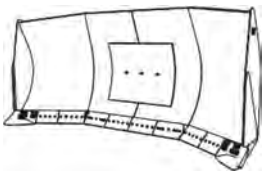
Cushion Dozers



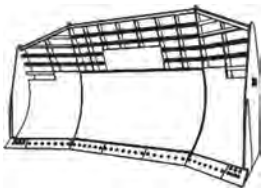
Cushion Dozers are designed to push-load wheel-tractor scrapers, or track-type tractors. The heavy-duty design includes reinforcement to transfer machine power without damaging the blade or the tractor. Blade cylinders are pinned to the C-frame, and the blade height is such that the blade lift cylinders are isolated from damaging forces.

The taller blade allows pushing from a higher position, eliminating blade drag and increasing productivity. The blade curvature is matched to the curve of the Cat Push Block for maximum contact area, pre- venting the block from riding over the top of the blade. Extended side plates make it easier for operators to "catch" the stinger when repositioning for a new pass. The center of the blade is armored with T-1 plate steel for maximum service life. The narrow width of the cush- ion blade increases machine maneuverability in con- gested cuts and reduces the possibility of cutting tires associated with SU and U-blades.

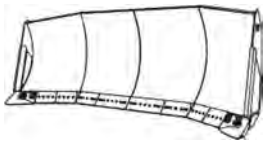
When not push-loading, the dozer can be used for cut maintenance and other general dozing jobs.



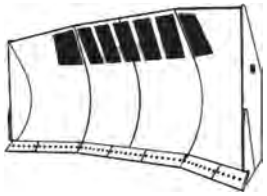
Coal U-Blades are designed specifically to move large volumes of coal in coal piles, at powerplants and transshipment points. The wing angle of thirty degrees crowds material to the center of the blade, maximizing capacity by minimizing side spill. The moldboard is much higher and wider than standard, specifically to match the material density and loading characteristics of coal. The curve of the moldboard rolls the material forward, enhancing the carrying capacity. With this design, coal-moving capacity can be as much as 200 percent greater than a standard U-blade.



Landfill U-Blades provide capacity increases of up to fifty percent over a straight blade. Landfill blades have the height and width to handle large volumes of low-density refuse, but are tough enough to dig and bulldoze ground cover. Vision to the load is provided by areas of screen in the upper blade. Angled wings slice into natural bed earth for trenches or cover material, adding to the versatility in the landfill.



Reclamation U-Blades — are purpose-built for reclamation of mine spoil piles. The blade has a larger capacity than a standard U-blade. The wing angle of 28 degrees provides a good balance between load retention and shearing action, keeping the optimal load in front of the blade, but cutting cleanly through the material when necessary.

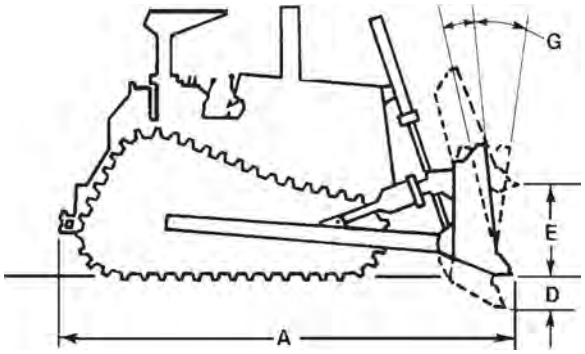


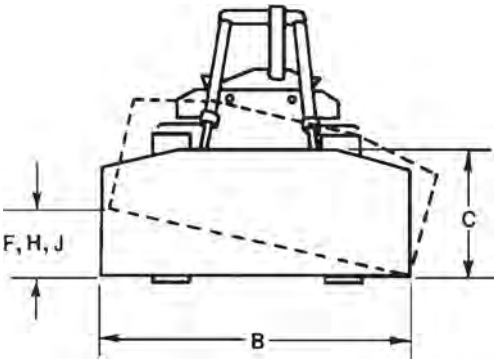
The width of **Woodchip U-Blades** gives operators maximum control and greater confidence, even in steep chip piles. Deep curvature of the moldboard keeps material flowing to liven dead chips and optimize production on long pushes. Blade height and wings angled at thirty degrees combine for excellent material retention – giving better production with every pass. An operator visibility window in the top section is standard.

Multi-Application/Rock and Root Rakes

Multi-Application/Rock and Root Rakes are perfectly suited for heavy duty land clearing including removal of stumps, large rocks or large trees and for work in clay and other heavy soils. Frames are constructed of high strength steel for longer life. Cast teeth, with replaceable tips, are designed for maximum ground penetration and resistance to shock loading when prying or pushing trees, stumps and rocks. Brush rack is standard and increases height and capacity by as much as 40%.

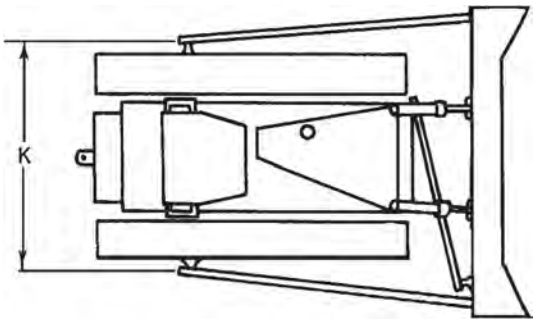
Rake is a direct replacement for existing blade, and utilizes existing push arms and C-frames.





KEY

A Length (Blade Straight)
Blade:
B Width (including standard end bits)
C Height
D Maximum Digging Depth
E Ground Clearance @ Full Lift
F Maximum Tilt (Manual)
G Maximum Pitch Adjustment
H Maximum Hydraulic Tilt
J Hydraulic Tilt (manual brace centered)
K Push Arm Trunnion Width (to Ball Centers)



Blade capacities on the following pages are as determined by SAE recommended practice J1265. Capacities are defined as:

$Vs = 0.8\ WH^2$.

$Vu = ZH\ (W\text{-}Z)\ \tan X$.

Where: Vs = Capacity of straight or angling blade.
Vu = Capacity of semi-U or full U-blade.
W = Blade width exclusive of end bits.
H = Effective blade height considering tapered top corners, etc.
Z = Wing length measured parallel to blade width @ ground line of cutting edges.
X = Wing angle.

MODEL	D6R2 6S		D6R2 6SU		D6R2 6SU XL		D6R2 6S LGP	
Gauge	—		1880 mm	**74"**	1880 mm	**74"**	2286 mm	**90"**
Type	**Straight**		**Semi-Universal**		**Semi-Universal**		**Straight**	
Blade Capacities*	3.89 m^3	**5.1 yd^3**	5.61 m^3	**7.3 yd^3**	5.55 m^3	**7.26 yd^3**	3.75 m^3	**4.9 yd^3**
Weight, Shipping** (Dozer)	2251 kg	**4963 lb**	2333 kg	**5143 lb**	2570 kg	**5666 lb**	2418 kg	**5331 lb**
Tractor and Dozer Dimensions:								
A Length (Blade Straight)	4903 mm	**193.1"**	5095 mm	**200.6"**	5332 mm	**210.0"**	5465 mm	**215.2"**
Blade Dimensions:								
B Width (including std. end bits)	3360 mm	**132.3"**	3260 mm	**128.3"**	3260 mm	**128.3"**	4063 mm	**160"**
C Height	1257 mm	**49.5"**	1412 mm	**55.6"**	1412 mm	**55.6"**	1101 mm	**43.3"**
D Max. Digging Depth	473 mm	**18.6"**	473 mm	**18.6"**	459 mm	**18.1"**	655 mm	**25.8"**
E Ground Clearance @ Full Lift	1104 mm	**43.5"**	1104 mm	**43.5"**	1195 mm	**47.0"**	1083 mm	**42.6"**
G Max. Pitch Adjustment	**+5.3 to 4.8°**		**+5.6 to -5.2°**		**+5.6 to -5.2°**		**+4.4 to -4.4°**	
H Max. Hydraulic Tilt	765 mm	**30.1"**	743 mm	**29.3"**	743 mm	**29.3"**	701 mm	**27.6"**
K Push Arm Trunnion Width (to Ball Centers)	2640 mm	**103.9"**	2640 mm	**103.9"**	2640 mm	**103.9"**	3490 mm	**137.4"**

MODEL	D6R2 6A		D6R2 6A XL		D6T 6A		D6T 6SU	
Gauge	1880 mm	**74"**	1880 mm	**74"**	1880 mm	**74"**	1880 mm	**74"**
Type	**Angling**		**Angling**		**Angling**		**Semi-Universal**	
Blade Capacities*	3.93 m^3	**5.1 yd^3**	3.89 m^3	**5.1 yd^3**	3.64 m^3	**4.75 yd^3**	5.35 m^3	**6.99 yd^3**
Weight, Shipping** (Dozer)	2715 kg	**5986 lb**	2625 kg	**5787 lb**	3138 kg	**6904 lb**	2973 kg	**6540 lb**
Tractor and Dozer Dimensions:								
A Length (Blade Straight)	5007 mm	**197.2"**	5209 mm	**205.1"**	5.00 m	**16'5"**	5.08 m	**17'6"**
Length (Blade Angled)	—		—		5.83 m	**19'2"**	—	
Width (Blade Angled)	—		—		3.78 m	**12'5"**	—	
Width (with C-Frame only)	—		—		2.93 m	**9'8"**	—	
Blade Dimensions:								
B Width (including std. end bits)	4166 mm	**164.0"**	4166 mm	**164.0"**	4.16 m	**13'8"**	3.26 m	**10'8"**
C Height	1155 mm	**45.5"**	1155 mm	**45.5"**	1154 mm	**3'10"**	1411 mm	**4'8"**
D Max. Digging Depth	506 mm	**19.9"**	524 mm	**20.6"**	506 mm	**1'8"**	453 mm	**1'6"**
E Ground Clearance @ Full Lift	1142 mm	**45.0"**	1205 mm	**47.4"**	1144 mm	**3'9"**	1204 mm	**3'11"**
G Max. Pitch Adjustment	**25°**		**25°**		—		**+5.6° to -5.2°**	
H Max. Hydraulic Tilt	408 mm	**16.1"**	408 mm	**16.1"**	519 mm	**1'8"**	811 mm	**2'8"**
Blade Angle	—		—		**25°**		—	
J Hydraulic Tilt (Manual Brace Centered)	—		—		—		455 mm	**1'6"**
K Push Arm Trunnion Width (to Ball Centers)	2640 mm	**103.9"**	2625 mm	**103.9"**	2.58 m	**8'6"**	2.58 m	**8'6"**

*Blade capacities as determined by SAE J1265. Tractor and dozer dimensions variations due to SystemOne undercarriage products are negligible. Notice that the capacity of the SU-blade is the volume carried by a straight blade of the same dimensions plus the volume included in the "cup" of the SU-blade. It is intended for **relative comparisons of dozer sizes,** and not for predicting capacities or productivities in actual field conditions.
**Shipping Weight —Total Bulldozer Arrangement includes: Blade, push arms or C-frame, braces, cylinders, lines, trunnions and lift cylinder mountings.

MODEL	D6T 6A XL		D6T 6SU XL		D6T 6VPAT XL		D6T 6A XW	
Gauge	1.88 m	**74"**	1.88 m	**74"**	2.13 m	**84"**	2.03 m	**80"**
Type	**Angling**		**Semi-Universal**		**VPAT**		**Angling**	
Blade Capacities*	3.94 m^3	**5.15 yd^3**	5.55 m^3	**7.26 yd^3**	4.64 m^3	**6.07 yd^3**	4.35 m^3	**5.69 yd^3**
Weight, Shipping** (Dozer)	3086 kg	**6803 lb**	2831 kg	**6242 lb**	3464 kg	**7637 lb**	3731 kg	**8226 lb**
Tractor and Dozer Dimensions:								
A Length (Blade Straight)	5.21 m	**17'1"**	5.33 m	**17'6"**	5.39 m	**17'8"**	5.29 m	**17'4"**
Length (Blade Angled)	6.05 m	**19'10"**	—		3.54 m	**11'7"**	6.20 m	**20'4"**
Width (Blade Angled)	3.77 m	**12'5"**	—		3.49 m	**11'5"**	4.11 m	**13'6"**
Width (with C-Frame only)	2.99 m	**9'10"**	—		—		3.29 m	**10'10"**
Blade Dimensions:								
B Width (including std. end bits)	4.16 m	**13'8"**	3.26 m	**10'8"**	3.88 m	**12'9"**	4.52 m	**14'10"**
C Height	1154 mm	**3'10"**	1407 mm	**4'7"**	1294 mm	**4'3"**	1153 mm	**3'9"**
D Max. Digging Depth	555 mm	**1'10"**	501 mm	**1'7"**	792 mm	**2'7"**	541 mm	**1'9"**
E Ground Clearance @ Full Lift	1112 mm	**3'7"**	1180 mm	**3'10"**	1053 mm	**3'5"**	1139 mm	**3'9"**
G Max. Pitch Adjustment	—		**+4.0° to -4.0°**		**+0.5° to -3.1°**		—	
H Max. Hydraulic Tilt	424 mm	**1'5"**	811 mm	**2'8"**	410 mm	**1'4"**	424 mm	**1'5"**
Blade Angle	**25°**		—		**24°**		**25°**	
J Hydraulic Tilt (Manual Brace Centered)	—		455 mm	**1'6"**	—		—	
K Push Arm Trunnion Width (to Ball Centers)	2.58 m	**8'6"**	2.58 m	**8'6"**	—		2.89 m	**9'8"**

MODEL	D6T 6SU XW		D6T 6A LGP		D6T 6S LGP		D6T 6VPAT LGP/XW	
Gauge	2.03 m	**80"**	2.29 m	**90"**	2.29 m	**90"**	2.29 m	**90"**
Type	**Semi-Universal**		**Angling**		**Straight**		**VPAT**	
Blade Capacities*	5.64 m^3	**7.38 yd^3**	4.94 m^3	**6.46 yd^3**	3.79 m^3	**4.96 yd^3**	5.02 m^3	**6.57 yd^3**
Weight, Shipping** (Dozer)	2976 kg	**6562 lb**	3745 kg	**8255 lb**	2720 kg	**5997 lb**	3558 kg	**7845 lb**
Tractor and Dozer Dimensions:								
A Length (Blade Straight)	5.33 m	**17'6"**	5.81 m	**19'1"**	5.50 m	**18'1"**	5.53 m	**18'2"**
Length (Blade Angled)	—		6.81 m	**22'4"**	—		—	
Width (Blade Angled)	—		4.63 m	**15'2"**	—		3.72 m	**12'2"**
Width (with C-Frame only)	—		3.77 m	**12'5"**	—		—	
Blade Dimensions:								
B Width (including std. end bits)	3.56 m	**11'8"**	5.07 m	**16'8"**	4.06 m	**13'3"**	4.16 m	**13'8"**
C Height	1407 mm	**4'7"**	1150 mm	**3'9"**	1108 mm	**3'8"**	1294 mm	**4'3"**
D Max. Digging Depth	502 mm	**1'7"**	853 mm	**2'10"**	590 mm	**1'11"**	743 mm	**2'5"**
E Ground Clearance @ Full Lift	1180 mm	**3'10"**	1004 mm	**3'3"**	1094 mm	**3'7"**	1102 mm	**3'7"**
G Max. Pitch Adjustment	**+4.0° to -4.0°**		—		**+4.4° to -4.4°**		**+0.5° to -3.1°**	
H Max. Hydraulic Tilt	791 mm	**2'7"**	618 mm	**2'0"**	747 mm	**2'5"**	435 mm	**1'5"**
Blade Angle	—		**24.2°**		—		**24°**	
J Hydraulic Tilt (Manual Brace Centered)	442 mm	**1'5"**	—		399 mm	**1'4"**	—	
K Push Arm Trunnion Width (to Ball Centers)	2.89 m	**9'8"**	3.42 m	**11'5"**	3.42 m	**11'5"**	—	

*Blade capacities as determined by SAE J1265.
Notice that the capacity of the SU-blade is the volume carried by a straight blade of the same dimensions plus the volume included in the "cup" of the SU-blade.
It is intended for **relative comparisons of dozer sizes,** and not for predicting capacities or productivities in actual field conditions.
**Shipping Weight —Total Bulldozer Arrangement includes: Blade, push arms or C-frame, braces, cylinders, lines, trunnions and lift cylinder mountings.

MODEL	D9R/D9T			
	9SU		9U	
Type	Semi-U		Universal	
Blade Capacities*	13.5 m^3	**17.7 yd^3**	16.4 m^3	**21.4 yd^3**
Weight, Shipping** (Dozer)	6863 kg	**15,130 lb**	7388 kg	**16,288 lb**
Tractor and Dozer Dimensions:				
A Length (Blade Straight)	6.60 m	**21'6"**	6.96 m	**22'8"**
Blade Dimensions:				
B Width (including std. end bits)	4.31 m	**14'1"**	4.65 m	**15'2"**
C Height	1934 mm	**6'4.1"**	1934 mm	**6'4.1"**
D Max. Digging Depth	606 mm	**1'11.9"**	606 mm	**1'11.9"**
E Ground Clearance @ Full Lift	1422 mm	**4'8"**	1422 mm	**4'8"**
G Max. Pitch Adjustment	**+3.4° to 2.9°**		**+3.4° to 2.9°**	
H Max. Hydraulic Tilt	940 mm	**3'1"**	1014 mm	**3'3.9"**
J Hydraulic Tilt (Manual Brace Centered)	570 mm	**1'10.4"**	616 mm	**2'0.3"**
K Push Arm Trunnion Width (to Ball Centers)	3.30 m	**10'8"**	3.30 m	**10'8"**
Maximum Track Width Permitted	762 mm	**2'6"**	762 mm	**2'6"**
Dual Tilt Option				
G Dual Pitch Adj.	**+4.8° to 5.2°**		**+4.8° to 4.9°**	
H Dual Max. Hyd. Tilt	1139 mm	**3'8.8"**	1231 mm	**4'0.5"**

*Blade capacities as determined by SAE J1265.
Notice that the capacity of the U-blade is the volume carried by a straight blade of the same dimensions plus the volume included in the "cup" of the U-blade.
It is intended for **relative comparisons of dozer sizes**, and not for predicting capacities or productivities in actual field conditions.
Notice that the capacity of the SU-blade is the volume carried by a straight blade of the same dimensions plus the volume included in the "cup" of the SU-blade.
It is intended for **relative comparisons of dozer sizes,** and not for predicting capacities or productivities in actual field conditions.
**Shipping Weight —Total Bulldozer Arrangement includes: Blade, push arms or C-frame, braces, cylinders, lines, trunnions and lift cylinder mountings.

MODEL	D11T					
	11SU		11U		11 CD	
Type	Semi-U		Universal		CarryDozer	
Blade Capacities*	27.2 m^3	**35.5 yd^3**	34.4 m^3	**45.0 yd^3**	43.6 m^3	**57.0 yd^3**
Weight, Shipping**						
Standard Dozer	14 813 kg	**32,658 lb**	17 296 kg	**38,131 lb**	24 085 kg	**53,099 lb**
Abrasion Dozer	16 192 kg	**35,698 lb**	18 823 kg	**41,498 lb**	—	
Tractor and Dozer Dimensions:						
A Length	8.58 m	**28'2"**	8.64 m	**28'4"**	8.77 m	**28'9"**
Width	5.50 m	**18'1"**	6.26 m	**20'7"**	6.43 m	**21'1"**
Blade Dimensions:						
B Width (including std. end bits)	5.58 m	**18'4"**	6.35 m	**20'10"**	6.71 m	**22'0"**
C Height	2.75 m	**9'0"**	2.83 m	**9'3"**	2.96 m***	**9'8"*** **
D Max. Digging Depth	766 mm	**2'6.2"**	766 mm	**2'6.2"**	688 mm	**2'3"**
E Ground Clearance @ Full Lift	1533 mm	**5'0.4"**	1533 mm	**5'0.4"**	1850 mm	**6'1"**
G Max. Pitch Adjustment	**+2.1° to 2.2°**		**+2.1° to 2.2°**		—	
H Max. Hydraulic Tilt	1184 mm	**3'10.6"**	1344 mm	**4'4.9"**	1800 mm	**5'11"**
J Hydraulic Tilt (Manual Brace Centered)	886 mm	**2'10.9"**	1006 mm	**3'3.6"**	—	
K Push Arm Trunnion Width (to Ball Centers)	4.18 m	**13'9"**	4.18 m	**13'9"**	4.18 m	**13'9"**
Maximum Track Width Permitted	914 mm	**3'0"**	914 mm	**3'0"**	914 mm	**3'0"**
Dual Tilt Option	**+7.5° to 7.6°** or		**+7.5° to 7.6°** or			
G Dual Pitch Adjustment	**+0° to 13°**		**+0° to 13°**		**+47.8° to 10.4°**	
H Dual Max. Hyd. Tilt	1706 mm	**5'7.2"**	1938 mm	**6'4.3"**	—	

*Blade capacities as determined by SAE J1265.
Notice that the capacity of the U-blade is the volume carried by a straight blade of the same dimensions plus the volume included in the "cup" of the U-blade. It is intended for **relative comparisons of dozer sizes,** and not for predicting capacities or productivities in actual field conditions.
Notice that the capacity of the SU-blade is the volume carried by a straight blade of the same dimensions plus the volume included in the "cup" of the SU-blade. It is intended for **relative comparisons of dozer sizes,** and not for predicting capacities or productivities in actual field conditions.
**Shipping Weight —Total Bulldozer Arrangement includes: Blade, push arms or C-frame, braces, cylinders, lines, trunnions and lift cylinder mountings.
***Blade height with cutting edge at 53°.

All dimensions are approximate.

BULLDOZER PRODUCTION OFF-THE-JOB

You can estimate bulldozer production using the production curves that follow and the correction factors that are applicable. Use this formula:

$$\text{Production } (Lm^3/hr) \text{ (LCY/hr)} = \text{Maximum production} \times \text{Correction factors}$$

The bulldozer production curves give maximum uncorrected production for universal, semi-universal, and straight blades and are based on the following conditions:

1. 100% efficiency (60 minute hour — level cycle).
2. Power shift machines with 0.05 min. fixed times.
3. Machine cuts for 15 m (50 feet), then drifts blade load to dump over a high wall. (Dump time — 0 sec.)
4. Soil density of 1370 kg/Lm^3 (2300 lb/LCY).
5. Coefficient of traction:*
   a. Track machines — 0.5 or better
   b. Wheel machines — 0.4 or better
6. Hydraulic controlled blades used.
7. Dig 1F**
   Carry 2F**
   Return 2R**

To obtain estimated production in bank cubic meters or bank cubic yards, appropriate load factor from the Tables section should be applied to the corrected production as calculated above.

$$\text{Production } Bm^3/hr \text{ (BCY/h)} = Lm^3/hr \text{ (LCY/h)} \times LF$$

*Coefficient of traction assumed to be at least 0.4. While poor traction affects both track and wheel vehicles, causing them to take smaller blade loads, wheeled units are affected more severely and production falls much more rapidly. While no fixed rules can predict this production loss, a rough rule of thumb is that wheel dozer production falls off 4% for each one-hundredth decrease in coefficient of traction below 0.40. If, for example, coefficient of traction is 0.30, the difference is ten-hundredths (0.10), and production is 60% (10 × 4% = 40% decrease).

**This gear sequence is based on level to downhill terrain, light to medium density material, and no blade extensions such as spill plates, rock guards, etc. Exceeding these condi- tions may require carry in 1F, but productivity should equal or exceed "standard conditions" due to the larger loads that can be carried in 1F.

19-50

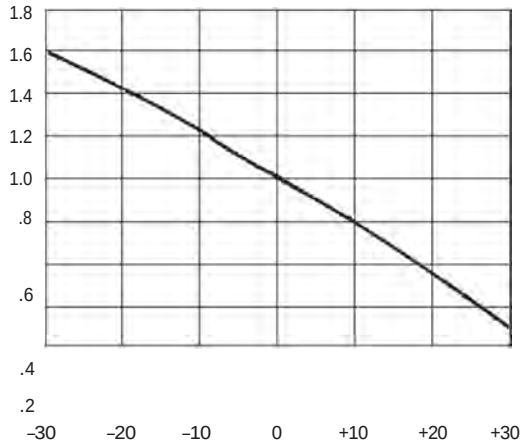
JOB CONDITION CORRECTION FACTORS

	TRACK-TYPE TRACTOR
OPERATOR —	
Excellent	1.00
Average	0.75
Poor	0.60
MATERIAL —	
Loose stockpile	1.20
Hard to cut; frozen —	
with tilt cylinder	0.80
without tilt cylinder	0.70
Hard to drift; "dead" (dry, non-cohesive material) or very sticky material	0.80
Rock, ripped or blasted	0.60-0.80
SLOT DOZING	1.20
SIDE BY SIDE DOZING	1.15-1.25
VISIBILITY —	
Dust, rain, snow, fog or darkness	0.80
JOB EFFICIENCY —	
50 min/hr	0.83
40 min/hr	0.67
BULLDOZER*	
Adjust based on SAE capacity relative to the base blade used in the Estimated Dozing Production graphs.	
GRADES — See following graph.	

***NOTE:** Angling blades and cushion blades are not considered production dozing tools. Depending on job conditions, the A-blade and C-blade will average 50-75% of straight blade production.

% Grade vs. Dozing Factor

(–) Downhill
(+) Uphill



ESTIMATING DOZER PRODUCTION OFF-THE-JOB

Example problem:

Determine average hourly production of a D8T/8SU (with tilt cylinder) moving hard-packed clay an average distance of 45 m (150 feet) down a 15% grade, using a slot dozing technique.

Estimated material weight is 1600 kg/Lm^3 (2650 lb/LCY). Operator is average. Job efficiency is estimated at 50 min/hr.

Uncorrected Maximum Production — 458 Lm^3/h (600 LCY/hr) (example only)

Applicable Correction Factors:

Hard-packed clay is "hard to cut" material . . .–0.80
Grade correction (from graph) .....–1.30
Slot dozing .....–1.20
Average operator .....–0.75
Job efficiency (50 min/hr).....–0.83
Weight correction..... (2300/2650)–0.87

Production = Maximum Production × Correction Factors
= (600 LCY/hr) (0.80) (1.30) (1.20) (0.75) (0.83) (0.87)
= 405.5 LCY/hr

To obtain production in metric units, the same proce- dure is used substituting maximum uncorrected produc- tion in Lm^3.

$$= 458\ Lm^3/h \times \text{Factors}$$
$$= 309.6\ Lm^3/h$$

RIPPERS

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Features:

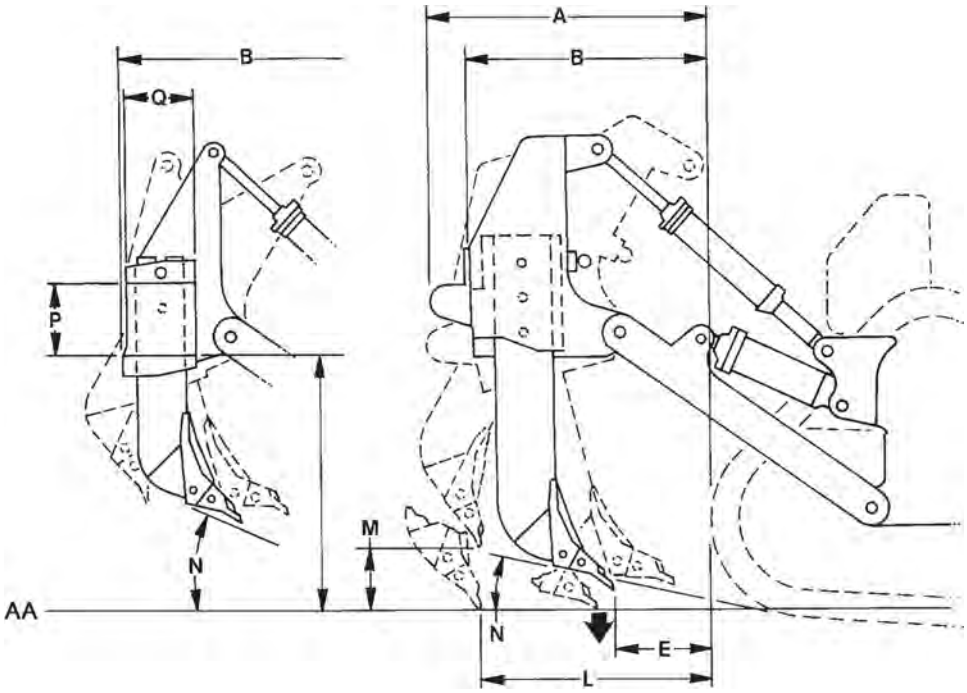
- **Parallelogram linkage with hydraulically variable pitch** on D7E, D7R, D8R/D8T, D9R/D9T, D10T2 and D11T. Operator can adjust angle of ripper tip to the material for penetration at all ripping depths to increase production.
- **Fixed Parallelogram linkage design** used on D3K2, D4K2, D5K2, D6K2, D6N, D6R, D6R XL, D6T and D6T XL. This design holds tooth angle constant at all ripping depths.
- **Adjustable Single shank** arrangements available for D8R/D8T, D9R/D9T, D10T2 and D11T for tough ripping applications and deep ripping requirements.
- **Hydraulically Variable Pitch Multi-shank** arrangements available on D7E, D7R, D8R/D8T, D9R/D9T, D10T2 and D11T allow wide-beam coverage in easier-to-rip materials.
- **Counterweighted CarryDozer Ripper single shank** available for D11T and D11T CD, multi-shank available for D11T CD.

DEFINITION OF FORCES SHOWN IN TABLES THAT FOLLOW

"Pryout," (Breakout) kilonewtons (and pounds) — the maximum sustained upward force, generated by the lift cylinders measured at the ripper tip. Breakout force is measured with the shank in the top hole, shank vertical and ripper full down. Breakout force may be hydraulically or balance limited.

"Penetration force," kilonewtons (and pounds) — the maximum sustained downward force, generated by the ripper lift cylinders measured at the ripper tip, which is required to raise the back end of the vehicle with the tip on ground and the shank (pinned in the top hole) vertical.

Adjustable Parallelogram Ripper

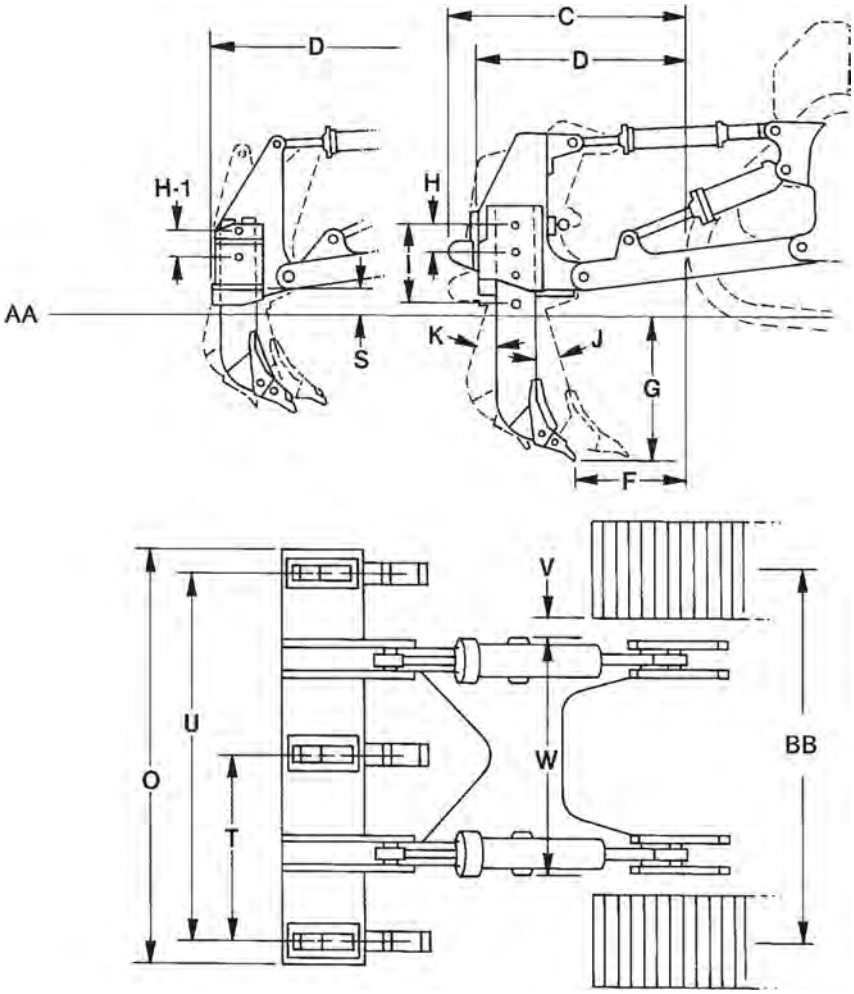


NOTE: Letters correspond to ripper specifications on pages that follow.

KEY

AA — Ground Line

Adjustable Parallelogram Ripper



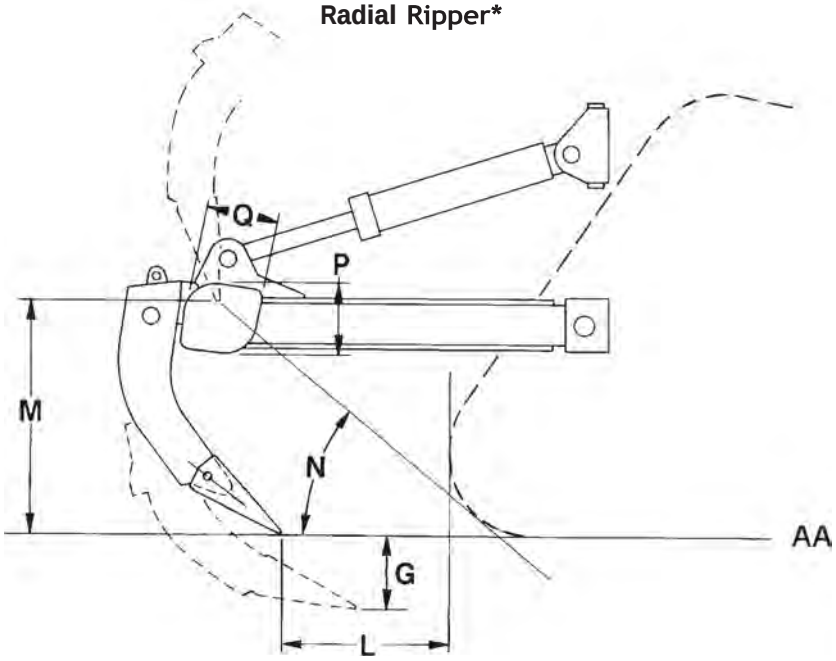
NOTE: Letters correspond to ripper specifications on pages that follow.

KEY

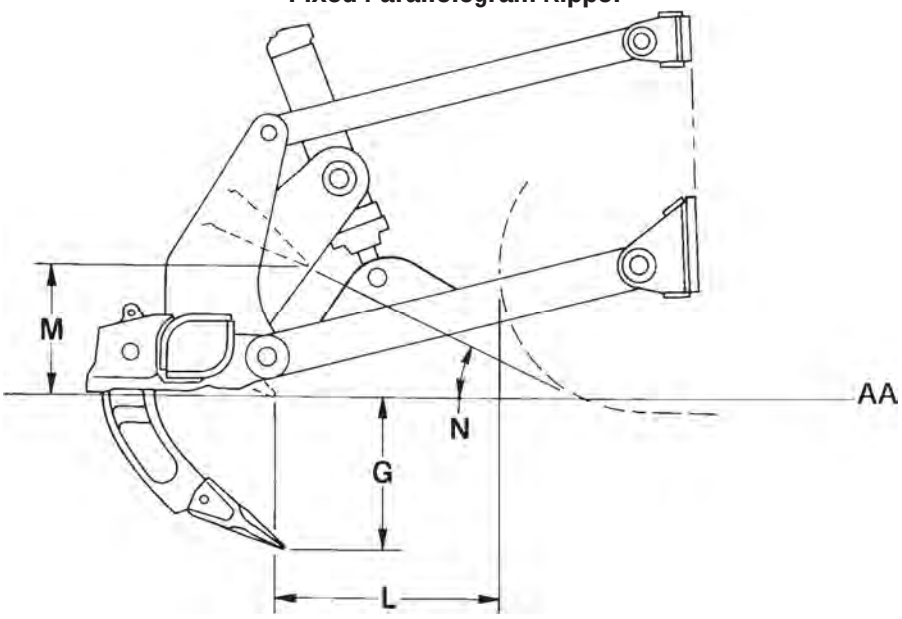
AA — Ground Line
BB — Track Gauge

Specification Diagrams
- Radial Ripper
- Fixed Parallelogram Ripper

Radial Ripper*



Fixed Parallelogram Ripper



NOTE: Letters correspond to ripper specifications on pages that follow.

KEY

AA — Ground Line
* —Tip Standard

TRACTOR/RIPPER	D11T		D11T	
	Adjustable Parallelogram			
Ripper Type	**Multi-shank**		**CD Multi-shank**	
Dimensions:				
Ripper to Track				
Ripper length behind track, shank vertical, ripper up (A)				
A With Pushblock	**N/A**		**N/A**	
B Without Pushblock	1.69 m	**5'6"**	1.71 m	**5'8"**
Ripper length behind track, shank vertical, ripper down (A)				
C With Pushblock	**N/A**		**N/A**	
D Without Pushblock	2.16 m	**7'1"**	2.16 m	**7'1"**
Tip to track distance, shank vertical (A)				
E Ripper Up	0.78 m	**2'7"**	0.78 m	**2'7"**
F Ripper Down	1.95 m	**6'5"**	1.96 m	**6'5"**
Shank*				
G Maximum digging depth	1100 mm	**3'7.3"**	1100 mm	**3'7.3"**
H Dig adjustment per hole	280 mm	**11"**	280 mm	**11"**
I Total dig adjustment	280 mm	**11"**	280 mm	**11"**
Pitch Adjustment, ripper down:				
J Forward	**12.2°**		**12.2°**	
K Backward	**31.8°**		**31.8°**	
L Maximum reach at ground line	1.71 m	**5'7"**	1.71 m	**5'7"**
M Maximum ground clearance under tooth (shank pinned in bottom hole)	1090 mm	**3'6.9"**	1090 mm	**3'6.9"**
N Maximum ramp angle, ripper up (shank pinned in bottom hole)	**36.4°**		**36.4°**	
Shank Section	100 × 400 mm	**3.9" × 15.7"**	100 × 400 mm	**3.9" × 15.7"**
Ripper Beam				
O Overall width	3.33 m	**10'11"**	3.34 m	**10'11.5"**
P Height	560 mm	**22"**	595 mm	**23.4"**
Q Length	560 mm	**22"**	595 mm	**23.4"**
Clearance under beam, shank vertical				
R Ripper Up	2.06 m	**6'9"**	2.03 m	**6'8"**
S Ripper Down	282 mm	**11.1"**	247 mm	**9.7"**
Number of Pockets	**3**		**3**	
T Pocket Spacing	1.5 m	**4'11"**	1.5 m	**4'11"**
U Shank Gauge	3.0 m	**9'10"**	3.0 m	**9'10"**
V Track Clearance with standard shoe	166 mm	**5.6"**	166 mm	**5.6"**
W Width across widest part of lift cylinders	1.9 m	**6'3"**	1.9 m	**6'3"**
Installed Weights:				
Ripper with standard shank	8674 kg	**19,123 lb**	11 790 kg	**25,993 lb**
Each additional tooth group	689 kg	**1519 lb**	689 kg	**1519 lb**
Ripper Forces:**				
Penetration Force, shank vertical	335 kN	**75,311 lb**	365 kN	**82,055 lb**
Pryout Force, shank vertical	632 kN	**142,079 lb**	636 kN	**142,978 lb**

*Hydraulic pin puller is standard with deep ripping shank. Deep Ripping Arrangement maximum digging depth is 2.18 m **(7'2")**.
**Forces are for a ripper on a tractor equipped with an EROPS, U-Dozer and performance track. Forces will vary slightly with other vehicle configurations.

TIP SELECTION FOR THE D8R/D8T, D9R/D9T, D10T2 AND D11T RIPPERS

Three tip configurations (short, intermediate and long) in two styles (centerline and penetration) are available for economical operation in a variety of conditions.

RECOMMENDED TIP USAGE

Short — Use in high impact conditions where breakage problems occur. The shorter the tip, the more it resists breakage.

Intermediate — Most effective in moderate impact conditions where abrasion is not excessive.

Long — Use in loose, abrasive materials where breakage is not a problem. Generally offers the most wear material.

Centerline vs Penetration

The materials being ripped and the tractor doing the ripping will both have an effect on which tip will do the best job. High density material requires a "penetration" tip. High impact material requires a "centerline" tip. The following is a general guide to tip application.

	Tips to use		
Ripping Condition	**D8R/D8T D9R/D9T**	**D10T2**	**D11T**
Tandem Tractors	Short	Short	Short
Single Shank and Multi-shank			
Extreme Duty.	Int.	Short	Short
Medium Duty.	Long	Int.	Int.
Abrasive Duty	Long	Long	Long

Always use the longest tip that will wear without excessive breakage. Different tips should be tried to determine the most economical.

ESTIMATING RIPPING PRODUCTION

Ripping costs must be compared to other methods of loosening the material — usually drilling and blast- ing — on a cost per ton or bank cubic yard basis. Thus, an accurate estimation of ripper production is needed to determine unit ripping costs.

There are three general methods of estimating ripping production:

1. The best method is to record the time spent ripping, then remove (using scrapers or loaders and trucks) and weigh the ripped material. The total weight divided by the time spent will give hourly production. If the contractor is paid by volume, then a density must be used and the accuracy is only as good as the density used. For payment by volume removed, method 2 may be desirable. Some care will be needed to assure that only ripped material is removed.
2. Another method is to cross-section the area and then record the time spent ripping. After the material has been removed, cross-section the area again to determine the volume of rock removed. The volume divided by the time spent ripping gives the ripping rate per minute or hour.
3. Timing the ripper over a measured distance is the least accurate method, but valuable for quick estimating on the job. An average cycle time should be determined from a number of timed cycles. Turn-around or back-up time must be included. Measure the average rip distance, rip spacing and depth of penetration. This data will give the volume per cycle from which the production in bank cubic yards can be calculated. Experience has shown results obtained from this method are about 10 to 20% higher than the more accurate method of cross-sectioning.

An example of the measured distance method for calculating ripper production is:

Data — D10T2 — No. 10 with one shank.
910 mm (36 in) between passes.
1.6 km/h (1 mph) average speed (including slippage and stalls).
Every 91 m (300 ft) requires 0.25 min to raise, pivot, turn, and lower again: 91 m (300 ft) = 1 pass.
610 mm (24 in) penetration.
Full time ripping (no pushing or dozing assignment).

Example of Estimating Production (Metric)

Time per pass:

1.6 km/h = 26.7 m/min. Then $\frac{91 \text{ m}}{26.7 \text{ m/min}}$ = 3.41 min;

3.41 min + 0.25 min (turn time) = 3.66 min/pass.

If the operator works an average of 45 min per h, it is possible to make = $\frac{45}{3.66}$ = 12.3 passes per h

Volume ripped: 91 m × 0.9 m × 0.6 m = 49.1 BCM per pass

Production = 49.1 × 12.3 = 604 BCM per h

Remember the results from this method are usually 10 to 20 per cent higher than the actual production that can be expected on the job.

●●●

Example of Estimating Production (English)

Time per pass:

MPH = 88 fpm. Then $\frac{300 \text{ ft}}{88 \text{ fpm}}$ = 3.41 min;

3.41 min + 0.25 min. (turn time) = 3.66 min/pass.

If the operator works an average of 45 min per h, it is possible to make = $\frac{45}{3.66}$ = 12.3 passes per h

Volume ripped: $\frac{300 \times 3 \times 2}{27}$ = 66.7 BCY per pass

Production = 66.7 × 12.3 = 820 BCY per hr

●●●

NOTE: The demands of heavy ripping will increase the normal owning and operating costs of the tractor. These costs should be increased no less than 30-40% in heavy ripping applications to estimate rock loosening costs.

There is no ready answer or rule-of-thumb solution to predict ripping production. Even if everything is known about the seismic velocity of the material, its composition, job conditions, equipment and operator, only a "guesstimate" can be given. The final answer must come from a production study obtained on the job site.

Sample problem (Metric)

Determine the loosening costs in the following situation:

Machine	— D10T2 Tractor with No. 10 Single Shank Ripper
Rip Spacing	— 915 mm
Ripper Penetration	— 610 mm
Rip Distance	— 91 m
Rip Time	— 3.41 minutes
Maneuver Time	— 0.25 minutes
Seismic Velocity	— 1830 meters per second

Assume 60 min. hour

Solution:

1. Total Cycle Time = 3.41 + 0.25 = 3.66 min
   Cycles/hour = $\frac{60 \text{ min/hr}}{3.66 \text{ min/cycle}}$ = 16.4
2. Production per cycle = 91 m × 0.9 m × 0.6 m = 49.1 BCM/cycle
3. Production = 49.1 BCM/cycle × 16.4 cycles/h = 805 BCM/h
4. Remember results of this method are usually 10 to 20% high.
   Actual Production = 80% of 805 BCM/h = 644 BCM/h
   Or 90% of 805 BCM/h = 725 BCM/h
5. Owning and Operating Costs
   A D10T2 (ripping only) could have a $115.00/h O & O costs including $30/h operator.
6. Loosening Costs
   $115.00/hr ÷ 644 BCM/h = $0.179/BCM
   $115.00/hr ÷ 725 BCM/h = $0.159/BCM
   The loosening cost should range from 15.9¢ to 17.9¢/BCM

●●●

Sample problem (English)

Determine the loosening costs in the following situation:

Machine	— D10T2 Tractor with No. 10 Single Shank Ripper
Rip Spacing	— 3 feet
Ripper Penetration	— 2 feet
Rip Distance	— 300 feet
Rip Time	— 3.41 minutes
Maneuver Time	— 0.25 minutes
Seismic Velocity	— 6000 feet per second

Assume 60 min. hour

Solution:

1. Total Cycle Time = 3.41 + 0.25 = 3.66 min

$$\text{Cycles/hour} = \frac{60 \text{ min/hr}}{3.66 \text{ min/cycle}} = 16.4$$

2. Production per cycle = $\frac{300 \times 3 \times 2}{27}$ = 66.7 BCY/cycle

3. Production = 66.7 BCY/cycle × 16.4 cycles/hr = 1094 BCY/hour

4. Remember results of this method are usually 10 to 20% high.
   Actual Production = 80% × 1094 = 875 BCY/hr
   or 90% × 1094 = 984 BCY/hr

5. Owning and Operating Costs
   A D10T2 (ripping only) could have a $115.00/hr O & O costs including $30/hr operator

6. Loosening Costs
   $115.00/hr ÷ 875 BCY/hr = $0.131/BCY
   $115.00/hr ÷ 984 BCY/hr = $0.117/BCY
   The loosening cost should range from 11.7¢ to 13.1¢/BCY

●●●

USE OF SEISMIC VELOCITY CHARTS

The charts of ripper performance estimated by seismic wave velocities have been developed from field tests conducted in a variety of materials. Considering the extreme variations among materials and even among rocks of a specific classification, the charts must be recognized as being at best only one indicator of rippability.

Accordingly, consider the following precautions when evaluating the feasibility of ripping a given formation:

— Tooth penetration is often the key to ripping success, regardless of seismic velocity. This is particularly true in homogeneous materials such as mudstones and claystones and the fine-grained caliches. It is also true in tightly cemented formations such as conglomerates, some glacial tills and caliches containing rock fragments.

— Low seismic velocities of sedimentaries can indicate probable rippability. However, if the fractures and bedding joints do not allow tooth penetra- tion, the material may not be ripped effectively.

— Pre-blasting or "popping" may induce sufficient fracturing to permit tooth entry, particularly in the caliches, conglomerates and some other rocks; but the economics should be checked carefully when considering popping in the higher grades of sandstones, limestones and granites.

Ripping is still more art than science, and much will depend on operator skill and experience. Ripping for scraper loading may call for different techniques than if the same material is to be dozed away. Cross-ripping requires a change in approach. The number of shanks used, length and depth of shank, tooth angle, direc- tion, throttle position — all must be adjusted according to field conditions. Ripping success may well depend on the operator finding the proper combination for those conditions.

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INTEGRATED TOOLCARRIERS

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WHEEL LOADERS

Features:

- **Cat® heavy duty diesel engine.**
- **Productive operator environment. Excellent visibility.**
- **Automatic lift and bucket controls.**
- **Adjustable suspension seat and steering column.**
- **Four wheel enclosed wet disc brakes.**
- **Automatic power shift transmissions.** Allows operator to select automatic or manual mode.
- **Hydrostatic drive on 903C2, 906K/M, 907K/M, 908K/M, 910K/M, 914K/M, 918M, 924K, 926M, 930K/M and 938K/M.**
- **Transmission neutralizer switch (950H-980H, 950K-980K, 950L-980L and 950M-982M).**
- **Advanced power train with continuously variable transmission** available on the 966M XE and 972M XE.
- **Computerized machine function monitoring.**
- **Command control steering** with integrated transmission controls and electro-hydraulic controls … 950H-980H.
- **Electro-Hydraulic (EH) Joystick Steering with Force Feedback (Speed Sensitive) on 966K, 966M, 972K, 972M, 980K, 980M and 982M (optional on 950M and 962M).**
- **Lock up clutch on 950L, 950M, 962L, 962M, 966L, 966M, 972L, 972M, 980L, 980M, 982M, 988K, 990K and 994K (optional on the 980K, 992K and 993K).**
- **Impeller clutch on 988K, 990K, 992K, 993K and 994K.**
- **Tilting hood … 950H-980H, 950K-980K, 950L-980L and 950M-982M.**
- **Brake wear indicator.**
- **Limited slip differentials on 924K, 926M, 930K/M, 938K/M (optional on 950H-980H, 950K-980K, 980L, 980M and 982M).**
- **Differential locks … 903C2, 906K/M, 907K/M, 908K/M, 910K/M, 914K/M, 918M, 924K, 926M, 930K/M, 938K/M, 950M, 962M, 966M and 972M (optional on 950L, 962L, 966L and 972L).**
- **Automatic Ride Control suspension system.** Operator select "on," "off" or "automatic" (excluding 903C2).
- **Payload control system** (excluding models below 924K).
- **Optional Fusion coupler system** for attachment interchangeability with pin-on performance. Attachments can interchange across the entire SWL/MWL/IT line (excluding models below 924K).
- **Performance Series Buckets** — Reduced dig times and better material retention lead to significant productivity and fuel efficiency improvements (910K/M, 914K/M, 918M, 924K, 926M, 930K/M, 938K/M, 950H-980H, 950K- 980K, 950L-980L and 950M-982M).

Listed features may be standard on some models, optional or unavailable on others. Contact your Cat dealer for specific information.

MODEL	950H		962H		966H	
Emission Standards	**Tier 3 equivalent***		**Tier 3 equivalent***		**Tier 3 equivalent***	
Maximum Engine: Net	147 kW	**197 hp**	156 kW	**209 hp**	195 kW	**262 hp**
Gross	162 kW	**217 hp**	172 kW	**231 hp**	211 kW	**283 hp**
Engine Model	**C7 ACERT**		**C7 ACERT**		**C11 ACERT**	
Maximum Net Power Engine RPM	**1800**		**1800**		**1800**	
Bore	110 mm	**4.3"**	110 mm	**4.3"**	130 mm	**5.1"**
Stroke	127 mm	**5"**	127 mm	**5"**	140 mm	**5.5"**
No. Cylinders	**6**		**6**		**6**	
Displacement	7.2 L	**439 in³**	7.2 L	**439 in³**	11.1 L	**677 in³**
Speeds Forward:	**km/h**	**mph**	**km/h**	**mph**	**km/h**	**mph**
1st	6.9	**4.3**	7.0	**4.4**	6.7	**4.2**
2nd	12.7	**7.9**	13.0	**8.1**	12.6	**7.8**
3rd	22.3	**13.9**	22.6	**14.0**	22.1	**13.7**
4th	37.0	**23.0**	38.0	**23.6**	37.4	**23.2**
Speeds Reverse:	**km/h**	**mph**	**km/h**	**mph**	**km/h**	**mph**
1st	7.6	**4.7**	7.6	**4.7**	7.4	**4.6**
2nd	13.9	**8.6**	13.9	**8.6**	13.9	**8.6**
3rd	24.5	**15.2**	24.5	**15.2**	24.3	**15.1**
4th	40.0	**24.9**	40.0	**24.9**	37.4	**23.2**
Hydraulic Cycle Time, Rated Load in Bucket:	**Seconds**		**Seconds**		**Seconds**	
Raise (from Carry Position)	**6.2**		**6.2**		**5.9**	
Dump (at Maximum Raise)	**2.0**		**2.0**		**1.6**	
Lower (Empty, Float Down)	**2.5**		**2.5**		**2.4**	
Total	**10.7**		**10.7**		**9.9**	
Tread Width	2.14 m	**7'0"**	2.14 m	**7'0"**	2.23 m	**7'4"**
Width Over Tires	2.79 m	**9'2"**	2.79 m	**9'2"**	3.06 m	**9'10"**
Ground Clearance	412 mm	**16"**	412 mm	**16"**	434 mm	**17"**
Fuel Tank Capacity	264 L	**70 U.S. gal**	264 L	**70 U.S. gal**	380 L	**100 U.S. gal**
Hydraulic Tank Capacity	110 L	**29 U.S. gal**	110 L	**29 U.S. gal**	110 L	**29 U.S. gal**
Hydraulic System Capacity (includes tank)	186 L	**48.4 U.S. gal**	186 L	**48.4 U.S. gal**	200 L	**52 U.S. gal**

*Meets Tier 3, Stage IIIA, Japan 2006 (Tier 3) equivalent emission standards.
NOTE: Net Engine Power is provided according to SAE J1349 and ISO 9249. Gross Engine Power is provided according to SAE J1995. Machines may only be available in certain regions. Contact your local Cat dealer for product availability.

MODEL	972H		980H		986H		990K	
Emission Standards	Tier 3 equivalent*		Tier 3 equivalent*		Tier 2 equivalent or Tier 3 equivalent**		Tier 2 equivalent or Tier 4 Final***	
Maximum Engine: Net	214 kW	**287 hp**	260 kW	**349 hp**	305 kW	**409 hp**	521 kW	**699 hp**
Gross	232 kW	**311 hp**	293 kW	**392 hp**	335 kW	**449 hp**	561 kW	**752 hp**
Rated Payload†	—		—		10 tonnes	**11 tons**	15.9 tonnes	**17.5 tons**
Gross Rated Bucket Payload†	—		—		—		24 249 kg	**53,460 lb**
Engine Model	C13 ACERT		C15 ACERT		C15 ACERT		C27 ACERT	
Maximum Net Power Engine RPM	1800		1800		1800		1800	
Bore	130 mm	**5.1"**	137 mm	**5.4"**	137 mm	**5.4"**	137 mm	**5.4"**
Stroke	157 mm	**6.2"**	171 mm	**6.75"**	171 mm	**6.75"**	152 mm	**6"**
No. Cylinders	6		6		6		12	
Displacement	12.5 L	**763 in³**	15.2 L	**928 in³**	15.2 L	**928 in³**	27.0 L	**1650 in³**
Speeds Forward:	km/h	mph	km/h	mph	km/h	mph	km/h	mph
1st	7.2	**4.5**	6.6	**4.1**	7.3	**5**	7.3	**4.5**
2nd	12.6	**7.8**	11.8	**7.3**	12.7	**8**	13.3	**8.3**
3rd	21.4	**13.3**	20.7	**12.9**	22	**14**	22.9	**14.2**
4th	36.9	**22.9**	36.3	**22.6**	39	**24**	—	
Speeds Reverse:	km/h	mph	km/h	mph	km/h	mph	km/h	mph
1st	8.2	**5.1**	7.6	**4.7**	7.6	**5**	7.9	**4.9**
2nd	14.2	**8.8**	13.5	**8.4**	14.1	**9**	14.7	**9.1**
3rd	24.3	**15.1**	23.6	**14.7**	25	**12**	24.9	**15.5**
4th	38.8	**24.0**	41.5	**25.8**	—		—	
Hydraulic Cycle Time, Rated Load in Bucket:	Seconds		Seconds		Seconds		Seconds	
Raise††	5.9		6.0		8.5		8.2	
Dump (at Maximum Raise)	2.1		2.1		3		2.9	
Lower (Empty, Float Down)	2.4		3.4		4.3		3.6	
Total	10.4		11.5		15.8		13.8	
Tread Width	2.23 m	**7'4"**	2.43 m	**8'0"**	2.59 m	**8'6"**	3.1 m	**10'2"**
Width Over Tires	3.00 m	**9'10"**	3.18 m	**10'5"**	3.54 m	**11'7"**	4.1 m	**13'5"**
Ground Clearance	434 mm	**17"**	430 mm	**16.9"**	459 mm	**18"**	596 mm	**23.5"**
Fuel Tank Capacity	380 L	**100 U.S. gal**	453 L	**120 U.S. gal**	600 L	**159 U.S. gal**	1114 L	**294 U.S. gal**
Hydraulic Tank Capacity	110 L	**29 U.S. gal**	125 L	**33 U.S. gal**	130 L	**34 U.S. gal**	—	
Implement and Fan	—		—		—		261 L	**68.9 U.S. gal**
Steering and Braking	—		—		—		132 L	**34.9 U.S. gal**
Hydraulic System Capacity (includes tank)	200 L	**52 U.S. gal**	250 L	**66 U.S. gal**	330 L	**87 U.S. gal**	795 L	**210 U.S. gal**

*Meets Tier 3, Stage IIIA, Japan 2006 (Tier 3) equivalent emission standards.
**Meets Tier 2/Stage II/Japan 2001 (Tier 2) equivalent OR Tier 3/Stage IIIA/Japan 2006 (Tier 3) equivalent emission standards.
***Meets Tier 2/Stage II/Japan 2001 (Tier 2) equivalent OR Tier 4 Final/Stage IV/Japan 2014 (Tier 4 Final) emission standards.
†Changes in bucket weight, including field installed wear iron, can impact rated payload. Consult your Cat dealer for assistance in selecting and configuring the proper bucket for the application. The Cat Large Wheel Loader Payload Policy is a guideline intended to maximize wheel loader structural and component life. The Cat Payload Policy is that the "Gross Bucket plus Payload Capacity" is the MAXIMUM weight that should be carried on the end of the Lift Arm/Boom.
††Raise is from carry position for the 972H and 980H.
NOTE: 972H and 980H Net Engine Power is provided according to SAE J1349 and ISO 9249. Gross Engine Power is provided according to SAE J1995. The 972H and 980H are not available in all regions. Contact your local Cat dealer for product availability.

MODEL	992K		993K		994K	
Maximum Engine: Net	607 kW	**814 hp**	764 kW	**1024 hp**	1297 kW	**1739 hp**
Gross	671 kW	**900 hp**	773 kW	**1036 hp**	1377 kW	**1847 hp**
Rated Payload:*						
STD	21.8 tonnes	**24 tons**	22.7 tonnes	**30 tons**	40.8 tonnes	**45 tons**
HL, EHL, SHL	19 tonnes	**21 tons**	24.9 tonnes	**27.5 tons**	38.1 tonnes	**42 tons**
Gross Rated Bucket Payload:*						
STD	33 687 kg	**74,265 lb**	42 912 kg	**94,603 lb**	64 791 kg	**142,838 lb**
HL	30 138 kg	**66,441 lb**	40 459 kg	**89,195 lb**	61 458 kg	**135,489 lb**
Engine Model	**C32 ACERT****		**C32 ACERT****		**3516E**	
Emission Level						
Rated Engine RPM	**1750**		**1900**		**1600**	
Bore	145 mm	**5.7"**	145 mm	**5.7"**	170 mm	**6.7"**
Stroke	162 mm	**6.4"**	162 mm	**6.4"**	215 mm	**8.5"**
No. Cylinders	**12**		**12**		**16**	
Displacement	32.1 L	**1959 in³**	32.1 L	**1959 in³**	78 L	**4766 in³**
Speeds Forward:	**km/h**	**mph**	**km/h**	**mph**	**km/h**	**mph**
1st	7.1	**4.4**	6.8	**4.2**	7.4	**4.6**
2nd	12.2	**7.6**	11.9	**7.4**	12.9	**8.0**
3rd	20.6	**12.8**	20.5	**12.7**	24.0	**14.9**
Speeds Reverse:	**km/h**	**mph**	**km/h**	**mph**	**km/h**	**mph**
1st	7.4	**4.6**	7.5	**4.7**	8.1	**5.0**
2nd	13.0	**8.1**	13.1	**8.1**	14.1	**8.8**
3rd	22.4	**13.9**	22.5	**13.9**	24.0	**14.9**
Hydraulic Cycle Time, Rated Load in Bucket:	**Seconds**		**Seconds**		**Seconds**	
Raise	**9.4**		**9.2**		**12.6**	
Dump	**1.8**		**1.8**		**3.1**	
Lower (Empty, Float Down)	**3.7**		**3.1**		**4.2**	
Total	**14.9**		**14.1**		**19.9**	
Tread Width	3.3 m	**10'10"**	3.54 m	**11'6"**	4.3 m	**14'1"**
Width Over Tires	4.5 m	**14'9"**	4.93 m	**16'2"**	5.49 m	**18'10"**
Ground Clearance	682 mm	**26.8"**	721 mm	**2'5"**	898 mm	**33"**
Fuel Tank Capacity	1610 L	**425 U.S. gal**	2170 L	**573 U.S. gal**	3445 L	**910 U.S. gal**
Hydraulic Systems:						
Lift, Tilt	646 L	**171 U.S. gal**	755 L	**199 U.S. gal**	1022 L	**270 U.S. gal**
Tank Only	326 L	**86 U.S. gal**	553 L	**146 U.S. gal**	756 L	**200 U.S. gal**
Steering and Brakes	231 L	**61 U.S. gal**	227 L	**60 U.S. gal**	379 L	**100 U.S. gal**
Tank Only	159 L	**42 U.S. gal**	185 L	**48.9 U.S. gal**	340 L	**90 U.S. gal**

*Changes in bucket weight, including field installed wear iron, can impact rated payload. Consult your Cat dealer for assistance in selecting and configuring the proper bucket for the application. The Cat Large Wheel Loader Payload Policy is a guideline intended to maximize wheel loader structural and component life. The Cat Payload Policy is that the "Gross Bucket plus Payload Capacity" is the MAXIMUM weight that should be carried on the end of the Lift Arm/Boom.

**Products available to meet Tier 2/Stage II/Japan 2001 (Tier 2) equivalent OR Tier 4 Final/Stage IV/Japan 2014 (Tier 4 Final) emission standards.

NOTE: The 994K meets Tier 1 equivalent emission standards.

Bucket Type		General Purpose — Pin On								High Lift Delta
Edge Type		Bolt-on Cutting Edges	Teeth & Segments	Bolt-on Cutting Edges	Teeth & Segments	Bolt-on Cutting Edges	Teeth & Segments	Bolt-on Cutting Edges	Teeth & Segments	
Capacity — rated	m³	3.80	3.80	4.00	4.00	4.20	4.20	4.60	4.60	—
	yd³	**4.97**	**4.97**	**5.23**	**5.23**	**5.49**	**5.49**	**6.02**	**6.02**	**—**
Capacity — 110%	m³	4.18	4.18	4.40	4.40	4.62	4.62	5.06	5.06	—
	yd³	**5.47**	**5.47**	**5.75**	**5.75**	**6.04**	**6.04**	**6.62**	**6.62**	**—**
Width	mm	3220	3271	3220	3271	3220	3271	3220	3271	—
	ft/in	**10'6"**	**10'8"**	**10'6"**	**10'8"**	**10'6"**	**10'8"**	**10'6"**	**10'8"**	**—**
Dump clearance at maximum lift	mm	3067	2915	3058	2905	2991	2837	2977	2823	558
and 45° discharge	ft/in	**10'0"**	**9'6"**	**10'0"**	**9'6"**	**9'9"**	**9'3"**	**9'9"**	**9'3"**	**1'9"**
Reach at maximum lift	mm	1327	1467	1334	1473	1388	1525	1400	1537	–25
and 45° discharge	ft/in	**4'4"**	**4'9"**	**4'4"**	**4'10"**	**4'6"**	**5'0"**	**4'7"**	**5'0"**	**–1"**
Reach at level lift arm	mm	2739	2943	2750	2955	2838	3043	2857	3062	404
and bucket level	ft/in	**8'11"**	**9'7"**	**9'0"**	**9'8"**	**9'3"**	**9'11"**	**9'4"**	**10'0"**	**1'3"**
Digging depth	mm	124	124	124	124	124	124	124	124	–25
	in	**4.9**	**4.9**	**4.9**	**4.9**	**4.9**	**4.9**	**4.9**	**4.9**	**–1"**
Overall length	mm	8681	8906	8693	8918	8780	9005	8799	9024	697
	ft/in	**28'6"**	**29'3"**	**28'7"**	**29'4"**	**28'10"**	**29'7"**	**28'11"**	**29'8"**	**2'3"**
Overall height with	mm	5788	5788	5902	5902	5902	5902	5874	5874	558
bucket at maximum lift	ft/in	**19'0"**	**19'0"**	**19'5"**	**19'5"**	**19'5"**	**19'5"**	**19'4"**	**19'4"**	**1'9"**
Loader clearance circle with	mm	14 727	14 899	14 733	14 905	14 778	14 951	14 787	14 961	481
bucket at carry position	ft/in	**48'4"**	**48'11"**	**48'5"**	**48'11"**	**48'6"**	**49'1"**	**48'7"**	**49'1"**	**1'6"**
Static tipping load, straight	kg	16 045	15 863	16 024	15 842	15 831	15 648	15 822	15 636	372
(ISO)*	lb	**35,364**	**34,963**	**35,319**	**34,915**	**34,893**	**34,488**	**34,872**	**34,463**	**821**
Static tipping load, straight	kg	17 316	17 131	17 305	17 120	17 104	16 917	17 120	16 931	299
(rigid tire)*	lb	**38,164**	**37,757**	**38,141**	**37,733**	**37,697**	**37,287**	**37,732**	**37,318**	**658**
Static tipping load, articulated	kg	14 052	13 869	14 028	13 845	13 848	13 664	13 829	13 643	166
(ISO)*	lb	**30,971**	**30,569**	**30,918**	**30,514**	**30,522**	**30,117**	**30,479**	**30,070**	**366**
Static tipping load, articulated	kg	15 312	15 128	15 298	15 113	15 111	14 925	15 116	14 928	112
(rigid tire)*	lb	**33,749**	**33,342**	**33,718**	**33,309**	**33,304**	**32,894**	**33,316**	**32,901**	**248**
Breakout force**	kN	187	185	185	183	173	171	170	168	–14
	lbf	**42,151**	**41,781**	**41,695**	**41,326**	**38,984**	**38,618**	**38,277**	**37,912**	**-3170**
Operating weight*	kg	23 073	23 211	23 125	23 263	23 181	23 319	23 221	23 359	1763
	lb	**50,853**	**51,157**	**50,968**	**51,272**	**51,091**	**51,395**	**51,179**	**51,483**	**3888**

*Static tipping loads and operating weights shown are based on standard machine configuration with 26.5R25 L3 Michelin XHA2 radial tires, power train guard, full fuel tank, coolants, lubricants, air conditioner and operator.
Static tipping loads conform to the international standard as defined in ISO 14397-1 (SEPT2007).
Measured 100 mm **(4") behind tip of cutting edge with bucket hinge pin as pivot point in accordance with SAE J732 (APR2007).

NOTE: Specifications and ratings conform to all applicable standards recommended by the Society of Automotive Engineers, including SAE Standard J732 (APR2007) which governs loader ratings.

NOTE: Bucket availability varies by region. Consult your local dealer for availability.

Bucket Type		Rock — Pin On		Material Handling/Standard — Pin On				
Edge Type		Bolt-on Cutting Edges	Teeth & Segments	Bolt-on Cutting Edges	Teeth & Segments	Bolt-on Cutting Edges	Teeth & Segments	High Lift Delta
Capacity — rated	m^3	3.40	3.40	4.00	4.00	4.60	4.60	—
	yd^3	**4.45**	**4.45**	**5.23**	**5.23**	**6.02**	**6.02**	**—**
Capacity — 110%	m^3	3.74	3.74	4.40	4.40	5.06	5.06	—
	yd^3	**4.89**	**4.89**	**5.75**	**5.75**	**6.62**	**6.62**	**—**
Width	mm	3252	3252	3220	3271	3220	3271	—
	ft/in	**10'8"**	**10'8"**	**10'6"**	**10'8"**	**10'6"**	**10'8"**	**—**
Dump clearance at maximum lift	mm	3124	3026	2978	2815	2893	2730	558
and 45° discharge	ft/in	**10'2"**	**9'11"**	**9'9"**	**9'2"**	**9'5"**	**8'11"**	**1'9"**
Reach at maximum lift	mm	1454	1576	1252	1379	1337	1464	–25
and 45° discharge	ft/in	**4'9"**	**5'2"**	**4'1"**	**4'6"**	**4'4"**	**4'9"**	**–1"**
Reach at level lift arm	mm	2818	2974	2769	2973	2889	3093	404
and bucket level	ft/in	**9'2"**	**9'9"**	**9'1"**	**9'9"**	**9'5"**	**10'1"**	**1'3"**
Digging depth	mm	68	68	124	124	124	124	–25
	in	**2.7**	**2.7**	**4.9**	**4.9**	**4.9**	**4.9**	**-1"**
Overall length	mm	8745	8906	8711	8936	8831	9056	697
	ft/in	**28'9"**	**29'3"**	**28'7"**	**29'4"**	**29'0"**	**29'9"**	**2'3"**
Overall height with	mm	5845	5845	5858	5858	5982	5982	558
bucket at maximum lift	ft/in	**19'3"**	**19'3"**	**19'3"**	**19'3"**	**19'8"**	**19'8"**	**1'9"**
Loader clearance circle with	mm	14 813	14 901	14 742	14 914	14 804	14 978	481
bucket at carry position	ft/in	**48'8"**	**48'11"**	**48'5"**	**49'0"**	**48'7"**	**49'2"**	**1'6"**
Static tipping load, straight	kg	16 255	16 185	15 834	15 653	15 622	15 438	372
(ISO)*	lb	**35,826**	**35,672**	**34,899**	**34,499**	**34,431**	**34,026**	**821**
Static tipping load, straight	kg	17 542	17 471	17 078	16 894	16 885	16 699	299
(rigid tire)*	lb	**38,663**	**38,507**	**37,640**	**37,235**	**37,216**	**36,805**	**658**
Static tipping load, articulated	kg	14 217	14 147	13 861	13 680	13 655	13 471	166
(ISO)*	lb	**31,334**	**31,180**	**30,551**	**30,151**	**30,096**	**29,690**	**366**
Static tipping load, articulated	kg	15 496	15 425	15 097	14 913	14 909	14 723	112
(rigid tire)*	lb	**34,153**	**33,998**	**33,274**	**32,870**	**32,861**	**32,450**	**248**
Breakout force**	kN	186	185	182	181	166	165	–14
	lbf	**41,828**	**41,704**	**41,111**	**40,742**	**37,481**	**37,117**	**-3170**
Operating weight*	kg	24 004	24 056	23 134	23 272	23 267	23 404	1763
	lb	**52,905**	**53,019**	**50,987**	**51,291**	**51,279**	**51,583**	**3888**

*Static tipping loads and operating weights shown are based on standard machine configuration with 26.5R25 L3 Michelin XHA2 radial tires, power train guard, full fuel tank, coolants, lubricants, air conditioner and operator.
Static tipping loads conform to the international standard as defined in ISO 14397-1 (SEPT2007).
Measured 100 mm **(4") behind tip of cutting edge with bucket hinge pin as pivot point in accordance with SAE J732 (APR2007).

NOTE: Specifications and ratings conform to all applicable standards recommended by the Society of Automotive Engineers, including SAE Standard J732 (APR2007) which governs loader ratings.

NOTE: Bucket availability varies by region. Consult your local dealer for availability.

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Bucket Type		General Purpose — Pin On						High Lift Delta
Edge Type		Bolt-on Cutting Edges	Teeth & Segments	Bolt-on Cutting Edges	Teeth & Segments	Bolt-on Cutting Edges	Teeth & Segments	
Capacity — rated	m^3	5.40	5.40	5.70	5.70	6.00	6.00	—
	yd^3	**7.06**	**7.06**	**7.46**	**7.46**	**7.85**	**7.85**	**—**
Capacity — 110%	m^3	5.94	5.94	6.27	6.27	6.60	6.60	—
	yd^3	**7.77**	**7.77**	**8.20**	**8.20**	**8.63**	**8.63**	**—**
Width	mm	3447	3535	3447	3535	3447	3535	—
	ft/in	**11'3"**	**11'7"**	**11'3"**	**11'7"**	**11'3"**	**11'7"**	**—**
Dump clearance at maximum lift	mm	3242	3077	3174	3007	3156	2989	220
and 45° discharge	ft/in	**10'7"**	**10'1"**	**10'4"**	**9'10"**	**10'4"**	**9'9"**	**8"**
Reach at maximum lift	mm	1580	1717	1628	1762	1649	1784	2
and 45° discharge	ft/in	**5'2"**	**5'7"**	**5'4"**	**5'9"**	**5'4"**	**5'10"**	**0"**
Reach at level lift arm	mm	3064	3276	3148	3360	3176	3388	160
and bucket level	ft/in	**10'0"**	**10'8"**	**10'3"**	**11'0"**	**10'5"**	**11'1"**	**6"**
Digging depth	mm	133	133	133	133	133	133	–1
	in	**5.2**	**5.2**	**5.2**	**5.2**	**5.2**	**5.2**	**–0**
Overall length	mm	9637	9878	9721	9962	9749	9990	200
	ft/in	**31'8"**	**32'5"**	**31'11"**	**32'9"**	**32'0"**	**32'10"**	**8"**
Overall height with	mm	6391	6391	6213	6213	6239	6239	221
bucket at maximum lift	ft/in	**21'0"**	**21'0"**	**20'5"**	**20'5"**	**20'6"**	**20'6"**	**9"**
Loader clearance circle with	mm	15 857	16 080	15 902	16 125	15 917	16 141	175
bucket at carry position	ft/in	**52'1"**	**52'10"**	**52'3"**	**52'11"**	**52'3"**	**53'0"**	**7"**
Static tipping load, straight	kg	20 504	20 322	20 272	20 089	20 136	19 952	–1720
(ISO)*	lb	**45,192**	**44,790**	**44,681**	**44,277**	**44,379**	**43,974**	**–3792**
Static tipping load, straight	kg	22 086	21 900	21 855	21 667	21 719	21 531	–1950
(rigid tire)*	lb	**48,678**	**48,268**	**48,168**	**47,755**	**47,870**	**47,456**	**–4299**
Static tipping load, articulated	kg	17 895	17 710	17 677	17 492	17 544	17 358	–1550
(ISO)*	lb	**39,441**	**39,035**	**38,961**	**38,552**	**38,667**	**38,257**	**–3416**
Static tipping load, articulated	kg	19 764	19 578	19 546	19 358	19 414	19 226	–1787
(rigid tire)*	lb	**43,561**	**43,150**	**43,079**	**42,666**	**42,789**	**42,375**	**–3939**
Breakout force**	kN	201	199	190	188	186	184	3
	lbf	**45,379**	**44,838**	**42,792**	**42,264**	**41,931**	**41,407**	**719**
Operating weight*	kg	29 945	30 084	30 028	30 167	30 124	30 263	115
	lb	**65,999**	**66,304**	**66,182**	**66,487**	**66,393**	**66,698**	**253**

*Static tipping loads and operating weights shown are based on standard machine configuration with 29.5R25, L3 Michelin XHA2 radial tires, power train guard, full fuel tank, coolant, lubricants, air conditioner and operator.
Static tipping loads conform to the international standard as defined in ISO 14397-1 (SEPT2007).
Measured 100 mm **(4") behind tip of cutting edge with bucket hinge pin as pivot point in accordance with SAE J732 (APR2007).

NOTE: Specifications and ratings conform to all applicable standards recommended by the Society of Automotive Engineers, including SAE Standard J732 (APR2007) which governs loader ratings.

NOTE: Bucket availability varies by region. Consult your local dealer for availability.

Bucket Type		Material Handling — Pin On		Rock — Pin On		Coal — Pin On	General Purpose/ Heavy Duty — Pin On		
Edge Type		Bolt-on Cutting Edges	Teeth & Segments	Bolt-on Cutting Edges	Teeth & Segments	Bolt-on Cutting Edges	Bolt-on Cutting Edges	Teeth & Segments	High Lift Delta
Capacity — rated	m^3	5.70	5.70	4.40	4.40	8.20	5.70	5.70	—
	yd^3	**7.46**	**7.46**	**5.75**	**5.75**	**10.73**	**7.46**	**7.46**	**—**
Capacity — 110%	m^3	6.27	6.27	4.84	4.84	9.02	6.27	6.27	—
	yd^3	**8.20**	**8.20**	**6.33**	**6.33**	**11.80**	**8.20**	**8.20**	**—**
Width	mm	3447	3535	3504	3504	3638	3447	3535	—
	ft/in	**11'3"**	**11'7"**	**11'5"**	**11'5"**	**11'11"**	**11'3"**	**11'7"**	**—**
Dump clearance at maximum lift and 45° discharge	mm	3075	2898	3101	3101	2887	3174	3007	220
	ft/in	**10'1"**	**9'6"**	**10'2"**	**10'2"**	**9'5"**	**10'4"**	**9'10"**	**8"**
Reach at maximum lift and 45° discharge	mm	1543	1665	1844	1844	1724	1628	1762	2
	ft/in	**5'0"**	**5'5"**	**6'0"**	**6'0"**	**5'7"**	**5'4"**	**5'9"**	**0"**
Reach at level lift arm and bucket level	mm	3173	3385	3360	3360	3435	3148	3360	160
	ft/in	**10'4"**	**11'1"**	**11'0"**	**11'0"**	**11'3"**	**10'3"**	**11'0"**	**6"**
Digging depth	mm	133	133	106	106	138	133	133	–1
	in	**5.2**	**5.2**	**4.1**	**4.1**	**5.4**	**5.2**	**5.2**	**-0**
Overall length	mm	9746	9987	9949	9949	10 011	9721	9962	200
	ft/in	**32'0"**	**32'10"**	**32'8"**	**32'8"**	**32'11"**	**31'11"**	**32'9"**	**8"**
Overall height with bucket at maximum lift	mm	6212	6212	6184	6184	6506	6213	6213	221
	ft/in	**20'5"**	**20'5"**	**20'4"**	**20'4"**	**21'5"**	**20'5"**	**20'5"**	**9"**
Loader clearance circle with bucket at carry position	mm	15 916	16 139	16 094	16 093	16 236	15 902	16 125	175
	ft/in	**52'3"**	**53'0"**	**52'10"**	**52'10"**	**53'4"**	**52'3"**	**52'11"**	**7"**
Static tipping load, straight (ISO)*	kg	19 825	19 643	21 253	21 285	19 512	20 116	19 932	–1720
	lb	**43,694**	**43,295**	**46,843**	**46,913**	**43,006**	**44,336**	**43,932**	**-3792**
Static tipping load, straight (rigid tire)*	kg	21 360	21 175	22 897	22 940	21 151	21 694	21 507	–1950
	lb	**47,078**	**46,670**	**50,466**	**50,560**	**46,616**	**47,815**	**47,402**	**-4299**
Static tipping load, articulated (ISO)*	kg	17 271	17 088	18 537	18 550	16 932	17 519	17 334	–1550
	lb	**38,067**	**37,663**	**40,857**	**40,884**	**37,318**	**38,613**	**38,204**	**-3416**
Static tipping load, articulated (rigid tire)*	kg	19 091	18 906	20 482	20 509	18 854	19 385	19 198	–1787
	lb	**42,078**	**41,670**	**45,144**	**45,202**	**41,556**	**42,726**	**42,313**	**-3939**
Breakout force**	kN	187	184	190	189	157	189	187	3
	lbf	**42,029**	**41,504**	**42,739**	**42,551**	**35,358**	**42,665**	**42,136**	**719**
Operating weight*	kg	30 153	30 292	31 109	31 184	30 532	30 175	30 313	115
	lb	**66,457**	**66,762**	**68,564**	**68,730**	**67,293**	**66,504**	**66,809**	**253**

*Static tipping loads and operating weights shown are based on standard machine configuration with 29.5R25, L3 Michelin XHA2 radial tires, power train guard, full fuel tank, coolant, lubricants, air conditioner and operator.
Static tipping loads conform to the international standard as defined in ISO 14397-1 (SEPT2007).
Measured 100 mm **(4") behind tip of cutting edge with bucket hinge pin as pivot point in accordance with SAE J732 (APR2007).

NOTE: Specifications and ratings conform to all applicable standards recommended by the Society of Automotive Engineers, including SAE Standard J732 (APR2007) which governs loader ratings.

NOTE: Bucket availability varies by region. Consult your local dealer for availability.

23-214

Bucket Type		Rock — Pin On					Rock/ Heavy Duty/Extra Wide Bucket — Pin On	
Edge Type		Teeth & Segments + Side Protector	Teeth + Side Protector	Teeth & Segments + Side Protector	Teeth + Side Protector	Teeth + Side Protector	Teeth & Segments + Side Protector	High Lift Delta
Capacity — rated	m^3	4.48	4.31	5.66	5.38	5.38	5.41	—
	yd^3	**5.86**	**5.64**	**7.40**	**7.03**	**7.03**	**7.07**	**—**
Capacity — 110%	m^3	4.93	4.75	6.22	5.91	5.91	5.95	—
	yd^3	**6.45**	**6.21**	**8.14**	**7.74**	**7.74**	**7.78**	**—**
Width	mm	3504	3504	3504	3504	3510	3645	—
	ft/in	**11'5"**	**11'5"**	**11'5"**	**11'5"**	**11'6"**	**11'11"**	**—**
Dump clearance at maximum lift	mm	3051	3051	2890	2890	2983	2941	220
and 45° discharge	ft/in	**10'0"**	**10'0"**	**9'5"**	**9'5"**	**9'9"**	**9'7"**	**8"**
Reach at maximum lift	mm	1788	1788	1979	1979	1930	1965	2
and 45° discharge	ft/in	**5'10"**	**5'10"**	**6'5"**	**6'5"**	**6'4"**	**6'5"**	**0"**
Reach at level lift arm	mm	3359	3359	3608	3608	3512	3561	160
and bucket level	ft/in	**11'0"**	**11'0"**	**11'10"**	**11'10"**	**11'6"**	**11'8"**	**6"**
Digging depth	mm	106	71	106	71	77	77	–1
	in	**4.1**	**2.8**	**4.1**	**2.8**	**3.0**	**3.0**	**–0**
Overall length	mm	9948	9948	10 197	10 197	10 069	10 156	200
	ft/in	**32'8"**	**32'8"**	**33'6"**	**33'6"**	**33'1"**	**33'4"**	**8"**
Overall height with	mm	6204	6204	6378	6378	6378	6378	221
bucket at maximum lift	ft/in	**20'5"**	**20'5"**	**21'0"**	**21'0"**	**21'0"**	**21'0"**	**9"**
Loader clearance circle with	mm	16 093	16 093	16 235	16 235	16 156	16 340	175
bucket at carry position	ft/in	**52'10"**	**52'10"**	**53'4"**	**53'4"**	**53'1"**	**53'8"**	**7"**
Static tipping load, straight	kg	20 998	21 519	20 119	20 693	20 705	19 813	–1720
(ISO)*	lb	**46,279**	**47,428**	**44,343**	**45,607**	**45,635**	**43,669**	**–3792**
Static tipping load, straight	kg	22 649	23 190	21 764	22 361	22 374	21 461	–1950
(rigid tire)*	lb	**49,918**	**51,112**	**47,968**	**49,285**	**49,313**	**47,301**	**–4299**
Static tipping load, articulated	kg	18 265	18 775	17 439	17 995	18 008	17 091	–1550
(ISO)*	lb	**40,257**	**41,381**	**38,436**	**39,663**	**39,690**	**37,669**	**–3416**
Static tipping load, articulated	kg	20 223	20 750	19 387	19 965	19 977	19 053	–1787
(rigid tire)*	lb	**44,572**	**45,733**	**42,730**	**44,003**	**44,031**	**41,993**	**–3939**
Breakout force**	kN	188	204	159	172	184	173	3
	lbf	**42,289**	**45,879**	**35,932**	**38,725**	**41,402**	**38,896**	**719**
Operating weight*	kg	31 475	31 175	31 821	31 521	31 517	32 239	115
	lb	**69,370**	**68,709**	**70,132**	**69,471**	**69,463**	**71,055**	**253**

*Static tipping loads and operating weights shown are based on standard machine configuration with 29.5R25, L3 Michelin XHA2 radial tires, power train guard, full fuel tank, coolant, lubricants, air conditioner and operator.
Static tipping loads conform to the international standard as defined in ISO 14397-1 (SEPT2007).
Measured 100 mm **(4") behind tip of cutting edge with bucket hinge pin as pivot point in accordance with SAE J732 (APR2007).

NOTE: Specifications and ratings conform to all applicable standards recommended by the Society of Automotive Engineers, including SAE Standard J732 (APR2007) which governs loader ratings.

NOTE: Bucket availability varies by region. Consult your local dealer for availability.

Bucket Type			Standard Lift						
			Rock			Heavy Duty Rock		High Abrasion Rock	
Ground Engaging Tools			Teeth & Segments	Teeth & Segments	Teeth & Segments	Teeth & Segments	Teeth & Segments	Teeth & Segments	Teeth & Segments
Cutting Edge Type			Spade	Spade	Spade	Spade	Spade	Spade	Spade
Rated bucket capacity (§)		m^3	10.7	11.5	12.3	10.7	11.5	10.7	10.7
		yd^3	**14.0**	**15.0**	**16.0**	**14.0**	**15.0**	**14.0**	**14.0**
Operating load at rated capacity		kg	21 773	21 773	21 773	21 773	21 773	21 773	21 773
		lb	**48,000**	**48,000**	**48,000**	**48,000**	**48,000**	**48,000**	**48,000**
Struck capacity (§)		m^3	8.9	9.5	10.2	8.9	9.5	8.9	8.9
		yd^3	**11.6**	**12.4**	**13.3**	**11.6**	**12.4**	**11.6**	**11.6**
Bucket width (§)		mm	4824	4884	4824	5068	4824	5165	5068
		ft/in	**15'10"**	**16'0"**	**15'10"**	**16'7"**	**15'10"**	**16'11"**	**16'7"**
Dump clearance at full lift SAE 45° discharge (§)		mm	4849	4785	4741	4849	4788	4935	4935
		ft/in	**15'11"**	**15'8"**	**15'7"**	**15'11"**	**15'8"**	**16'2"**	**16'2"**
	Tooth tip	mm	4607	4548	4495	4612	4545	4699	4699
		ft/in	**15'1"**	**14'11"**	**14'8"**	**15'1"**	**14'11"**	**15'5"**	**15'5"**
Reach at full lift SAE 45° discharge (§)		mm	2092	2149	2194	2092	2151	2036	2036
		ft/in	**6'11"**	**7'0"**	**7'2"**	**6'11"**	**7'11"**	**6'10"**	**6'10"**
	Tooth tip	mm	2326	2378	2427	2322	2385	2292	2292
		ft/in	**7'7"**	**7'10"**	**8'0"**	**7'7'**	**7'10"**	**7'6"**	**7'6"**
Reach with boom horizontal and bucket level		mm	5114	5193	5265	5108	5200	5025	5025
		ft/in	**16'10"**	**17'0"**	**17'4"**	**16'10"**	**17'1"**	**16'6"**	**16'6"**
Digging depth (segment) (§)		mm	196	201	201	196	198	175	175
		in	**7.7**	**7.9**	**7.9**	**7.7**	**7.8**	**6.9**	**6.9**
Overall length — bucket level ground (§)		mm	15 736	15 818	15 890	15 729	15 823	15 632	15 632
		ft/in	**51'7"**	**51'11"**	**51'1"**	**51'7"**	**51'11"**	**51'4"**	**51'4"**
Overall height with bucket at full raise (§)		mm	9313	9313	9492	9313	9313	9392	9313
		ft/in	**30'7"**	**30'7"**	**31'1"**	**30'7"**	**30'7"**	**30'10"**	**30'7"**
Loader clearance radius with bucket in carry position (§)		mm	11 097	11 121	11 131	11 096	11 122	11 085	11 085
		ft/in	**36'5"**	**36'6"**	**36'6"**	**36'5"**	**36'6"**	**36'5"**	**36'5"**
Tipping load straight* (§)		kg	55 216	54 526	54 184	53 745	54 784	51 692	53 325
		lb	**121,730**	**120,209**	**119,455**	**118,487**	**120,778**	**113,961**	**117,561**
Static tipping load full 35° turn* (§)		kg	48 361	47 695	47 341	46 893	47 953	44 839	46 474
		lb	**106,618**	**105,149**	**104,369**	**103,381**	**105,718**	**98,853**	**102,458**
Static tipping load full 40° turn* (§)		kg	46 440	45 780	45 422	44 972	46 037	42 919	44 554
		lb	**102,383**	**100,928**	**100,138**	**99,146**	**101,494**	**94,620**	**98,225**
Static tipping load full 43° turn* (§)		kg	45 201	44 546	44 185	43 735	44 803	41 681	43 316
		lb	**99,651**	**98,207**	**97,411**	**96,419**	**98,774**	**91,891**	**95,495**
Tipping load straight** (§)		kg	57 096	56 402	56 093	55 615	56 662	53 564	55 194
		lb	**125,874**	**124,344**	**123,663**	**122,610**	**124,918**	**118,088**	**121,681**
Static tipping load full 35° turn** (§)		kg	51 328	50 653	50 338	49 847	50 913	47 796	49 426
		lb	**113,158**	**111,671**	**110,976**	**109,893**	**112,244**	**105,372**	**108,965**
Static tipping load full 40° turn** (§)		kg	49 634	48 965	48 648	48 153	49 225	46 102	47 732
		lb	**109,424**	**107,950**	**107,250**	**106,159**	**108,523**	**101,638**	**105,231**
Static tipping load full 43° turn** (§)		kg	48 527	47 863	47 544	47 047	48 123	44 996	46 625
		lb	**106,984**	**105,519**	**104,817**	**103,720**	**106,092**	**99,198**	**102,791**
Breakout force*** (§)		kg	58 466	55 998	54 249	57 842	56 147	59 381	60 218
		lbf	**128,894**	**123,454**	**119,599**	**127,519**	**123,782**	**130,913**	**132,758**
Operating weight*** (§)		kg	98 610	99 012	99 391	100 786	97 469	102 956	101 232
		lb	**217,398**	**218,284**	**219,119**	**222,195**	**214,882**	**226,979**	**223,178**

*Tipping loads were calculated within guidelines of ISO 14397-1:2007 to include tire squash (Tire pressure at 683 kPa **[99 psi]**).
**Tipping load is calculated without tire squash.
***Static tipping load and operating weight shown are based on standard machine configurations with a fuel tank, coolant, lubricants, and operator.

NOTE: Specifications and ratings conform to all applicable standards recommended by the Society for Automotive Engineers. SAE Standards J732C govern loader ratings and are denoted in the text by (§).

Bucket Type		High Lift						
		Rock			Heavy Duty Rock		High Abrasion Rock	
Ground Engaging Tools		Teeth & Segments	Teeth & Segments	Teeth & Segments	Teeth & Segments	Teeth & Segments	Teeth & Segments	Teeth & Segments
Cutting Edge Type		Spade	Spade	Spade	Spade	Spade	Spade	Spade
Rated bucket capacity (§)	m^3	10.7	11.5	12.3	10.7	11.5	10.7	10.7
	yd^3	**14.0**	**15.0**	**16.0**	**14.0**	**15.0**	**14.0**	**14.0**
Operating load at rated capacity	kg	19 051	19 051	19 051	19 051	19 051	19 051	19 051
	lb	**42,000**	**42,000**	**42,000**	**42,000**	**42,000**	**42,000**	**42,000**
Struck capacity (§)	m^3	8.9	9.5	10.2	8.9	9.5	8.9	8.9
	yd^3	**11.6**	**12.4**	**13.3**	**11.6**	**12.4**	**11.6**	**11.6**
Bucket width (§)	mm	4824	4884	4824	4884	4824	4900	4900
	ft/in	**15'10"**	**16'0"**	**15'10"**	**16'7"**	**15'10"**	**16'11"**	**16'7"**
Dump clearance at full lift SAE 45° discharge (§) Tooth tip	mm	5224	5166	5112	5229	5162	5316	5316
	ft/in	**17'2"**	**16'11"**	**16'9"**	**17'2"**	**16'11"**	**17'5"**	**17'5"**
Reach at full lift SAE 45° discharge (§) Tooth tip	mm	2193	2246	2294	2189	2252	2159	2159
	ft/in	**7'2"**	**7'4"**	**7'6"**	**7'2"**	**7'5"**	**7'1"**	**7'1"**
Reach with boom horizontal and bucket level	mm	5504	5583	5655	5498	5590	5415	5415
	ft/in	**18'1"**	**18'4"**	**18'7"**	**18'0"**	**18'4"**	**17'9"**	**17'9"**
Digging depth (segment) (§)	mm	176	181	181	176	178	155	155
	in	**7.0**	**7.0**	**7.0**	**7.0**	**7.0**	**6.0**	**6.0**
Overall length — bucket level ground (§)	mm	16 197	16 279	16 351	16 191	16 284	16 095	16 095
	ft/in	**53'2"**	**53'5"**	**53'8"**	**53'1"**	**53'5"**	**52'10"**	**52'10"**
Overall height with bucket at full raise (§)	mm	9930	9930	9930	9930	9930	9930	9930
	ft/in	**32'7"**	**32'7"**	**32'7"**	**32'7"**	**32'7"**	**32'7"**	**32'7"**
Loader clearance radius with bucket in carry position (§)	mm	11 326	11 352	11 349	11 324	11 352	11 313	11 313
	ft/in	**37'2"**	**37'3"**	**37'3"**	**37'2"**	**37'3"**	**37'1"**	**37'1"**
Tipping load straight* (§)	kg	51 408	50 761	50 436	49 938	51 017	47 875	49 522
	lb	**113,335**	**111,909**	**111,192**	**110,094**	**112,473**	**105,546**	**109,177**
Static tipping load full 35° turn* (§)	kg	44 798	44 172	43 833	43 332	44 427	41 268	42 916
	lb	**98,763**	**97,382**	**96,635**	**95,531**	**97,945**	**90,980**	**94,613**
Static tipping load full 40° turn* (§)	kg	42 946	42 325	41 981	41 481	42 580	39 417	41 065
	lb	**94,680**	**93,311**	**92,552**	**91,450**	**93,873**	**86,900**	**90,533**
Static tipping load full 43° turn* (§)	kg	41 753	41 135	40 789	40 288	41 390	38 224	39 873
	lb	**92,049**	**90,687**	**89,924**	**88,820**	**91,249**	**84,269**	**87,905**
Tipping load straight** (§)	kg	53 044	52 396	52 099	51 567	52 653	49 505	51 149
	lb	**116,942**	**115,513**	**114,858**	**113,686**	**116,080**	**109,140**	**112,764**
Static tipping load full 35° turn** (§)	kg	47 472	46 840	46 535	45 994	47 097	43 932	45 577
	lb	**104,658**	**103,264**	**102,592**	**101,399**	**103,831**	**96,853**	**100,480**
Static tipping load full 40° turn** (§)	kg	45 835	45 209	44 901	44 358	45 466	42 296	43 940
	lb	**101,049**	**99,669**	**98,990**	**97,793**	**100,235**	**93,247**	**96,871**
Static tipping load full 43° turn** (§)	kg	44 766	44 143	43 834	43 289	44 400	41 227	42 871
	lb	**98,692**	**97,319**	**96,637**	**95,436**	**97,885**	**90,890**	**94,514**
Breakout force*** (§)	kg	57 948	55 495	53 760	57 324	55 656	58 856	59 693
	lbf	**127,753**	**122,345**	**118,520**	**126,378**	**122,700**	**129,755**	**131,600**
Operating weight*** (§)	kg	99 788	100 182	100 561	101 956	99 963	104 126	102 404
	lb	**219,995**	**220,863**	**221,699**	**224,774**	**220,380**	**229,558**	**225,762**

*Tipping loads were calculated within guidelines of ISO 14397-1:2007 to include tire squash (Tire pressure at 683 kPa **[99 psi]**).
**Tipping load is calculated without tire squash.
***Static tipping load and operating weight shown are based on standard machine configurations with a fuel tank, coolant, lubricants, and operator.

NOTE: Specifications and ratings conform to all applicable standards recommended by the Society for Automotive Engineers. SAE Standards J732C govern loader ratings and are denoted in the text by (§).

SPECIFICATION DEFINITIONS FOR FRONT END LOADERS

Cat wheel and track loader specifications conform to Society of Automotive Engineers (SAE) definitions as expressed in standards J732 (JUN92), as follows:

Description of Specification Machine

On wheel loaders the tire inflation pressure at which specifications are taken must be described in addition to the current written basic machine description. On track loaders the type of grouser must be specified.

Hydraulic Cycle Times

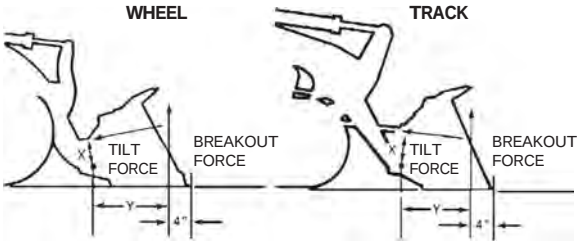
a. "Raise Time" — Time in seconds required to raise the bucket from level position on the ground.
b. "Lower Time" — Time in seconds required to lower the empty bucket from the full height to a level position on the ground.
c. "Dump Time" — Time in seconds required to move the bucket at maximum height from the maximum rollback position to full dump position while dumping the SAE loose material operating load.

Breakout Force

"Breakout force," pounds (and kilonewtons or kilograms) — the maximum sustained vertical upward force exerted 100 mm (4") behind the tip of the bucket cutting edge and achieved through the ability to lift and/or rollback about the specified pivot point under the following conditions:

a. Loader on a hard level surface with transmission in neutral.
b. All brakes released.
c. Unit at standard operating weight — rear of loader not tied down.
d. Bottom of cutting edge parallel to and not more than 20 mm (0.75") above or below the ground line.
e. When bucket circuit is used the pivot point must be specified as the bucket hinge pin, and the unit blocked under the bucket hinge pin pivot point in order to minimize linkage movement.
f. When the lift circuit is used, the pivot point must be specified as the lift arm hinge pin. Wheel loaders shall have front axle blocked to eliminate change in position of pivot pins due to tire deflection.
g. If both circuits are used simultaneously, the dominating pivot point listed in (e) or (f) must be specified.
h. If the circuit used causes the rear of the vehicle to leave the ground, then the vertical force value required to raise the rear of the vehicle is the breakout force.
i. For irregular shaped buckets, the tip of the bucket cutting edge referred to above shall mean the farther forward point of the cutting edge.

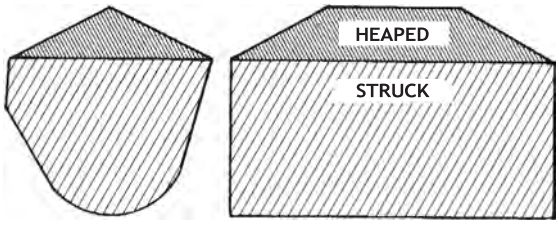
The following are illustrations used (according to provisions of SAE J732 JUN92) to measure Cat Loader breakout forces.



a. Breakout force resulting from rack back:
(Tilt Force) × (Dist. "X") = ("Y" Dist.) × (Breakout Force)

$$\frac{\text{(Tilt Force)} \times \text{(Dist. "X")}}{\text{"Y" Dist.}} = \text{Breakout Force}$$

SAE BUCKET RATING



SAE Bucket Capacities

Struck capacity is that volume contained in a bucket after a load is leveled by drawing a straight edge resting on the cutting edge and the back of the bucket.

Heaped capacity is a struck capacity plus that additional material that would heap on the struck load at a 2:1 angle of repose with the struck line parallel to the ground.

SAE J742 (FEB85) specifies that the addition of any auxiliary spill guard to protect against spillage which might injure the operator will not be included in bucket capacity ratings. Buckets with irregular shaped cutting edges (vee edge) the strike plane should be drawn at one-third the distance of the protruding portion of the cutting edge. Cat rock buckets are built with integral see-through rock guards. Cat light material buckets come standard with bolt-on edges. These features which add to actual bucket capacity are included in published ratings.

Dump Height

SAE J732 JUN92 specifies that dump height is the vertical distance from the ground to the lowest point of the cutting edge with the bucket hinge pin at maximum height and the bucket at a 45° dump angle. Dump angle is the angle in degrees that the longest flat section of the inside bottom of the bucket will rotate below horizontal.

SELECTING A MACHINE

Steps in selecting the proper size loader:

1. Determine production required or desired.
2. Determine loader cycle time and cycles per hour. A machine size must be assumed to select a basic cycle time.
3. Determine required payload per cycle in loose cubic yards and pounds (meters and kilograms).
4. Determine bucket size needed.
5. Make machine selection using bucket size and payload as criteria to meet production requirements.
6. Compare the loader cycle time used in calculations to the cycle time of the machine selected. If there is a difference, rework the process beginning at step 2.

1. Production Required

The production required of a wheel or track loader should be slightly greater than the production capability of the other critical units in the earth or material moving system. For example, if a hopper can handle 300 tons per hour, a loader capable of slightly more than 300 tons should be used. Required production should be carefully calculated so the proper machine and bucket selections are made.

2. Loader Cycle Times

When hauling loose granular material on a hard smooth operating surface, a .45-.55 minute basic cycle time is considered reasonable for Cat articulated loaders with a competent operator. This includes load, dump, four reversals of direction, full cycle of hydraulics and minimum travel.

Material type, pile height, and other factors may improve or reduce production, and should be added to or subtracted from the basic cycle time when applicable.

When hauls are involved, obtain the haul and return portion of the cycle from the estimated travel chart (this section). Add the haul and return times to the estimated basic cycle time to obtain total cycle time.

CYCLE TIME FACTORS

A basic cycle time (Load, Dump, Maneuver) of .45-.55 minutes is average for an articulated loader [the basic cycle for large loaders, 3 m^3 (4 yd^3) and up, can be slightly longer], but variations can be anticipated in the field. The following values for many variable elements are based on normal operations. Adding or subtracting any of the variable times will give the total basic cycle time.

	Minutes added (+) or Subtracted (–) From Basic Cycle
Machine	
— Material handler	05
Materials	
— Mixed	+.02
— Up to 3 mm (1/8 in)	+.02
— 3 mm (1/8 in) to 20 mm (3/4 in)	02
— 20 mm (3/4 in) to 150 mm (6 in)	00
— 150 mm (6 in) and over	+.03 and Up
— Bank or broken	+.04 and Up
Pile	
— Conveyor or Dozer piled 3 m (10 ft) and up	00
— Conveyor or Dozer piled 3 m (10 ft) or less	+.01
— Dumped by truck	+.02
Miscellaneous	
— Common ownership of trucks and loaders	Up to –.04
— Independently owned trucks	Up to +.04
— Constant operation	Up to –.04
— Inconsistent operation	Up to +.04
— Small target	Up to +.04
— Fragile target	Up to +.05

Using actual job conditions and the above factors, total cycle time can be estimated. Convert total cycle time to cycles per hour.

$$\textit{Cycles per hour at 100\% Efficiency} = \frac{60\ \text{min}}{\textit{Total Cycle Time in Minutes}}$$

Job efficiency is an important factor in machine selection. Efficiency is the actual number of minutes worked during an hour. Job efficiency accounts for bathroom breaks and other work interruptions.

$$\text{Cycles per hour at 50 minutes per hour (83\% efficiency)} = \text{Cycles per hour at 100\% efficiency} \times \frac{50\ \text{min actual work time}}{60\ \text{min hour}}$$

TRUCK LOADING

Average loader cycle times

910K-962H	0.45-0.50 min
966H-980H	0.50-0.55 min
986H-990K	0.55-0.60 min
992K-994K	0.60-0.70 min

3. Required Payload Per Cycle

Required payload per cycle is determined by dividing required hourly production by the number of cycles per hour.

4. Bucket Selection

After required payload per cycle has been calculated, the payload should be divided by the loose cubic yard (meter) material weight to determine number of loose cubic yards (meters) required per cycle.

The bulk of material handled does not weigh 1800 kg/m^3 (3000 lb/yd^3), so a reasonable knowledge of material weight is necessary for accurate production estimates. The Tables Section has average weight for certain materials when actual weights are not known.

The percentage of rated capacity a bucket carries in various materials is estimated below. The bucket size required to handle the required volume per cycle is found with the aid of the percentage of rated bucket capacity called "Bucket Fill Factor."

The bucket size needed is determined by dividing loose cubic meters (or yards) required per cycle by the bucket fill factor.

$$\textit{Bucket size} = \frac{\textit{Volume Required/Cycle}}{\textit{Bucket Fill Factor}}$$

BUCKET FILL FACTORS

The following indicates the approximate amounts of material as a percent of rated bucket capacity which will actually be delivered per bucket per cycle. This is known as "Bucket Fill Factor."

Loose Material	Fill factor
Mixed moist aggregates	95-100%
Uniform aggregates up to 3 mm (1/8 in)	95-100
3 mm (1/8 in) to 9 mm (3/8 in)	90-95
12 mm (1/2 in) to 20 mm (3/4 in)	85-90
24 mm (1.0 in) and over	85-90

Blasted Rock

Well blasted	80-95%
Average	75-90
Poor	60-75

Other

Rock dirt mixtures	100-120%
Moist loam	100-110
Soil, boulders, roots	80-100
Cemented materials	85-95

NOTE: Fill factors on wheel loaders are affected by bucket penetration, breakout force, rack back angle, bucket profile and ground engaging tools such as bucket teeth or bolt-on replaceable cutting edges.

Example:

12 mm (1/2 in) material and 3 m^3 (4 yd^3) bucket.
0.90 × 3 m^3 = 2.75 Loose m^3 delivered per cycle.
0.90 × 4 yd^3 = 3.6 Loose yd^3 delivered per cycle.

NOTE: Check the static tipping load on the specific machine to determine if bucket load is in fact a safe operating load.

Bucket Selection

$$\textit{Tons Required/Cycle} = \frac{\textit{Tons Required/Hour}}{\textit{Cycles/Hour}}$$

$$\textit{Kg (Pounds) Required/Cycle} = \textit{Tons Required/Cycle} \times \textit{907 kg (2000 lb)}$$

$$\textit{Volume Required/Cycle} = \frac{\textit{kg (Pounds) Cycle}}{\textit{Material Weight kg/m}^3\textit{ (lb/yd}^3\textit{)}}$$

Always select a machine with a greater capacity than the calculated required operating capacity. For most applications, payload above recommended and excessive counterweight can hinder machine performance and reduce dynamic stability and machine life.

For optimum performance in fast cycling situations such as truck loading, operating loads should not exceed the recommended capacity. To provide extra stability, calcium chloride ($CaCl_2$) ballast may be desired when operating at recommended operating load, see SAE Loader rating pages in this section. For specific stability data and optional tire sizes, see the "Performance Data" pages in this section.

When selecting special application buckets, such as multi-purpose and side dump the additional bucket weight must be deducted from recommended capacity.

Specific circumstances may involve other conditions which would also affect loader capacity. Because of the greatly varied applications and conditions, your Cat dealer should be contacted for guidance.

Example problem:

JOB CONDITIONS

Application	Truck loading
Production Required	450 metric ton (496 Tons) per hour
Material	9 mm (3/8") gravel in 6 m (20 ft) high stockpile
Density	1660 kg/m^3 (2800 lb/yd^3)

Trucks are 6-9 m^3 (8-12 yd^3) capacity and are owned by three contractors. Loading is constant. Hard level surface for loader maneuvering.

1. *PRODUCTION REQUIRED:* Given

2. *CYCLE TIME:* Assume loader size between 910K and 962H for initial choice of basic cycle.
(Refer to Cycle Time Factors in this section)

Independent trucks	.04 min
Basic Cycle	.50 min
Material	–.02 min
Independent trucks	+.04 min
Constant operation	–.02 min
Total Cycle	.50 min

NOTE: Load and carry times not required in total cycle.

$$\text{Cycles/hr at 83\% efficiency} = 120 \text{ cycles/hr} \times \frac{\text{50 min actual work time}}{\text{60 min per hr}} = 100 \text{ cycles/hr}$$

3. *VOLUME REQUIRED PER CYCLE*
(Density in tons)
Density in this example was given. When not given, refer to Tables Section to obtain an estimated density for the material being handled.

Metric: $\frac{1660 \text{ kg/m}^3}{1000 \text{ kg/ton}} = 1.66 \text{ ton/m}^3$

English: $\frac{2800 \text{ lb/yd}^3}{2000 \text{ lb/ton}} = 1.4 \text{ tons/yd}^3$

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Production Rate Required

Metric: $\frac{450 \text{ tons/hr}}{1.66 \text{ tons/m}^3} = 271 \text{ m}^3\text{/hr}$

English: $\frac{496 \text{ tons/hr}}{1.4 \text{ tons/yd}^3} = 354 \text{ yd}^3\text{/hr}$

Volume Required per Cycle

Metric: $\frac{271 \text{ m}^3\text{/hr}}{100 \text{ cycles/hr}} = 2.71 \text{ m}^3\text{/cycle}$

English: $\frac{354 \text{ yd}^3\text{/hr}}{100 \text{ cycles/hr}} = 3.54 \text{ yd}^3\text{/cycle}$

4. *DETERMINE BUCKET SIZE*

BUCKET FILL FACTOR

The volume of material required per cycle has been determined. Because of varying material fill factors, buckets do not always carry their rated load, a larger capacity bucket may be needed to carry the volume required. For fill factors, refer to Bucket Fill Factor Chart in this section.

Rated Bucket Capacity Required (Heaped)

$\frac{2.71 \text{ m}^3\text{/cycle}}{0.95 \text{ fill factor}} = 2.85 \text{ m}^3$

$\frac{3.54 \text{ yd}^3\text{/cycle}}{0.95 \text{ fill factor}} = 3.73 \text{ yd}^3$

A 2.9 m^3 (3.75 yd^3) bucket would provide the required capacity.

5. *MACHINE SELECTION*

The bucket size required and material density lead to the choice of a 950H with a 2.9 m^3 (3.75 yd^3) General Purpose Bucket (see bucket selection guide pages which follow.)

Finally, SAE payload criteria must be satisfied as follows:

The required operating capacity must not exceed one-half of the full turn static tipping load of the loader as equipped with a specific bucket.

The required operating capacity of the machine is determined by the volume the machine will carry per load times the density.

$2.9 \text{ m}^3 \times 1660 \text{ kg/m}^3 = 4814 \text{ kg}$

$(3.75 \text{ yd}^3 \times 2800 \text{ lb/yd}^3 = 10{,}500 \text{ lb})$

One half of full turn static tipping load for the 950H with a 2.9 m^3 (3.75 yd^3) General Purpose Bucket is 5410 kg (11,925 lb). SAE criteria is satisfied.

● ● ●

An Alternative Method of Machine Selection

Another method of selecting the right Wheel Loader and bucket to meet production requirements is by use of the nomographs on the following pages. The method is quicker and easier than the preceding example because it does not require as many calculations, yet the accuracy is about the same within the normal limits of input data.

Be careful when entering and reading data from the nomographs because some scales increase from bottom to top, while others are the reverse. Do not be overly concerned with the precision as affected by pencil line width or reading to the hundredth of a m^3 (yd^3). Remember that bucket fill factor, material density and cycle time are at best close estimates.

Example problem:

A Wheel Loader must produce 230 m^3 (300 yd^3) per hour in a truck loading application. Estimated cycle time is .6 minutes, working 45 minutes per hour. Bucket fill factor is 95% and material density is 1780 kg/m^3 (3000 lb/yd^3).

Determine bucket size and machine model.

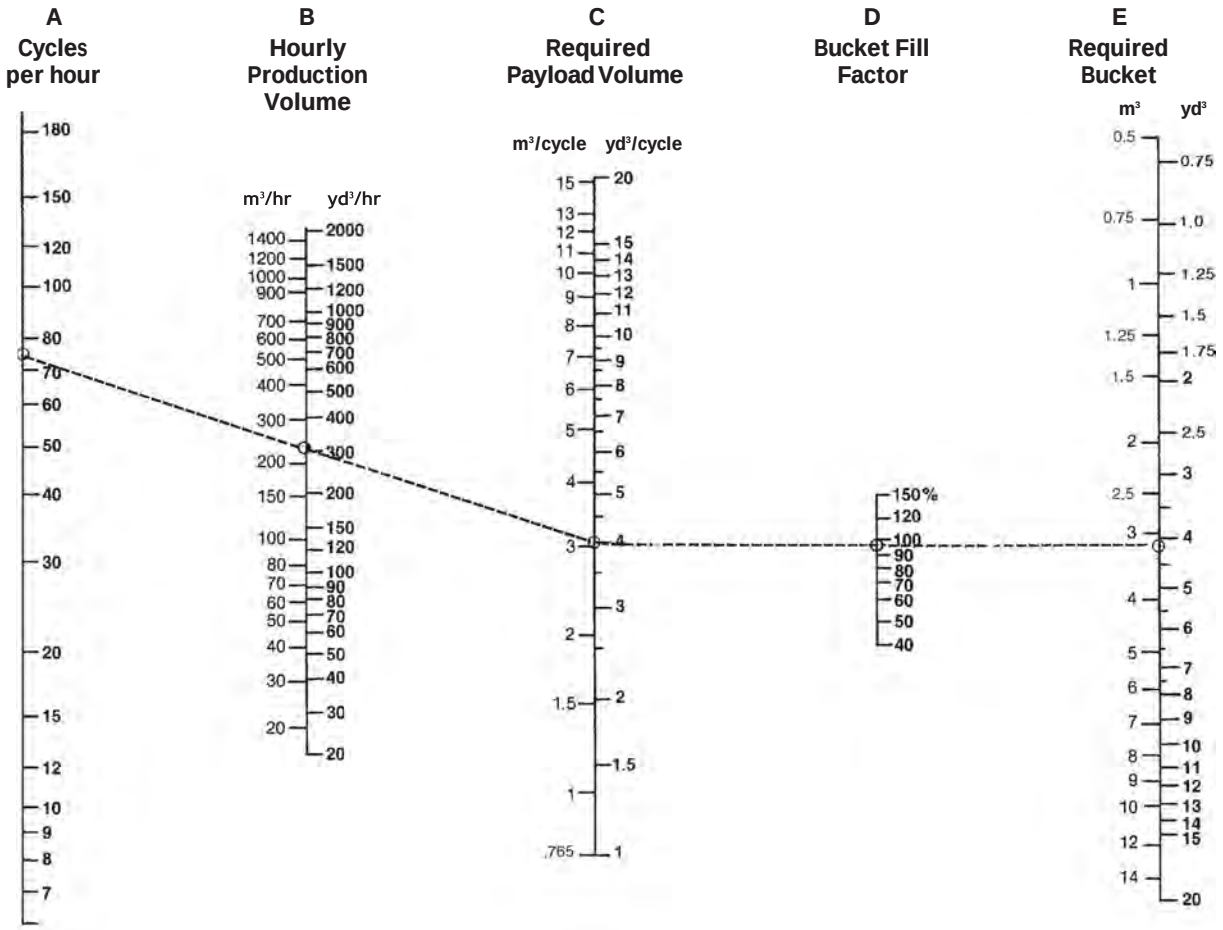
Solution:

At full efficiency, the Wheel Loader will cycle 100 times per hour. Since only an average of 45 minutes are available, only 75 cycles will be completed.

Starting on Scale A at 75 cycles per hour draw a straight line intersecting 230 m^3/hr (300 yd^3/hr) on Scale B and extending it on to Scale C giving 3 m^3/cycle (4 yd^3/cycle) required payload. Follow solution steps 1-10.

Production and Machine Selection Nomograph
- To find required bucket payload and bucket size

1. Enter required hourly production on Scale B 230 m^3/hr (300 yd^3/hr).
2. Enter cycles per hour on Scale A (60 ÷ .6 = 100 × .75 = 75 cycles/hr).
3. Connect A through B to C. This shows a required payload of 3 m^3 (4 yd^3) per cycle.
4. Enter estimated bucket fill factor on Scale D (0.95).
5. Connect C through Scale D to E for required bucket size 3 m^3 (4 yd^3).
6. Transfer cycles per hour Scale A and required payload Scale C to the following page.



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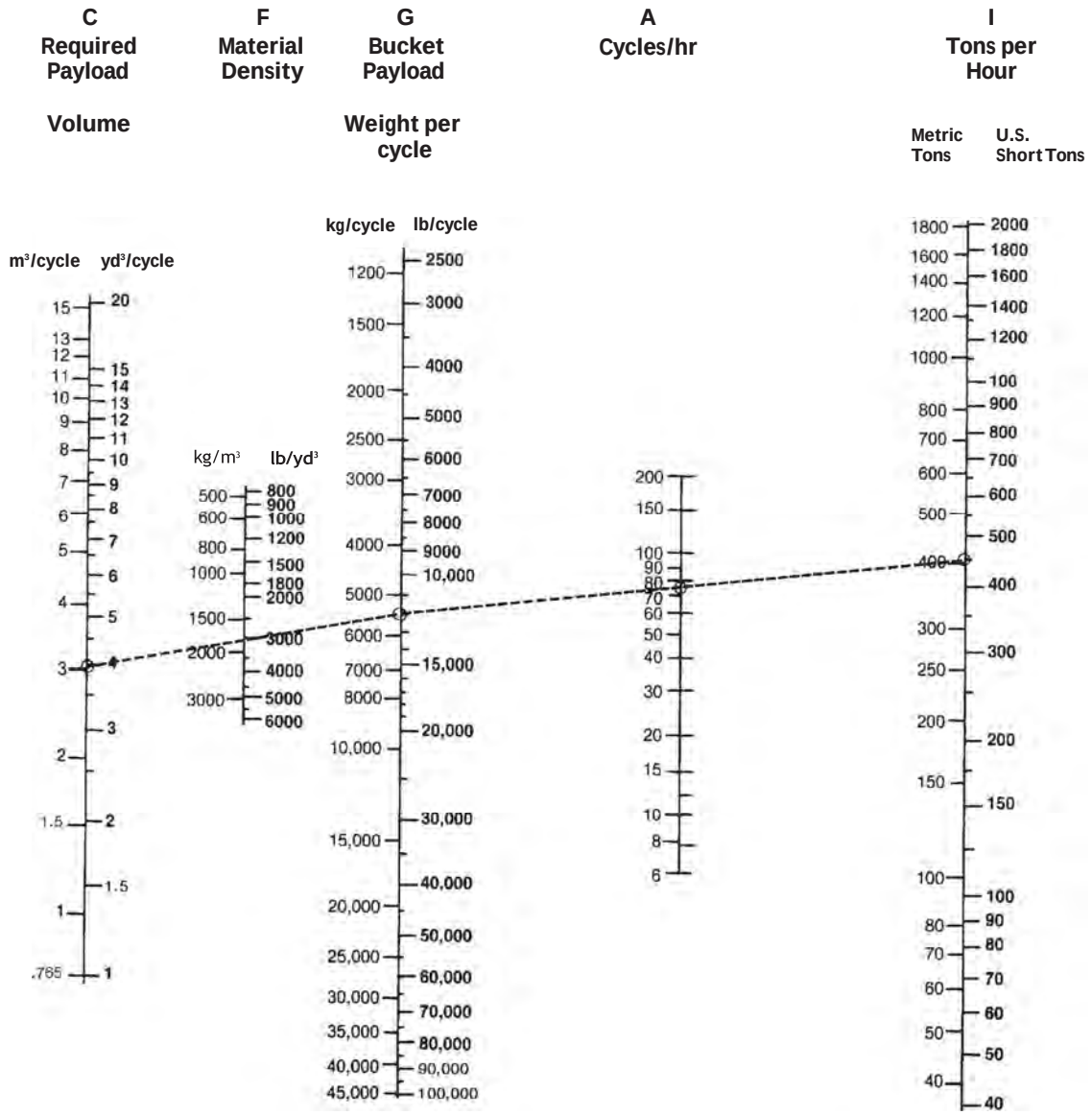
7. Enter material density on Scale F 1780 kg/m³ (3000 lb/yd³).
8. Connect C through Scale F to Scale G to give payload weight per cycle 5300 kg (11,500 lb).
9. Compare Scale G quantity 5300 kg (11,500 lb) with recommended machine working range listed on the following bucket selection pages.

Operating capacity for the 950H with 3.1 m³ (4 yd³) bucket is dependent on material density and bucket capacity (see bucket selection pages that follow).

10. For hourly tonnage, draw a straight line from Scale G through Scale A to Scale I 400 metric tons (450 U.S. tons).



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Model	Interface	Bucket Type	Width Range		Capacity Range		Weight Range		GET
			mm	in	m^3	yd^3	kg	lb	
986H	Pin On	General Purpose Performance Series	3695	**145**	6.1-7.7	**8.0-10.0**	3648-4065	**8042-8962**	K110
		Rock Performance Series	3772	**149**	5.4-6.1	**7.0-8.0**	3726-3941	**8214-8688**	K110
		Heavy Duty Rock Performance Series	4014	**158**	5.4	**7.0**	5061	**11,158**	K130
		Extreme Duty Rock	4146	**163**	5.0	**6.5**	5195	**12,050**	K130
		Serrated Edge Rock	3812	**150**	6.1	**8.0**	4232	**9330**	N/A
		Coal	3692	**145**	10.0	**13.5**	5195	**11,453**	BOCE Included
988K	Pin On	General Purpose Performance Series	3855	**152**	6.9-8.4	**9.0-11.0**	4539-4994	**10,007-11,010**	K110
		Rock Performance Series	4020	**158**	6.4-7.7	**8.3-10.0**	4880-5263	**10,759-11,603**	K130
		Heavy Duty Rock Performance Series	4080	**161**	6.4	**8.3**	6360	**14,021**	K130
		Heavy Duty Granite Performance Series	3986	**157**	6.4	**8.3**	7433	**16,385**	K130
		Serrated Edge Rock	3968	**156**	6.4-6.9	**8.3-9.0**	5455-5634	**12,026-12,421**	N/A
		Iron Ore	3922	**154**	4.7	**6.2**	5771	**12,723**	K130
		Coal	4120	**162**	11.5-13.0	**15.0-17.0**	6023-6435	**13,278-14,186**	BOCE Included
		Slag	3900-4032	**154-159**	5.4-6.4	**7.0-8.3**	7633-8454	**16,828-18,638**	J600/Serrated Edge

N/A = Not Applicable

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Model	Interface	Bucket Type	Width Range		Capacity Range		Weight Range		GET
			mm	in	m^3	yd^3	kg	lb	
990K	Pin On	Rock Performance Series	4610	**182**	8.6-10.0	**11.25-13.0**	7247-7497	**15,977-16,528**	K130
		Heavy Duty Rock Performance Series	4670	**184**	8.6	**11.25**	8980	**19,798**	K130
		Heavy Duty Granite Performance Series	4634	**182**	8.6	**11.25**	12 055	**26,520**	K150
		Slag	4450-4500	**175-177**	8.5-9.2	**11.2-12.0**	9149-9613	**20,127-21,149**	Weld-on edge included
		Coal	4370	**172**	13.4	**17.5**	7460	**16,410**	BOCE Included
		Iron Ore	4450	**175**	7.0	**9.2**	8525	**18,750**	K150
		Serrated Edge Rock	4610	**182**	9.5	**12.4**	8140	**17,910**	N/A
992K	Pin On	Rock	4824-4884	**190-192**	10.7-12.2	**14.0-16.0**	9382-10 574	**20,684-23,262**	K150/K170
		Heavy Duty Rock	5068	**200**	10.7	**14.0**	11 560	**25,485**	K170
		High Abrasion Rock	5068	**200**	10.7	**14.0**	11 927	**26,295**	K150
		Heavy Duty Granite	5165	**203**	10.7	**14.0**	13 720	**30,247**	K150
		Coal	6170	**243**	19.0	**25.0**	12 504	**27,506**	BOCE Included
		Iron Ore	4900	**193**	9.0	**11.8**	11 172	**24,577**	K150
		Serrated Edge Rock	4824	**190**	12.3	**16.0**	10 282	**22,620**	N/A
993K	Pin On	Rock	5068	**200**	12.2-14.5	**16.0-19.0**	12 864-14 209	**28,301-31,260**	K170
		High Abrasion Rock	5160	**203**	12.2-13.0	**16.0-17.0**	15 205-15 456	**33,451-34,004**	K170
		Heavy Duty Granite	5160	**203**	13.0	**17.0**	17 418	**38,320**	K170
		Coal	6300	**248**	23.0	**31.0**	17 673	**38,880**	K170
		Iron Ore	5160	**203**	10.0	**13.0**	14 063	**30,940**	K170
		Serrated Edge Rock	5080	**200**	15.0	**19.5**	13 915	**30,615**	N/A
994K	Pin On	Rock	6223	**245**	19.1-24.5	**25-32**	19 205-21 293	**42,340-46,942**	Spade edge*
		Heavy Duty Rock	6240	**246**	19.1-21.4	**25-28**	20 699-21 303	**45,633-46,966**	Spade edge*
		Coal	6964	**274**	32.1-39.8	**42-52**	20 862-22 773	**45,992-50,206**	Straight edge*
		Iron Ore	6240	**246**	17.2	**22.5**	19 518	**43,029**	Spade edge*

*With teeth and segments.
N/A = Not Applicable

986H — Standard Lift

Material Density				Bucket Volume	
kg/m³	**tonnes/m³**	**lb/yd³**	**tons/yd³**	**m³**	**yd³**
1632-1795	1.63-1.80	**2750-3025**	**1.38-1.51**	6.1	**8**
1740-1914	1.74-1.91	**2933-3227**	**1.46-1.61**	5.7	**7.5**
1865-2051	1.86-2.05	**3143-3457**	**1.57-1.73**	5.4	**7**

*Density range covers 100% rated payload to 110% rated payload in accordance with Large Wheel Loader payload policy.

988K

Material Density				Bucket Volume	
kg/m³	**tonnes/m³**	**lb/yd³**	**tons/yd³**	**m³**	**yd³**
1468-1614	1.47-1.61	**2500-2750**	**1.25-1.38**	7.7	**10**
1638-1801	1.64-1.80	**2778-3056**	**1.39-1.53**	6.9	**9**
1766-1942	1.77-1.94	**3001-3300**	**1.50-1.65**	6.4	**8.33**

990K

Material Density				Bucket Volume	
kg/m³	**tonnes/m³**	**lb/yd³**	**tons/yd³**	**m³**	**yd³**
1590-1749	1.59-1.75	**2692-2962**	**1.35-1.48**	10	**13**
1728-1901	1.73-1.90	**2917-3208**	**1.46-1.60**	9.2	**12**
1849-2034	1.85-2.03	**3111-3422**	**1.56-1.71**	8.6	**11.25**

992K — Standard

Up to specified density for 100% fill factor

Bucket Volume		Material Density	
m^3	yd^3	kg/m^3	lb/yd^3
12.2	**16**	1780	**3000**
11.5	**15**	1890	**3200**
10.7	**14**	2030	**3430**

992K — High Lift

Up to specified density for 100% fill factor

Bucket Volume		Material Density	
m^3	yd^3	kg/m^3	lb/yd^3
12.2	**16**	1560	**2630**
11.5	**15**	1560	**2630**
10.7	**14**	1560	**2630**

993K — Standard

Up to specified density for 100% fill factor

Bucket Volume		Material Density	
m^3	yd^3	kg/m^3	lb/yd^3
15.3	**20**	1780	**3000**
14.5	**19**	1870	**3160**
13.8	**18**	1970	**3330**

993K — High Lift

Up to specified density for 100% fill factor

Bucket Volume		Material Density	
m^3	yd^3	kg/m^3	lb/yd^3
14.5	**19**	1720	**2890**
13.8	**18**	1810	**3060**
13.0	**17**	1920	**3240**

WHEEL TRACTOR-SCRAPERS

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WHEEL TRACTOR-SCRAPERS

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Specifications
- Twin Engine Open Bowl
- Optional Push-Pull

MODEL	627K		637K		657G	
Flywheel Power: Tractor	304 kW	**407 hp**	425 kW	**570 hp**	421/447 kW	**564/600 hp**
Scraper	216 kW	**290 hp**	216 kW	**290 hp**	306/337 kW	**410/451 hp**
Approx. Operating Weight (Empty)◂	40 811 kg	**89,973 lb**	52 140 kg	**114,950 lb**	68 384 kg	**150,760 lb**
Scraper Capacity: Struck	13 m^3	**17.1 yd^3**	18.3 m^3	**24 yd^3**	24.5 m^3	**32 yd^3**
Heaped	18.4 m^3	**24 yd^3**	26 m^3	**34 yd^3**	33.6 m^3	**44 yd^3**
Rated Load	26 127 kg	**57,610 lb**	37 285 kg	**82,200 lb**	47 174 kg	**104,000 lb**
Weight Distribution — Empty: Front	**59%**		**59%**		**58%**	
Rear	**41%**		**41%**		**42%**	
Weight Distribution — Loaded: Front	**50%**		**50%**		**50%**	
Rear	**50%**		**50%**		**50%**	
Engine Model: Tractor	**C13 ACERT**		**C18 ACERT**		**C18 ACERT**	
Scraper	**C9.3 ACERT**		**C9 ACERT**		**C15 ACERT**	
Emission Standards	**Tier 4 Final/Stage IV/ Japan 2014 (Tier 4 Final)**		**Tier 4 Final/Stage IV/ Japan 2014 (Tier 4 Final)**		**Tier 3/Stage IIIA/ Japan 2006 (Tier 3) equivalent**	
Rated Engine RPM: Tractor	**2000**		**1900**		**1800**	
Scraper	**2150**		**2150**		**1800**	
Displacement: Tractor	12.5 L	**763 in^3**	18.1 L	**1105 in^3**	18.1 L	**1105 in^3**
Scraper	9.3 L	**567 in^3**	9.3 L	**567 in^3**	15.2 L	**928 in^3**
Top Speed (Loaded)	53.9 km/h	**33.5 mph**	55.8 km/h	**34.7 mph**	53 km/h	**33 mph**
180° Curb-to-Curb Turning Width	18.25 m	**59'11"**	19.94 m	**65'5"**	22.33 m	**73'3"**
Tires — Tractor/Scraper	**33.25R29★★E3**		**37.25R35★★E3**		**40.5/75R39★★E3**	
Width of Cut	3.14 m	**10'4"**	3.51 m	**11'6"**	3.85 m	**12'8"**
Maximum Depth of Cut	315 mm	**12.4"**	475 mm	**18.7"**	440 mm	**17.3"**
Maximum Depth of Spread	540 mm	**21.3"**	451 mm	**17.8"**	660 mm	**26"**
Fuel Tank Refill Capacity	1272 L	**336 U.S. gal**	1400 L	**370 U.S. gal**	1597 L	**424 U.S. gal**
Tractor DEF Tank	31.5 L	**8.3 U.S. gal**	31.5 L	**8.3 U.S. gal**	**—**	
Scraper DEF Tank	23.1 L	**6.1 U.S. gal**	22.9 L	**6.0 U.S. gal**	**—**	
GENERAL DIMENSIONS:						
Non Push-Pull						
Height — Overall Shipping	4.03 m	**13'2"**	4.15 m	**13'7"**	4.62 m	**15'2"**
Wheelbase	7.99 m	**26'2"**	8.81 m	**28'11"**	9.96 m	**32'8"**
Overall Length	14.02 m	**45'10"**	15.04 m	**49'4"**	16.2 m	**53'1"**
Overall Width	3.57 m	**11'7"**	3.94 m	**12'11"**	4.35 m	**14'4"**
Shipping Width (Draft Arm on Inside of Bowl)	**—**		**—**		3.91 m *	**12'10"**
Center Line of Scraper Tread	2.29 m	**7'5"**	2.46 m	**8'1"**	2.81 m	**9'3"**
Center Line of Tractor Tread	2.28 m	**7'4"**	2.46 m	**8'1"**	2.63 m	**8'8"**
GENERAL DIMENSIONS: Push-Pull						
Operating Weight (Empty)◂	42 158 kg	**92,942 lb**	54 005 kg	**119,060 lb**	72 804 kg	**160,505 lb**
Overall Length	15.58 m	**51'1"**	16.64 m	**54'7"**	18.01 m	**59'1"**
Weight Distribution — Empty:						
Front	**59%**		**61%**		**58%**	
Rear	**41%**		**39%**		**42%**	
Weight Distribution — Loaded:						
Front	**50%**		**51%**		**51%**	
Rear	**50%**		**49%**		**49%**	

*Standard Shipping Configuration.

◂ Operating weight includes standard machine, coolant, lubricants, full fuel tank, and operator. Operating weights for the 627K and 637K are based on Tier 4 Final/Stage IV/Japan 2014 (Tier 4 Final) platform machines. Deduct 569 kg **(1254 lb)** for the operating weight for the 627K Tier 2/Stage II/Japan 2001 (Tier 2) equivalent. Deduct 650 kg **(1433 lb)** for the operating weight for the 637K Tier 2/Stage II/Japan 2001 (Tier 2) equivalent. 657G is not available in Tier 2/ Stage II/Japan 2001 (Tier 2) equivalent.

NOTE: Wheel Tractor-Scrapers are not emission certified in Japan market.

MODEL	637K		657G	
Flywheel Power: Tractor	425 kW	**570 hp**	421/447 kW	**564/600 hp**
Scraper	216 kW	**290 hp**	306/337 kW	**410/451 hp**
Approx. Operating Weight (Empty)	53 425 kg	**117,782 lb**	72 190 kg	**158,817 lb**
Scraper Capacity: Struck	31 m^3	**41 yd^3**	45 m^3	**59 yd^3**
Heaped	38 m^3	**50 yd^3**	56 m^3	**73 yd^3**
Emission Standards	**Tier 4 Final/Stage IV/ Japan 2014 (Tier 4 Final)**		**Tier 3/Stage IIIA/ Japan 2006 (Tier 3) equivalent**	
Rated Load	37 285 kg	**82,200 lb**	49 895 kg	**110,000 lb**
Approx. Operating Weight (Loaded)	90 710 kg	**199,982 lb**	121 933 kg	**268,817 lb**
Top Speed (Loaded)	55.8 km/h	**34.7 mph**	53 km/h	**33 mph**
180° Curb-to-Curb Turning Width	21.46 m	**70'5"**	24.43 m	**80'2"**
GENERAL DIMENSIONS:				
Height — Overall Shipping	4.15 m	**13'7"**	4.62 m	**15'2"**
Wheelbase	9.57 m	**31'5"**	11.01 m	**36'1"**
Overall Length	15.48 m	**50'10"**	17.21 m	**56'5"**
Overall Width	3.94 m	**12'11"**	4.35 m	**14'4"**
Shipping Width (Draft Arm on Inside of Bowl)	—		3.91 m *	**12'10"**
Center Line of Scraper Tread	2.46 m	**8'1"**	2.81 m	**9'3"**
Center Line of Tractor Tread	2.46 m	**8'1"**	2.63 m	**8'8"**

*Standard Shipping Configuration.

◄ Operating weight includes standard machine, coolant, lubricants, full fuel tank, and operator. Operating weights for the 637K are based on Tier 4 Final/Stage IV/Japan 2014 (Tier 4 Final) and operating weights for the 657G are based on Tier 3/Stage IIIA/Japan 2006 (Tier 3) equivalent platform machines. Deduct 650 kg **(1433 lb)** for the operating weight for the 637K Tier 2/Stage II/Japan 2001 (Tier 2) equivalent.

NOTE: Wheel Tractor-Scrapers are not emission certified in Japan market.

Coal Bowl

Coal Bowl Wheel Tractor-Scrapers are typically used for building and maintaining coal stockpiles and hauling coal to the supply system at coal power plants. The self-loading capability, large capacity, coal pile compaction, and high speed of Coal Bowl Wheel Tractor-Scrapers make them the tool of choice for moving coal both short and long distances. Coal Bowl Wheel Tractor-Scrapers are available in the 637K and 657G tandem engine models.

Coal Bowl Advantages:

- Load hoppers
- Manage coal stockpiles
- Compaction reduces risk of spontaneous combustion in coal stockpile
- Exclusively designed large capacity coal bowls

Notes:

- The 637K Coal Scraper is 736 mm **(29.0")** longer, the bowl sides are 476 mm **(18.7")** taller, and the apron is 499 mm **(19.6")** taller than its earthmoving counterpart.
- The 657G Coal Scraper is 1072 mm **(42.2")** longer, the bowl sides are 1010 mm **(39.8")** taller, the apron is 677 mm **(26.7")** taller, and the ejector is 944 mm **(37.2")** taller than its earthmoving counterpart.

USE OF RIMPULL-SPEED-GRADEABILITY CURVES

The following explanation applies to Rimpull-Speed-Gradeability curves for Wheel Tractor-Scrapers, Construction & Mining Trucks/Tractors and Articulated Trucks.

Maximum speed attainable, gear range and available rimpull can be determined from curves on the following pages when machine weight and total effective grade (or total resistance) are known.

Rimpull is the force (in kg, lb or kN) available between the tire and the ground to propel the machine (limited by traction).

Weight is defined as Gross Machine Weight (kg or lb) = Machine + Payload.

Total Effective Grade (or Total Resistance) is grade resistance plus rolling resistance expressed as percent grade.

Grade is measured or estimated.

Rolling resistance is estimated (see Tables section for typical values.)

10 kg/metric ton (20 lb/U.S. ton) = 1% adverse grade.

Example

With a 6% grade and a rolling resistance of 40 kg/metric ton (80 lb/U.S. ton), find total resistance.

Rolling resistance = 40 kg/t ÷ 10 = 4% Effective Grade

(English: 80 lb ÷ 20 = 4%)

Total resistance = 4% rolling + 6% grade = 10%

Altitude Derating

Rimpull force and speed must be derated for alti- tude similar to flywheel horsepower. The percentage loss in rimpull force approximately corresponds to the percentage loss in flywheel horsepower. See Tables Section for altitude derations.

Rimpull-Speed-Gradeability

To determine gradeability performance: Read from gross weight down to the % of total resistance. (Total resistance equals actual % grade *plus* 1% for each 10 kg/metric ton (20 lb./U.S. ton) of rolling resistance.) From this weight-resistance point, read horizontally to the curve with the highest obtainable speed range, then down to the maximum speed. Usable rimpull depends upon traction and weight on drive wheels.

Example problem:

A 631K with an estimated payload of 37 013 kg (81,600 lb) is operating on a total effective grade of 10%. Find the available rimpull and maximum attainable speed.

Empty weight payload = Gross Weight
47 628 kg + 37 013 kg = 84 641 kg
(105,002 lb + 81,600 lb = 186,602 lb)

Solution: Using graph on the next page, read from 84 641 kg (186,602 lb) (point A) on top of gross weight scale down the line to the intersection of the 10% total resistance line (point B).

Go across horizontally from B to the Rimpull Scale on the left (point D). This gives the required rimpull: 7756 kg (17,100 lb).

Where the line cuts the speed curve (point C), read down vertically (point E) to obtain the maximum speed attainable for the 10% effective grade: 12.9 km/h (8 mph).

ANSWER: The machine will climb the 10% effective grade at a maximum speed of 12.9 km/h (8 mph) in 4th gear. Available rimpull is 7756 kg (17,100 lb).

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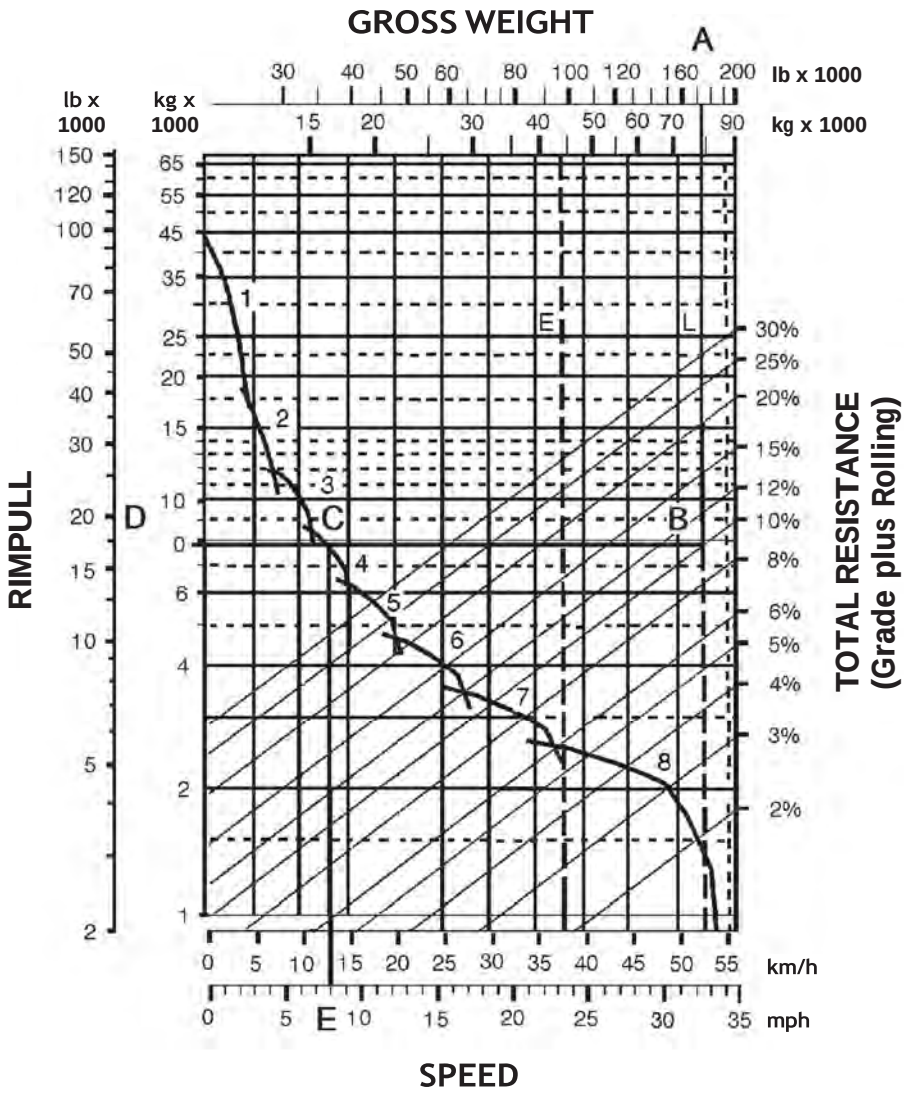


KEY

1 — 1st Gear Torque Converter Drive
2 — 2nd Gear Torque Converter Drive
3 — 3rd Gear Direct Drive
4 — 4th Gear Direct Drive
5 — 5th Gear Direct Drive
6 — 6th Gear Direct Drive
7 — 7th Gear Direct Drive
8 — 8th Gear Direct Drive

KEY

A — Loaded 84 641 kg (186,602 lb)
B — Intersection with 10% total resistance line
C — Intersection with rimpull curve (4th gear)
D — Required rimpull 7756 kg (17,100 lb)
E — Speed 12.9 km/h (8 mph)

TYPICAL FIXED TIMES FOR SCRAPERS
(Times may vary depending on job conditions)

Model	Loaded By	Load Time (Min.)	Maneuver and Spread or Maneuver and Dump (Min.)
613G	Self	0.9	0.7
623K	Self	0.9	0.7
621K	One D8	0.5	0.7
627K	One D8	0.5	0.6
621K	One D9	0.4	0.7
627K	One D9	0.4	0.6
627K/PP	Self	0.9*	0.6
631K	One D9	0.6	0.7
637K	One D9	0.6	0.6
631K	One D10	0.5	0.7
637K	One D10	0.5	0.6
637K/PP	Self	1.0*	0.6
657G	One D11	0.6	0.6
657G	Push Pull Self	1.1*	0.6
637K	Coal	0.8	0.7
657G	Coal	0.8	0.6

*Load time per pair, including transfer time.

NOTE: Empty Weights shown on the Wheel Tractor-Scraper charts includes ROPS Canopy. When calculating TMPH loadings *any* additional weight must be considered in establishing mean tire loads.

USE OF RETARDER CURVES

The following explanation applies to retarder curves for Wheel Tractor-Scrapers and Articulated Trucks.

The speed that can be maintained (without use of service brake) when the machine is descending a grade with retarder fully on can be determined from the retarder curves in this section if gross machine weight and total effective grade are known.

Total Effective Grade (or Total Resistance) is grade assistance *minus* rolling resistance.

10 kg/metric ton (20 lb/U.S. ton) = 1% adverse grade.

Example

15% favorable grade with 5% rolling resistance. Find Total Effective Grade.

Total Effective Grade = 15% Grade Assistance — 5%

Rolling Resistance = 10% Total Effective Grade Assistance.

Example problem:

A 651E with an estimated payload of 47 175 kg (104,000 lb) descends a 10% total effective grade. Find constant speed and gear range with maximum retarder effort. Find travel time if the slope is 610 m (2000 ft) long.

Empty Weight + Payload = Gross Weight
= 60 950 kg + 47 175 kg = 108 125 kg
(134,370 lb + 104,000 lb = 238,370 lb)

Solution: Using the retarder curve below, read from 108 125 kg (238,370 lb) (point A) on top of gross weight scale down the line to the intersection of the 10%

effective grade line (point B).

Go across horizontally from point B to the intersection of the retarder curve (point C). Point C intersects at the 5 (5th gear) range.

Where point C intersects the retarder curve, read down vertically to point D on the bottom scale to obtain the constant speed: 21.7 km/h (13.5 mph).

ANSWER: The 651E will descend the slope at 21.7 km/h (13.5 mph) in 5th gear. Travel time is 1.68 minutes.

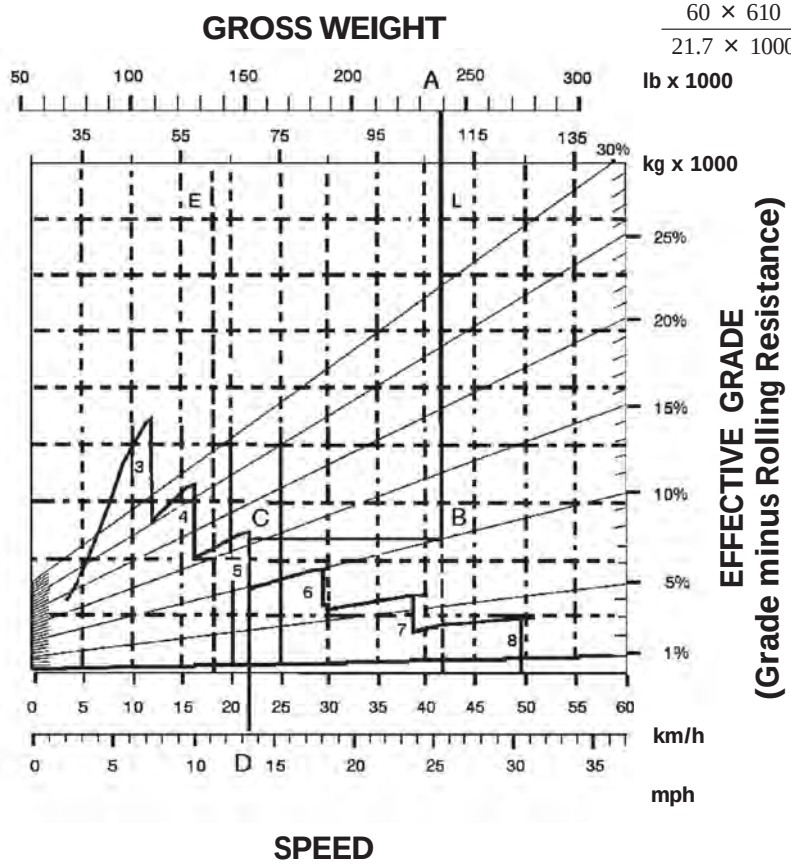
$$\frac{610 \text{ m}}{363 \text{ m/min}} = 1.68 \text{ min}$$

*(mph × 88 = F.P.M.)

$$\frac{2000 \text{ ft}}{13.5 \text{ mph} \times 88^*} = 1.68 \text{ min}$$

NOTE: The basic Distance-Speed-Time formula is 60 D ÷ S = T (or "60 D Street"), where 60 is minutes, D is distance, S is speed and T is time. In the above problem, 60 × 610 m ÷ 21.7 km/h × 1000 = T.

$$\frac{60 \times 610}{21.7 \times 1000} = T = (1.68)$$



KEY

KEY

3 — 3rd Gear Direct Drive 4 — 4th Gear Direct Drive 5 — 5th Gear Direct Drive 6 — 6th Gear Direct Drive 7 — 7th Gear Direct Drive 8 — 8th Gear Direct Drive

A — Loaded 108 125 kg (238, 370 lb) B — Intersection with 10% effective grade line C — In	tersection with retarder curve (5th gear) D — Constant speed 21.7 km/h (13.5 mph)	

MINING AND EARTHMOVING

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INTRODUCTION

This section explains the earthmoving principles used to determine machine productivity. It shows how to calculate production on-the-job or estimate production off-the-job.

ELEMENTS OF PRODUCTION

Production is the hourly rate at which material is moved. Production can be expressed in various units:

Metric

Bank Cubic Meters — BCM — bank m^3
Loose Cubic Meters — LCM — loose m^3
Compacted Cubic Meters — CCM — compacted m^3
Tonnes

English

Bank Cubic Yards — BCY — bank yd^3
Loose Cubic Yards — LCY — loose yd^3
Compacted Cubic Yards — CCY — compacted yd^3
Tons

For most earthmoving and material handling applications, production is calculated by multiplying the quantity of material (load) moved per cycle by the number of cycles per hour.

Production = Load/cycle × cycles/hour

The load can be determined by
1) load weighing with scales
2) load estimating based on machine rating
3) surveyed volume divided by load count
4) machine payload measurement system

Generally, earthmoving and overburden removal for coal mines are calculated by volume (bank cubic meters or bank cubic yards). Metal mines and aggregate producers usually work in weight (tons or tonnes).

Volume Measure — Material volume is defined according to its state in the earthmoving process. The three measures of volume are:

BCM (BCY) — one cubic meter (yard) of material as it lies in the natural bank state.

LCM (LCY) — one cubic meter (yard) of material which has been disturbed and has swelled as a result of movement.

CCM (CCY) — one cubic meter (yard) of material which has been compacted and has become more dense as a result of compaction.

In order to estimate production, the relationships between bank measure, loose measure, and compacted measure must be known.

Swell — Swell is the percentage of original volume (cubic meters or cubic yards) that a material increases when it is removed from the natural state. When excavated, the material breaks up into different size particles that do not fit together, causing air pockets or voids to reduce the weight per volume. For example to hold the same weight of one cubic unit of bank material it takes 30% more volume (1.3 times) after excavation. (Swell is 30%.)

$$1 + \text{Swell} = \frac{\text{Loose cubic volume for a given weight}}{\text{Bank cubic volume for the same given weight}}$$

$$\text{Bank} = \frac{\text{Loose}}{(1 + \text{Swell})}$$

$$\text{Loose} = \text{Bank} \times (1 + \text{Swell})$$

Example Problem:

If a material swells 20%, how many loose cubic meters (loose cubic yards) will it take to move 1000 bank cubic meters (1308 bank cubic yards)?

Loose = Bank × (1 + Swell) =
1000 BCM × (1 + 0.2) = 1200 LCM
1308 BCY × (1 + 0.2) = 1570 LCY

How many bank cubic meters (yards) were moved if a total of 1000 loose cubic meters (1308 yards) have been moved? Swell is 25%.

Bank = Loose ÷ (1 + Swell) =
1000 LCM ÷ (1 + 0.25) = 800 BCM
1308 LCY ÷ (1 + 0.25) = 1046 BCY

Load Factor — Assume one bank cubic yard of material weighs 3000 lb. Because of material characteristics, this bank cubic yard swells 30% to 1.3 loose cubic yards when loaded, with no change in weight. If this 1.0 bank cubic yard or 1.3 loose cubic yards is compacted, its volume may be reduced to 0.8 compacted cubic yard, and the weight is still 3000 lb.

Instead of dividing by 1 + Swell to determine bank volume, the loose volume can be multiplied by the load factor.

If the percent of material swell is known, the load factor (L.F.) may be obtained by using the following relationship:

$$\text{L.F.} = \frac{100\%}{100\% + \%\ \text{swell}}$$

Load factors for various materials are listed in the Tables Section of this handbook.

To estimate the machine payload in bank cubic yards, the volume in loose cubic yards is multiplied by the load factor:

$$\text{Load (BCY)} = \text{Load (LCY)} \times \text{L.F.}$$

The ratio between compacted measure and bank measure is called shrinkage factor (S.F.):

$$\text{S.F.} = \frac{\text{Compacted cubic yards (CCY)}}{\text{Bank cubic yards (BCY)}}$$

Shrinkage factor is either estimated or obtained from job plans or specifications which show the conversion from compacted measure to bank measure. Shrinkage factor should not be confused with percentage compaction (used for specifying embankment density, such as Modified Proctor or California Bearing Ratio [CBR]).

Material Density — Density is the weight per unit volume of a material. Materials have various densities depending on particle size, moisture content and variations in the material. The denser the material the more weight there is per unit of equal volume. Density estimates are provided in the Tables Section of this handbook.

$$\text{Density} = \frac{\text{Weight}}{\text{Volume}} = \frac{\text{kg (lb)}}{\text{m}^3\ (\text{yd}^3)}$$

$$\text{Weight} = \text{Volume} \times \text{Density}$$

A given material's density changes between bank and loose. One cubic unit of loose material has less weight than one cubic unit of bank material due to air pockets and voids. To correct between bank and loose use the following equations.

$$1 + \text{Swell} = \frac{\text{kg/BCM}}{\text{kg/LCM}} \text{ or } \frac{\text{lb/BCY}}{\text{lb/LCY}}$$

$$\text{lb/LCY} = \frac{\text{lb/BCY}}{(1 + \text{Swell})}$$

$$\text{lb/BCY} = \text{lb/LCY} \times (1 + \text{Swell})$$

Fill Factor — The percentage of an available volume in a body, bucket, or bowl that is actually used is expressed as the fill factor. A fill factor of 87% for a hauler body means that 13% of the rated volume is not being used to carry material. Buckets often have fill factors over 100%.

Example Problem:

A 14 cubic yard (heaped 2:1) bucket has a 105% fill factor when operating in a shot sandstone (4125 lb/BCY and a 35% swell).

a) What is the loose density of the material?
b) What is the usable volume of the bucket?
c) What is the bucket payload per pass in BCY?
d) What is the bucket payload per pass in tons?

a) lb/LCY = lb/BCY ÷ (1 + Swell) = 4125 ÷ (1.35) = 3056 lb/LCY
b) LCY = rated LCY × fill factor = 14 × 1.05 = 14.7 LCY
c) lb/pass = volume × density lb/LCY = 14.7 × 3056 = 44,923 lb
BCY/pass = weight ÷ density lb/BCY = 44,923 ÷ 4125 = 10.9 BCY
or bucket LCY from part b ÷ (1 + Swell) = 14.7 ÷ 1.35 = 10.9 BCY
d) tons/pass = lb ÷ 2000 lb/ton = 44,923 ÷ 2000 = 22.5 tons

Example Problem:

Construct a 10,000 compacted cubic yard (CCY) bridge approach of dry clay with a shrinkage factor (S.F.) of 0.80. Haul unit is rated 14 loose cubic yards struck and 20 loose cubic yards heaped.

a) How many bank yards are needed?
b) How many loads are required?

a) $\text{BCY} = \frac{\text{CCY}}{\text{S.F.}} = \frac{10{,}000}{0.80} = 12{,}500 \text{ BCY}$

b) Load (BCY) = Capacity (LCY) × Load factor (L.F.) = 20 × 0.81

= 16.2 BCY/Load
(L.F. of 0.81 from Tables)

$$\text{Number of loads required} = \frac{12{,}500 \text{ BCY}}{16.2 \text{ BCY/Load}} = 772 \text{ Loads}$$

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Soil Density Tests — There are a number of acceptable methods that can be used to determine soil density. Some that are currently in use are:

Nuclear density moisture gauge
Sand cone method
Oil method
Balloon method
Cylinder method

All these except the nuclear method use the following procedure:

1. Remove a soil sample from bank state.
2. Determine the volume of the hole.
3. Weigh the soil sample.
4. Calculate the bank density kg/BCM (lb/BCY).

The nuclear density moisture gauge is one of the most modern instruments for measuring soil density and moisture. A common radiation channel emits either neutrons or gamma rays into the soil. In determining soil density, the number of gamma rays absorbed and back scattered by soil particles is *indirectly* propor- tional to the soil density. When measuring moisture content, the number of moderated neutrons reflected back to the detector after colliding with hydrogen particles in the soil is *directly* proportional to the soil's moisture content.

All these methods are satisfactory and will provide accurate densities when performed correctly. Several repetitions are necessary to obtain an average.

NOTE: Several newer methods have been successfully applied, along with weigh scales to determine volume and loose density of material moved in hauler bodies. These measurements include photogrammatic and laser scanning technologies.

FIGURING PRODUCTION ON-THE-JOB

Load Weighing — The most accurate method of determining the actual load carried is by weighing. This is normally done by weighing the haul unit one wheel or axle at a time with portable scales. Any scales of adequate capacity and accuracy can be used. While weighing, the machine must be level to reduce error caused by weight transfer. Enough loads must be weighed to provide a good average. Machine weight is the sum of the individual wheel or axle weights.

The weight of the load can be determined using the empty and loaded weight of the unit.

Weight of
load = gross machine weight – empty weight

To determine the bank cubic measure carried by a machine, the load weight is divided by the bankstate density of the material being hauled.

$$\text{BCY} = \frac{\text{Weight of load}}{\text{Bank density}}$$

Times Studies — To estimate production, the number of complete trips a unit makes per hour must be determined. First obtain the unit's cycle time with the help of a stop watch. Time several complete cycles to arrive at an average cycle time. By allowing the watch to run continuously, different segments such as load time, wait time, etc. can be recorded for each cycle. Knowing the individual time segments affords a good opportunity to evaluate the balance of the spread and job efficiency. The following is an example of a scraper load time study form. Numbers in the white columns are stop watch readings; numbers in the shaded columns are calculated:

Total Cycle Times (less delays)	Arrive Cut	Wait Time	Begin Load	Load Time	End Load	Begin Delay	Delay Time	End Delay
	0.00	0.30	0.30	0.60	0.90			
3.50	3.50	0.30	3.80	0.65	4.45			
4.00	7.50	0.35	7.85	0.70	8.55	9.95	1.00	10.95
4.00	12.50	0.42	12.92	0.68	13.60			

NOTE: All numbers are in minutes

This may be easily extended to include other segments of the cycle such as haul time, dump time, etc.

Haul roads may be further segmented to more accurately define performance, including measured speed traps. Similar forms can be made for pushers, loaders, dozers, etc. *Wait Time* is the time a unit must wait for another unit so that the two can function together (haul unit waiting for pusher). *Delay Time* is any time, other than wait time, when a machine is not performing in the work cycle (scraper waiting to cross railroad track).

To determine trips-per-hour at 100% efficiency, divide 60 minutes by the average cycle time less all wait and delay time. Cycle time may or may not include wait and/or delay time. Therefore, it is possible to figure different kinds of production: measured production, production without wait or delay, maximum production, etc. For example:

Actual Production: includes all wait and delay time.

Normal Production (without delays): includes wait time that is considered normal, but no delay time.

Maximum Production: to figure maximum (or optimum) production, both wait time and delay time are eliminated. The cycle time may be further altered by using an optimum load time.

Example (English)

A job study of a Wheel Tractor-Scraper might yield the following information:

Average wait time	= 0.28 minute
Average load time	= 0.65
Average delay time	= 0.25
Average haul time	= 4.26
Average dump time	= 0.50
Average return time	= 2.09
Average total cycle	= 8.03 minutes
Less wait & delay time	= 0.53
Average cycle 100% eff.	= 7.50 minutes

Weight of haul unit empty — 48,650 lb

Weights of haul unit loaded —

Weighing unit #1 — 93,420 lb
Weighing unit #2 — 89,770 lb
Weighing unit #3 — 88,760 lb
271,950 lb;
average = 90,650 lb

1. Average load weight = 90,650 lb – 48,650 lb = 42,000 lb
2. Bank density = 3125 lb/BCY
3. $\text{Load} = \dfrac{\text{Weight of load}}{\text{Bank density}}$

$$= \frac{42{,}000 \text{ lb}}{3125 \text{ lb/BCY}} = 13.4 \text{ BCY}$$

4. Cycles/hr = $\dfrac{60 \text{ min/hr}}{} = \dfrac{60 \text{ min/hr}}{} = 80 \text{ cycles/hr}$

Cycle time 7.50 min/cycle

5. Production = Load/cycle × cycles/hr
(less delays) = 13.4 BCY/cycle × 8.0 cycles/hr
= 107.2 BCY/hr

Example (Metric)

A job study of a Wheel Tractor-Scraper might yield the following information:

Average wait time	= 0.28 minute
Average load time	= 0.65
Average delay time	= 0.25
Average haul time	= 4.26
Average dump time	= 0.50
Average return time	= 2.09
Average total cycle	= 8.03 minutes
Less wait & delay time	= 0.53
Average cycle 100% eff.	= 7.50 minutes

Weight of haul unit empty — 22 070 kg
Weights of haul unit loaded —
Weighing unit #1 — 42 375 kg
Weighing unit #2 — 40 720 kg
Weighing unit #3 — 40 260 kg
123 355 kg;
average = 41 120 kg

1. Average load weight = 41 120 kg – 22 070 kg = 19 050 kg
2. Bank density = 1854 kg/BCM
3. $\text{Load} = \dfrac{\text{Weight of load}}{\text{Bank density}}$

$$= \frac{19\,050 \text{ kg}}{1854 \text{ kg/BCM}} = 10.3 \text{ BCM}$$

4. Cycles/hr =

$$\frac{60 \text{ min/hr}}{\text{Cycle time}} = \frac{60 \text{ min/hr}}{7.50 \text{ min/cycle}} = 80 \text{ cycles/hr}$$

5. Production = Load/cycle × cycles/hr
(less delays) = 10.3 BCM/cycle × 8.0 cycles/hr
= 82 BCM/hrr

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ESTIMATING PRODUCTION OFF-THE-JOB

It is often necessary to estimate production of earthmoving machines which will be selected for a job. As a guide, the remainder of the section is devoted to discussions of various factors that may affect production. Some of the figures have been rounded for easier calculation.

Rolling Resistance (RR) is a measure of the force that must be overcome to roll or pull a wheel over the ground. It is affected by ground conditions and load — the deeper a wheel sinks into the ground, the higher the rolling resistance. Internal friction and tire flexing also contribute to rolling resistance. Experience has shown that minimum resistance is 1%-1.5% (see Typical Rolling Resistance Factors in Tables section) of the gross machine weight (on tires). A 2% base resistance is quite often used for estimating. Resistance due to tire penetration is approximately 1.5% of the gross machine weight for each inch of tire penetration (0.6% for each cm of tire penetration). Thus rolling resistance can be calculated using these relationships in the following manner:

RR = 2% of GMW + 0.6% of GMW per cm tire penetration

RR = 2% of GMW + 1.5% of GMW per inch tire penetration

It's *not* necessary for the tires to actually penetrate the road surface for rolling resistance to increase above the minimum. If the road surface flexes under load, the effect is nearly the same — the tire is always running "uphill." Only on very hard, smooth surfaces with a well compacted base will the rolling resistance approach the minimum.

When actual penetration takes place, some variation in rolling resistance can be noted with various inflation pressures and tread patterns.

NOTE: When figuring "pull" requirements for track-type tractors, rolling resistance applies only to the trailed unit's *weight on wheels*. Since track-type tractors utilize steel wheels moving on steel "roads," a tractor's rolling resistance is relatively constant and is accounted for in the Drawbar Pull rating.

Grade Resistance is a measure of the force that must be overcome to move a machine over unfavorable grades (uphill). Grade assistance is a measure of the force that assists machine movement on favorable grades (downhill).

Grades are generally measured in percent slope, which is the ratio between vertical rise or fall and the horizontal distance in which the rise or fall occurs. For example, a 1% grade is equivalent to a 1 m (ft) rise or fall for every 100 m (ft) of horizontal distance; a rise of 4.6 m (15 ft) in 53.3 m (175 ft) equals an 8.6% grade.

$$\frac{\text{4.6 m (rise)}}{\text{53.3 m (horizontal distance)}} = \text{8.6\% grade}$$

$$\frac{\text{15 ft (rise)}}{\text{175 ft (horizontal distance)}} = \text{8.6\% grade}$$

Uphill grades are normally referred to as adverse grades and downhill grades as favorable grades. Grade resistance is usually expressed as a positive (+) percentage and grade assistance is expressed as a negative (–) percentage.

It has been found that for each 1% increment of adverse grade an additional 10 kg (20 lb) of resistance must be overcome for each metric (U.S.) ton of machine weight. This relationship is the basis for determining the Grade Resistance Factor which is expressed in kg/metric ton (lb/U.S. ton):

Grade Resistance Factor = 10 kg/m ton × % grade
= 20 lb/U.S. ton × % grade

Grade resistance (assistance) is then obtained by multiplying the Grade Resistance Factor by the machine weight (GMW) in metric (U.S.) tons.

Grade Resistance = GR Factor × GMW in metric (U.S.) tons

Grade resistance may also be calculated using percentage of gross weight. This method is based on the relationship that grade resistance is approximately equal to 1% of the gross machine weight for 1% of grade.

Grade Resistance = 1% of GMW × % grade

Grade resistance (assistance) affects both wheel and track-type machines.

Total Resistance is the combined effect of rolling resistance (wheel vehicles) and grade resistance. It can be computed by summing the values of rolling resistance and grade resistance to give a resistance in kilogram (pounds) force.

Total Resistance = Rolling Resistance + Grade Resistance

Total resistance can also be represented as consisting completely of grade resistance expressed in percent grade. In other words, the rolling resistance component is viewed as a corresponding quantity of additional adverse grade resistance. Using this approach, total resistance can then be considered in terms of percent grade.

This can be done by converting the contribution of rolling resistance into a corresponding percentage of grade resistance. Since 1% of adverse grade offers a resistance of 10 kg (20 lb) for each metric or (U.S.) ton of machine weight, then each 10 kg (20 lb) of resistance per ton of machine weight can be represented as an additional 1% of adverse grade. Rolling resistance in percent grade and grade resistance in percent grade can then be summed to give Total Resistance in percent or Effective Grade. The following formulas are useful in arriving at Effective Grade.

Rolling Resistance (%) = 2% + 0.6% per cm tire penetration
= 2% + 1.5% per inch tire penetration

Grade Resistance (%) = % grade

Effective Grade (%) = RR (%) + GR (%)

Effective grade is a useful concept when working with Rimpull-Speed-Gradeability curves, Retarder curves, Brake Performance curves, and Travel Time curves.

Traction — is the driving force developed by a wheel or track as it acts upon a surface. It is expressed as usable Drawbar Pull or Rimpull. The following factors affect traction: weight on the driving wheel or tracks, gripping action of the wheel or track, and ground conditions. The coefficient of traction (for any roadway) is the ratio of the maximum pull developed by the machine to the total weight on the drivers.

$$\text{Coeff. of traction} = \frac{\text{Pull}}{\text{weight on drivers}}$$

Therefore, to find the usable pull for a given machine:
Usable pull = Coeff. of traction × weight on drivers

Example: Track-Type Tractor

What usable drawbar pull (DBP) can a 26 800 kg (59,100 lb) Track-type Tractor exert while working on firm earth? on loose earth? (See table section for coefficient of traction.)

Answer:
Firm earth — Usable DBP =
0.90 × 26 800 kg = 24 120 kg
(0.90 × 59,100 lb = 53,190 lb)
Loose earth — Usable DBP =
0.60 × 26 800 kg = 16 080 kg
(0.60 × 59,100 lb = 35,460 lb)

If a load required 21 800 kg (48,000 lb) pull to move it, this tractor could move the load on firm earth. However, if the earth were loose, the tracks would spin.

NOTE: D8R through D11R Tractors may attain higher coefficients of traction due to their suspended undercarriage.

Example: Wheel Tractor-Scraper

What usable rimpull can a 621F size machine exert while working on firm earth? on loose earth? The total loaded weight distribution of this unit is:

Drive unit	Scraper unit
wheels: 23 600 kg (52,000 lb)	wheels: 21 800 kg (48,000 lb)

Remember, use weight on drivers only.
Answer:
Firm earth — 0.55 × 23 600 kg = 12 980 kg
(0.55 × 52,000 lb = 28,600 lb)
Loose earth — 0.45 × 23 600 kg = 10 620 kg
(0.45 × 52,000 lb = 23,400 lb)

On firm earth this unit can exert up to 12 980 kg (28,600 lb) rimpull without excessive slipping. However, on loose earth the drivers would slip if more than 10 620 kg (23,400 lb) rimpull were developed.

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Altitude — Specification sheets show how much pull a machine can produce for a given gear and speed when the engine is operating at rated horsepower. When a standard machine is operated in high altitudes, the engine may require derating to maintain normal engine life. This engine deration will produce less drawbar pull or rimpull.

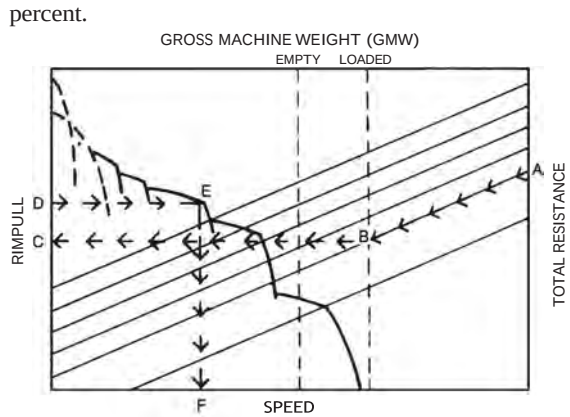
The Tables Section gives the altitude deration in percent of flywheel horsepower for current machines. It should be noted that some turbocharged engines can operate up to 4570 m (15,000 ft) before they require derating. Most machines are engineered to operate up to 1500-2290 m (5000-7500 ft) before they require deration.

The horsepower deration due to altitude must be considered in any job estimating. The amount of power deration will be reflected in the machine's gradeability and in the load, travel, and dump and load times (unless loading is independent of the machine itself). Altitude may also reduce retarding performance. Consult a Cat representative to determine if deration is applicable. Fuel grade (heat content) can have a similar effect of derating engine performance.

The example job problem that follows indicates one method of accounting for altitude deration: by increasing the appropriate components of the total cycle time by a percentage equal to the percent of horsepower deration due to altitude. (i.e., if the travel time of a hauling unit is determined to be 1.00 minute at full HP, the time for the same machine derated to 90% of full HP will be 1.10 min.) This is an approximate method that yields reasonably accurate estimates up to 3000 m (10,000 feet) elevation.

Travel time for hauling units derated more than 10% should be calculated as follows using Rimpull-Speed-Gradeability charts.

1) Determine total resistance (grade plus rolling) in percent.



2) Beginning at point A on the chart follow the total resistance line diagonally to its intersection, B, with the vertical line corresponding to the appropriate gross machine weight. (Rated loaded and empty GMW lines are shown dotted.)

3) Using a straight-edge, establish a horizontal line to the left from point B to point C on the rim-pull scale.

4) Divide the value of point C as read on the rim- pull scale by the percent of total horsepower available after altitude deration from the Tables Section. This yields rimpull value D higher than point C.

5) Establish a horizontal line right from point D. The farthest right intersection of this line with a curved speed range line is point E.

6) A vertical line down from point E determines point F on the speed scale.

7) Multiply speed in kmh by 16.7 (mph by 88) to obtain speed in m/min (ft/min). Travel time in minutes for a given distance in feet is determined by the formula:

$$\text{Time (min)} = \frac{\text{Distance in m (ft)}}{\text{Speed in m/min (ft/min)}}$$

The Travel Time Graphs in sections on Wheel Tractor-Scrapers and Construction & Mining Trucks can be used as an alternative method of calculating haul and/or return times.

Job Efficiency is one of the most complex elements of estimating production since it is influenced by factors such as operator skill, minor repairs and adjustments, personnel delays, and delays caused by job layout. An approximation of efficiency, if no job data is available, is given below.

Operation	Working Hour	Efficiency Factor
Day	50 min/hr	0.83
Night	45 min/hr	0.75

These factors do not account for delays due to weather or machine downtime for maintenance and repairs. You must account for such factors based on experience and local conditions.

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The following example provides a method to manually estimate production and cost. Today, computer programs, such as Caterpillar's Fleet Production and Cost Analysis (FPC), provide a much faster and more accurate means to obtain those application results.

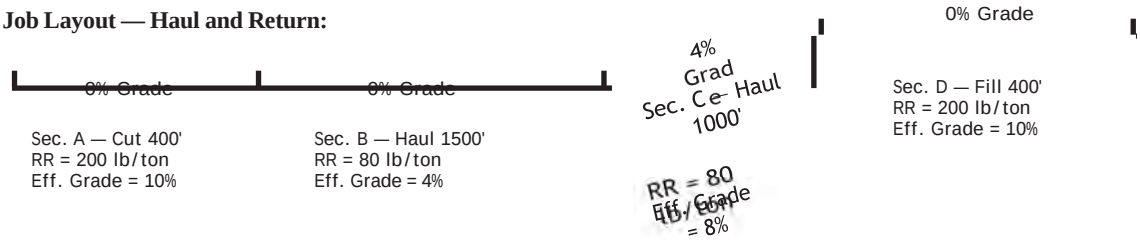
Example problem (English)

A contractor is planning to put the following spread on a dam job. What is the estimated production?

Equipment:
- 11 — 631G Wheel Tractor-Scrapers
- 2 — D9T Tractors with C-dozers
- 2 — 12H Motor Graders
- 1 — 825G Tamping Foot Compactor

Material:
- Description — Sandy clay; damp, natural bed
- Bank Density — 3000 lb/BCY
- Load Factor — 0.80
- Shrinkage Factor — 0.85
- Traction Factor — 0.50
- Altitude — 7500 ft

Job Layout — Haul and Return:



Total Effective Grade = RR (%) ± GR (%)

Sec. A: Total Effective Grade = 10% + 0% = 10%

Sec. B: Total Effective Grade = 4% + 0% = 4%

1. Estimate Payload:

Est. load (LCY) × L.F. × Bank Density = payload

31 LCY × 0.80 × 3000 lb/BCY = 74,400 lb payload

2. Establish Machine Weight:

Empty Wt. — 102,460 lb or 51.27 tons

Wt. of Load — 74,400 lb or 37.2 tons

Total (GMW) — 176,860 lb or 88.4 tons

3. Calculate Usable Pull (traction limitation):

Loaded: (weight on driving wheels = 54%) (GMW)

Traction Factor × Wt. on driving wheels =

0.50 × 176,860 lb × 54% = 47,628 lb

Empty: (weight on driving wheels = 69%) (GMW)

Traction Factor × Wt. on driving wheels =

0.50 × 102,460 lb × 69% = 35,394 lb

4. Derate for Altitude:

Check power available at 7500 ft from altitude deration table in the Tables Section.

631G — 100%	12H — 83%
D9T — 100%	825G —100%

Sec. C: Total Effective Grade = 4% + 4% = 8%
Sec. D: Total Effective Grade = 10% + 0% = 10%

Then adjust if necessary:

Load Time — controlled by D9T, at 100% power, no change.

Travel, Maneuver and Spread time — 631G, no change.

5. Compare Total Resistance to Tractive Effort on haul:

Grade Resistance —

GR = lb/ton × tons × adverse grade in percent

Sec. C: = 20 lb/ton × 88.4 tons × 4% grade = 7072 lb

Rolling Resistance —

RR = RR Factor (lb/ton) × GMW (tons)

Sec. A: = 200 lb/ton × 88.4 tons = 17,686 lb
Sec. B: = 80 lb/ton × 88.4 tons = 7072 lb
Sec. C: = 80 lb/ton × 88.4 tons = 7072 lb
Sec. D: = 200 lb/ton × 88.4 tons = 17,686 lb

Total Resistance —

TR = RR + GR

Sec. A: = 17,686 lb + 0 = 17,686 lb
Sec. B: = 7072 lb + 0 = 7072 lb
Sec. C: = 7072 lb + 6496 lb = 14,144 lb
Sec. D: = 17,686 lb + 0 = 17,686 lb

Check usable pounds pull against maximum pounds pull required to move the 631G.

Pull usable … 47,628 lb loaded

Pull required … 17,686 lb maximum total resistance

Estimate travel time for haul from 631G (loaded) travel time curve; read travel time from distance and effective grade.

Travel time (from curves):

Sec. A: 0.60 min
Sec. B: 1.00
Sec. C: 1.20
Sec. D: 0.60
3.40 min

NOTE: This is an estimate only; it *does not account for all the acceleration and deceleration time*, therefore it is not as accurate as the information obtained from a computer program.

6. Compare Total Resistance to Tractive Effort on return:

Grade Assistance —

GA = 20 lb/ton × tons × negative grade in percent

Sec. C: = 20 lb/ton × 51.2 tons × 4% grade = 4096 lb

Rolling Resistance —

RR = RR Factor × Empty Wt (tons)

Sec. D: = 200 lb/ton × 51.2 tons = 10,240 lb
Sec. C: = 80 lb/ton × 51.2 tons = 4091 lb
Sec. B: = 80 lb/ton × 51.2 tons = 4091 lb
Sec. A: = 200 lb/ton × 51.2 tons = 10,240 lb

Total Resistance —

TR = RR – GA

Sec. D: = 10,240 lb – 0 = 10,240 lb
Sec. C: = 4096 lb – 4096 lb = 0
Sec. B: = 4096 lb – 0 = 4096 lb
Sec. A: = 10,240 lb – 0 = 10,240 lb

Check usable pounds pull against maximum pounds pull required to move the 631G.

Pounds pull usable … 35,349 lb empty

Pounds pull required … 10,240 lb

Estimate travel time for return from 631G empty travel time curve.

Travel time (from curves):

Sec. A: 0.40 min
Sec. B: 0.55
Sec. C: 0.80
Sec. D: 0.40
2.15 min

7. Estimate Cycle Time:

Total Travel Time (Haul plus Return)	= 5.55 min
Adjusted for altitude: 100% × 5.55 min	= 5.55 min
Load Time	0.7 min
Maneuver and Spread Time	0.7 min
Total Cycle Time	6.95 min

8. Check pusher-scraper combinations:

Pusher cycle time consists of load, boost, return and maneuver time. Where actual job data is not available, the following may be used.

Boost time = 0.10 minute
Return time = 40% of load time
Maneuver time = 0.15 minute
Pusher cycle time = 140% of load time + 0.25 minute
Pusher cycle time = 140% of 0.7 min + 0.25 minute
= 0.98 + 0.25 = 1.23 minute

Scraper cycle time divided by pusher cycle time indicates the number of scrapers which can be handled by each pusher.

$$\frac{6.95 \text{ min}}{1.23 \text{ min}} = 5.65$$

Each push tractor is capable of handling five plus scrapers. Therefore the two pushers can adequately serve the eleven scrapers.

9. Estimate Production:

Cycles/hour = 60 min ÷ Total cycle time
= 60 min/hr ÷ 6.95 min/cycle
= 8.6 cycles/hr
Estimated load = Heaped capacity × L.F.
= 31 LCY × 0.80
= 24.8 BCY
Hourly unit production = Est. load × cycles/hr
= 24.8 BCY × 8.6 cycles/hr
= 213 BCY/hr
Adjusted production = Efficiency factor × hourly production
= 0.83 (50 min hour) × 213 BCY
= 177 BCY/hr
Hourly fleet production = Unit production × No. of units
= 177 BCY/hr × 11
= 1947 BCY/hr

10. Estimate Compaction:

Compaction requirement = S.F. × hourly fleet production
= 0.85 × 1947 BCY/hr
= 1655 CCY/hr

Compaction capability (given the following):

Compacting width, 7.4 ft	(W)
Average compacting speed, 6 mph	(S)
Compacted lift thickness, 7 in	(L)
No. of passes required, 3	(P)

825G production =

$$\text{CCY/hr} = \frac{W \times S \times L \times 16.3}{P} \quad \text{(conversion constant)}$$

$$= \frac{7.4 \times 6 \times 7 \times 16.3}{3}$$

= 1688 CCY/hr

Given the compaction requirement of 1655 CCY/hr, the 825G is an adequate compactor match-up for the rest of the fleet. However, any change to job layout that would increase fleet production would upset this balance.

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Example problem (Metric)

A contractor is planning to put the following spread on a dam job. What is the estimated production?

Equipment:

11 — 631G Wheel Tractor-Scrapers
2 — D9T Tractors with C-dozers
2 — 12H Motor Graders
1 — 825G Tamping Foot Compactor

Material:

Description — Sandy clay; damp, natural bed
Bank Density — 1770 kg/BCM
Load Factor — 0.80
Shrinkage Factor — 0.85
Traction Factor — 0.50
Altitude — 2300 meters

Job Layout — Haul and Return:

Total Effective Grade = RR (%) ± GR (%)
Sec. A: Total Effective Grade = 10% + 0% = 10%
Sec. B: Total Effective Grade = 4% + 0% = 4%
Sec. C: Total Effective Grade = 4% + 4% = 8%
Sec. D: Total Effective Grade = 10% + 0% = 10%

1. Estimate Payload:
Est. load (LCM) × L.F. × Bank Density = payload
24 LCM × 0.80 × 1770 kg/BCM = 34 000 kg payload

2. Machine Weight:
Empty Wt. — 46 475 kg or 46.48 metric tons
Wt. of Load — 34 000 kg or 34 metric tons
Total (GMW) — 80 475 kg or 80.48 metric tons

3. Calculate Usable Pull (traction limitation):
Loaded: (weight on driving wheels = 54%) (GMW)
Traction Factor × Wt. on driving wheels =
0.50 × 80 475 kg × 54% = 21 728 kg
Empty: (weight on driving wheels = 69%) (GMW)
Traction Factor × Wt. on driving wheels =
0.50 × 46 475 kg × 69% = 16 034 kg

4. Derate for Altitude:
Check power available at 2300 m from altitude deration table in the Tables Section.
631G — 100% 12H — 83%
D9T — 100% 825G — 100%

Then adjust if necessary:
Load Time — controlled by D9T, at 100% power, no change.
Travel, Maneuver and Spread time — 631G, no change.

5. Compare Total Resistance to Tractive Effort on haul:
Grade Resistance —
GR = 10 kg/metric ton × tons × adverse grade in percent
Sec. C: = 10 kg/metric ton × 80.48 metric tons × 4% grade = 3219 kg

Rolling Resistance —
RR = RR Factor (kg/mton) × GMW (metric tons)
Sec. A: = 100 kg/metric ton × 80.48 metric tons = 8048 kg
Sec. B: = 40 kg/metric ton × 80.48 metric tons = 3219 kg
Sec. C: = 40 kg/metric ton × 80.48 metric tons = 3219 kg
Sec. D: = 100 kg/metric ton × 80.48 metric tons = 8048 kg

Total Resistance —
TR = RR + GR
Sec. A: = 8048 kg + 0 = 8048 kg
Sec. B: = 3219 kg + 0 = 3219 kg
Sec. C: = 3219 kg + 3219 kg = 6438 kg
Sec. D: = 8048 kg + 0 = 8048 kg

Check usable kilogram force against maximum kilogram force required to move the 631G.
Force usable … 21 728 kg loaded
Force required … 8048 kg maximum total resistance

Estimate travel time for haul from 631G (loaded) travel time curve; read travel time from distance and effective grade.
Travel time (from curves):
Sec. A: 0.60 min
Sec. B: 1.00
Sec. C: 1.20
Sec. D: 0.60
3.40 min

NOTE: This is an estimate only; it *does not account for all the acceleration and deceleration time*, therefore it is not as accurate as the information obtained from a computer program.

6. Compare Total Resistance to Tractive Effort on return:
Grade Assistance —
GA = 10 kg/mton × metric tons × negative grade in percent
Sec. C: = 10 kg/metric ton × 46.48 metric tons × 4% grade = 1859 kg

Rolling Resistance —
RR = RR Factor × Empty Wt.
Sec. D: = 100 kg/metric ton × 46.48 metric tons
= 4648 kg
Sec. C: = 40 kg/metric ton × 46.48 metric tons
= 1859 kg
Sec. B: = 40 kg/metric ton × 46.48 metric tons
= 1859 kg
Sec. A: = 100 kg/metric ton × 46.48 metric tons
= 4648 kg

Total Resistance —
TR = RR – GA
Sec. D: = 4648 kg – 0 = 4648 kg
Sec. C: = 1859 kg – 1859 kg = 0
Sec. B: = 1859 kg – 0 = 1859 kg
Sec. A: = 4648 kg – 0 = 4648 kg

Check usable kilogram force against maximum force required to move the 631G.
Kilogram force usable … 16 034 kg empty
Kilogram force required … 4645 kg

Estimate travel time for return from 631G empty

travel time curve.
Travel time (from curves):
Sec. A: 0.40 min

Sec. B: 0.55
Sec. C: 0.80
Sec. D: 0.40
2.15 min

7. Estimate Cycle Time:
Total Travel Time (Haul plus Return) = 5.55 min
Adjusted for altitude: 100% × 5.55 min = 5.55 min

Load Time	0.7 min
Maneuver and Spread Time	0.7 min
Total Cycle Time	6.95 min

8. Check pusher-scraper combinations:
Pusher cycle time consists of load, boost, return and maneuver time. Where actual job data is not available, the following may be used.

Boost time = 0.10 minute
Return time = 40% of load time
Maneuver time = 0.15 minute
Pusher cycle time = 140% of load time + 0.25 minute
Pusher cycle time = 140% of 0.7 min + 0.25 minute
= 0.98 + 0.25 = 1.23 minute

Each push tractor is capable of handling five plus scrapers. Therefore the two pushers can adequately serve the eleven scrapers.

9. Estimate Production:
Cycles/hour = 60 min ÷ Total cycle time
= 60 min/hr ÷ 6.95 min/cycle
= 8.6 cycles/hr
Estimated load = Heaped capacity × L.F.
= 24 LCM × 0.80
= 19.2 BCM

Hourly unit production = Est. load × cycles/hr
= 19.2 BCM × 8.6 cycles/hr
= 165 BCM
Adjusted production = Efficiency factor × hourly production
= 0.83 (50 min hour) × 165 BCM
= 137 BCM/hour
Hourly fleet production = Unit production × No. of units
= 137 BCM/hr × 11 units
= 1507 BCM/hr

10. Estimate Compaction:

Compaction requirement = S.F. × hourly fleet production
= 0.85 × 1507 BCM/hr
= 1280 CCM/hr

Compaction capability (given the following):

Compacting width, 2.26 m	(W)
Average compacting speed, 9.6 km/h	(S)
Compacted lift thickness, 18 cm	(L)
No. of passes required, 3	(P)

825G production =

$$\text{CCY/hr} = \frac{W \times S \times L \times 10}{P} \quad \text{(conversion factor)}$$

Scraper cycle time divided by pusher cycle time indicates the number of scrapers which can be handled by each pusher.

$$= \frac{2.26 \times 9.6 \times 18 \times 10}{3}$$

$$= 1302$$

Given the compaction requirement of 1280

$$\frac{6.95 \text{ min}}{1.23 \text{ min}} = 5.65$$

CCM/h, the 825G is an adequate compactor match-up for the rest of the fleet. However, any change to job layout that would increase fleet production would upset this balance.

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PRODUCTION ESTIMATING

Loading Match — Loading tools have a production range that varies with material, bucket configuration, target size, operator skill and load area conditions. The loader/truck matches given in the following table are with the typical number of passes and production range. Your Cat® dealer can provide advice and estimates based on your specific conditions.

FUEL CONSUMPTION AND PRODUCTIVITY

Fuel efficiency is the term used to relate fuel consumption and machine productivity. It is expressed in units of material moved per volume of fuel consumed. Common units are cubic meters or tonnes per liter of fuel (cubic yards or tons/gal). Determining fuel effi- ciency requires measuring both fuel consumption and production.

Measuring fuel consumption involves tapping into the vehicle's fuel supply system — without contami- nating the fuel. The amount of fuel consumed during operation is then measured on a weight or volumetric basis and correlated with the amount of work the machine has done. Cat machines equipped with VIMS™ system can record fuel consumed with relative accuracy, given the engine is performing close to specifications.

Cat Earthmoving and Mining Systems Production/50 Min. Hr.

Please refer to the individual machine section for production targets.

Cat Aggregate Systems Production/50 Min. Hr.

Please refer to the individual machine section for production targets.

FORMULAS AND RULES OF THUMB

Production, hourly = Load (BCM)/cycle × cycles/hr

= Load (BCY)/cycle × cycles/hr

Load Factor (L.F.) $= \dfrac{100\%}{100\% + \%\ \text{swell}}$

Load (bank measure) = Loose cubic meters (LCM) × L.F.

= Loose cubic yards (LCY) × L.F.

Shrinkage Factor (S.F.) $= \dfrac{\text{Compacted cubic meters (or yards)}}{\text{Bank cubic meters (or yards)}}$

Density = Weight/Unit Volume

Load (bank measure) $= \dfrac{\text{Weight of load}}{\text{Bank density}}$

Rolling Resistance Factor
= 20 kg/t + (6 kg/t/cm × cm)
= 40 lb/ton + (30 lb/ton/inch × inches)

Rolling Resistance
= RR Factor (kg/t) × GMW (tons)

= RR Factor (lb/ton) × GMW (tons)

Rolling Resistance (general estimation)
= 2% of GMW + 0.6% of GMW per cm tire penetration
= 2% of GMW + 1.5% of GMW per inch tire penetration

% Grade $= \dfrac{\text{vertical change in elevation (rise)}}{\text{corresponding horizontal distance (run)}}$

Grade Resistance Factor = 10 kg/m ton × % grade
= 20 lb/ton × % grade

Grade Resistance = GR Factor (kg/t) × GMW (tons)
= GR Factor (lb/ton) × GMW (tons)

Grade Resistance = 1% of GMW × % grade

Total Resistance
= Rolling Resistance (kg or lb) + Grade Resistance (kg or lb)

Total Effective Grade (%) = RR (%) + GR (%)

Usable pull (traction limitation)
= Coeff. of traction × weight on drivers
= Coeff. of traction × (Total weight × % on drivers)

Pull required = Rolling Resistance + Grade Resistance
= Total Resistance

Total Cycle Time = Fixed time + Variable time

Fixed time: See respective machine production section.

Variable time = Total haul time + Total return time

Travel Time $= \dfrac{\text{Distance (m)}}{\text{Speed (m/min)}}$

$= \dfrac{\text{Distance (ft)}}{\text{Speed (fpm)}}$

Cycles per hour $= \dfrac{60\ \text{min/hr}}{\text{Total cycle time (min/cycle)}}$

Adjusted production = Hourly production × Efficiency factor

No. of units required $= \dfrac{\text{Hourly production required}}{\text{Unit hourly production}}$

No. of scrapers a pusher will load $= \dfrac{\text{Scraper cycle time}}{\text{Pusher cycle time}}$

Pusher cycle time (min) = 1.40 Load time (min) + 0.25 min

Grade Horsepower $= \dfrac{\text{GMW (kg)} \times \text{Total Effective Grade} \times \text{Speed (km/h)}}{273.75}$

$= \dfrac{\text{GMW (lb)} \times \text{Total Effective Grade} \times \text{Speed (mph)}}{375}$

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SWELL — VOIDS — LOAD FACTORS

SWELL (%)	VOIDS (%)	LOAD FACTOR
5	4.8	0.952
10	9.1	0.909
15	13.0	0.870
20	16.7	0.833
25	20.0	0.800
30	23.1	0.769
35	25.9	0.741
40	28.6	0.714
45	31.0	0.690
50	33.3	0.667
55	35.5	0.645
60	37.5	0.625
65	39.4	0.606
70	41.2	0.588
75	42.9	0.571
80	44.4	0.556
85	45.9	0.541
90	47.4	0.526
95	48.7	0.513
100	50.0	0.500

Throughout this document, references to Tier 4 Interim/Stage IIIB/Japan 2011 (Tier 4 Interim) include U.S. EPA Tier 4 Interim, EU Stage IIIB, and Japan 2011 (Tier 4 Interim) equivalent emission standards. References to Tier 4 Final/Stage IV/Japan 2014 (Tier 4 Final) include U.S. EPA Tier 4 Final, EU Stage IV, and Japan 2014 (Tier 4 Final) emission standards.

Throughout this document, references to Tier 1/Stage I include U.S. EPA Tier 1 and EU Stage I equivalent emission standards. References to Tier 2/Stage II/Japan 2001 (Tier 2) equivalent include U.S. EPA Tier 2, EU Stage II, and Japan 2001 (Tier 2) equivalent emission standards. References to Tier 3/Stage IIIA/Japan 2006 (Tier 3) equivalent include U.S. EPA Tier 3, EU Stage IIIA, and Japan 2006 (Tier 3) equivalent emission standards.

BUCKET FILL FACTORS

Loose Material	Fill Factor
Mixed Moist Aggregates	95-100%
Uniform Aggregates up to 3 mm (1/8")	95-100
3 mm-9 mm (1/8"-3/8")	90-95
12 mm-20 mm (1/2"-3/4")	85-90
24 mm (1") and over	85-90
Blasted Rock	
Well Blasted	80-95%
Average Blasted	75-90
Poorly Blasted	60-75
Other	
Rock Dirt Mixtures	100-120%
Moist Loam	100-110
Soil, Boulders, Roots	80-100
Cemented Materials	85-95

NOTE: Loader bucket fill factors are affected by bucket penetration, breakout force, rack back angle, bucket profile and ground engaging tools such as bucket teeth or bolt-on replaceable cutting edges.

NOTE: For bucket fill factors for hydraulic excavators, see bucket payloads in the hydraulic excavator section.

NOTE: Above values are not valid for Hydraulic Mining Shovels.

ANGLE OF REPOSE OF VARIOUS MATERIALS

MATERIAL	ANGLE BETWEEN HORIZONTAL AND SLOPE OF HEAPED PILE	
	Ratio	Degrees
Coal, industrial	1.4:1—1.3:1	35-38
Common earth, Dry	2.8:1—1.0:1	20-45
Moist	2.1:1—1.0:1	25-45
Wet	2.1:1—1.7:1	25-30
Gravel, Round to angular	1.7:1—0.9:1	30-50
Sand & clay	2.8:1—1.4:1	20-35
Sand, Dry	2.8:1—1.7:1	20-30
Moist	1.8:1—1.0:1	30-45
Wet	2.8:1—1.0:1	20-45

TYPICAL ROLLING RESISTANCE FACTORS

Various tire sizes and inflation pressures will greatly reduce or increase the rolling resistance. The values in this table are approximate, particularly for the track and track + tire machines. These values can be used for estimating purposes when spe- cific performance information on particular equipment and given soil conditions is not available. See Mining and Earth- moving Section for more detail.

UNDERFOOTING	ROLLING RESISTANCE, PERCENT*			
	Tires		Track	Track
	Bias	Radial	**	+Tires
A very hard, smooth roadway, concrete, cold asphalt or dirt surface, no penetration or flexing	1.5%*	1.2%	0%	1.0%
A hard, smooth, stabilized surfaced roadway without penetration under load, watered, maintained	2.0%	1.7%	0%	1.2%
A firm, smooth, rolling roadway with dirt or light surfacing, flexing slightly under load or undulating, maintained fairly regularly, watered	3.0%	2.5%	0%	1.8%
A dirt roadway, rutted or flexing under load, little maintenance, no water, 25 mm (1") tire penetration or flexing	4.0%	4.0%	0%	2.4%
A dirt roadway, rutted or flexing under load, little maintenance, no water, 50 mm (2") tire penetration or flexing	5.0%	5.0%	0%	3.0%
Rutted dirt roadway, soft under travel, no maintenance, no stabilization, 100 mm (4") tire penetration or flexing	8.0%	8.0%	0%	4.8%
Loose sand or gravel	10.0%	10.0%	2%	7.0%
Rutted dirt roadway, soft under travel, no maintenance, no stabilization, 200 mm (8") tire penetration and flexing	14.0%	14.0%	5%	10.0%
Very soft, muddy, rutted roadway, 300 mm (12") tire penetration, no flexing	20.0%	20.0%	8%	15.0%

*Percent of combined machine weight.

**Assumes drag load has been subtracted to give Drawbar Pull for good to moderate conditions. Some resistance added for very soft conditions.

WEIGHT* OF MATERIALS	LOOSE kg/m³	LOOSE lb/yd³	BANK kg/m³	BANK lb/yd³	LOAD FACTORS
Basalt	1960	**3300**	2970	**5000**	0.67
Bauxite, Kaolin	1420	**2400**	1900	**3200**	0.75
Caliche	1250	**2100**	2260	**3800**	0.55
Carnotite, uranium ore	1630	**2750**	2200	**3700**	0.74
Cinders	560	**950**	860	**1450**	0.66
Clay — Natural bed	1660	**2800**	2020	**3400**	0.82
Dry	1480	**2500**	1840	**3100**	0.81
Wet	1660	**2800**	2080	**3500**	0.80
Clay & gravel — Dry	1420	**2400**	1660	**2800**	0.85
Wet	1540	**2600**	1840	**3100**	0.85
Coal — Anthracite, Raw	1190	**2000**	1600	**2700**	0.74
Washed	1100	**1850**			0.74
Ash, Bituminous Coal	530-650	**900-1100**	590-890	**1000-1500**	0.93
Bituminous, Raw	950	**1600**	1280	**2150**	0.74
Washed	830	**1400**			0.74
Decomposed rock —					
75% Rock, 25% Earth	1960	**3300**	2790	**4700**	0.70
50% Rock, 50% Earth	1720	**2900**	2280	**3850**	0.75
25% Rock, 75% Earth	1570	**2650**	1960	**3300**	0.80
Earth — Dry packed	1510	**2550**	1900	**3200**	0.80
Wet excavated	1600	**2700**	2020	**3400**	0.79
Loam	1250	**2100**	1540	**2600**	0.81
Granite — Broken	1660	**2800**	2730	**4600**	0.61
Gravel — Pitrun	1930	**3250**	2170	**3650**	0.89
Dry	1510	**2550**	1690	**2850**	0.89
Dry 6-50 mm (1/4"-2")	1690	**2850**	1900	**3200**	0.89
Wet 6-50 mm (1/4"-2")	2020	**3400**	2260	**3800**	0.89
Gypsum — Broken	1810	**3050**	3170	**5350**	0.57
Crushed	1600	**2700**	2790	**4700**	0.57
Hematite, iron ore, high grade	1810-2450	**4000-5400**	2130-2900	**4700-6400**	0.85
Limestone — Broken	1540	**2600**	2610	**4400**	0.59
Crushed	1540	**2600**	—	**—**	—
Magnetite, iron ore	2790	**4700**	3260	**5500**	0.85
Pyrite, iron ore	2580	**4350**	3030	**5100**	0.85
Sand — Dry, loose	1420	**2400**	1600	**2700**	0.89
Damp	1690	**2850**	1900	**3200**	0.89
Wet	1840	**3100**	2080	**3500**	0.89
Sand & clay — Loose	1600	**2700**	2020	**3400**	0.79
Compacted	2400	**4050**			
Sand & gravel — Dry	1720	**2900**	1930	**3250**	0.89
Wet	2020	**3400**	2230	**3750**	0.91
Sandstone	1510	**2550**	2520	**4250**	0.60
Shale	1250	**2100**	1660	**2800**	0.75
Slag — Broken	1750	**2950**	2940	**4950**	0.60
Snow — Dry	130	**220**			
Wet	520	**860**			
Stone — Crushed	1600	**2700**	2670	**4500**	0.60
Taconite	1630-1900	**3600-4200**	2360-2700	**5200-6100**	0.58
Top Soil	950	**1600**	1370	**2300**	0.70
Taprock — Broken	1750	**2950**	2610	**4400**	0.67
Wood Chips**	—	**—**	—	**—**	—

*Varies with moisture content, grain size, degree of compaction, etc. Tests must be made to determine exact material characteristics.

**Weights of commercially important wood species can be found in the last pages of the Logging & Forest Products section. To obtain wood weights use the following equations: $lb/yd^3 = (lb/ft^3) \times .4 \times 27$

$kg/m^3 = (kg/m^3) \times .4$

ALTITUDE DERATION

PERCENT FLYWHEEL HORSEPOWER AVAILABLE AT SPECIFIED ALTITUDES

MODEL	0-760 m (0-2500')	760-1500 m (2500-5000')	1500-2300 m (5000-7500')	2300-3000 m (7500-10,000')	3000-3800 m (10,000-12,500')	3800-4600 m (12,500-15,000')
D3K XL	100	100	100	100	88	85
D3K LGP	100	100	100	100	88	85
D4K XL	100	100	100	100	88	85
D4K LGP	100	100	100	100	88	85
D5K XL	100	100	100	100	88	85
D5K LGP	100	100	100	100	88	85
D5R2 XL & LGP	100	100	100	100	N/A	N/A
D5T XL	100	100	100	100	N/A	N/A
D6K2 XL & LGP	100	100	100	100	N/A	N/A
D6N XL & LGP*	100	100	100	100	100	100
D6R Series 3 (All)	100	100	100	100	92	84
D6R2	100	100	100	100	92	84
D6T[1]	100	100	100	100	100	100
D7E	100	100	100	100	99	95
D7R	100	100	100	100	100	96
D8R	100	100	100	93	85	77
D8T	100	100	100	100	100	100
D9R	100	100	100	93	85	77
D9T[1]	100	100	100	100	100	100
D9T[2]	100	100	100	99	92	83
D9T[3]	100	100	100	100	100	100
D9T[4]	100	100	100	98	91	80
D9T[5]	100	100	100	100	99	88
D10T2[5]**	100	100	100	100	100	100
D10T2[6]**	100	100	100	100	100	100
D11T/D11T CD[5]***	100	100	100	100	100	86
D11T/D11T CD[6]***	100	100	100	100	83	67

*Information not available at time of printing.
**In forward gears.
***D11T — High altitude arrangement available.
[1] Meets Tier 4 Final/Stage IV/Japan 2014 (Tier 4 Final) emission standards.
[2] Meets Tier 3 equivalent emission standards, North America — Standard Altitude.
[3] Meets Tier 3 equivalent emission standards, North America — High Altitude.
[4] Meets Stage IIIA/Japan 2006 (Tier 3) equivalent emission standards.
[5] Meets Tier 2/Stage II/Japan 2001 (Tier 2) equivalent emission standards.
[6] Meets Tier 4 Final.

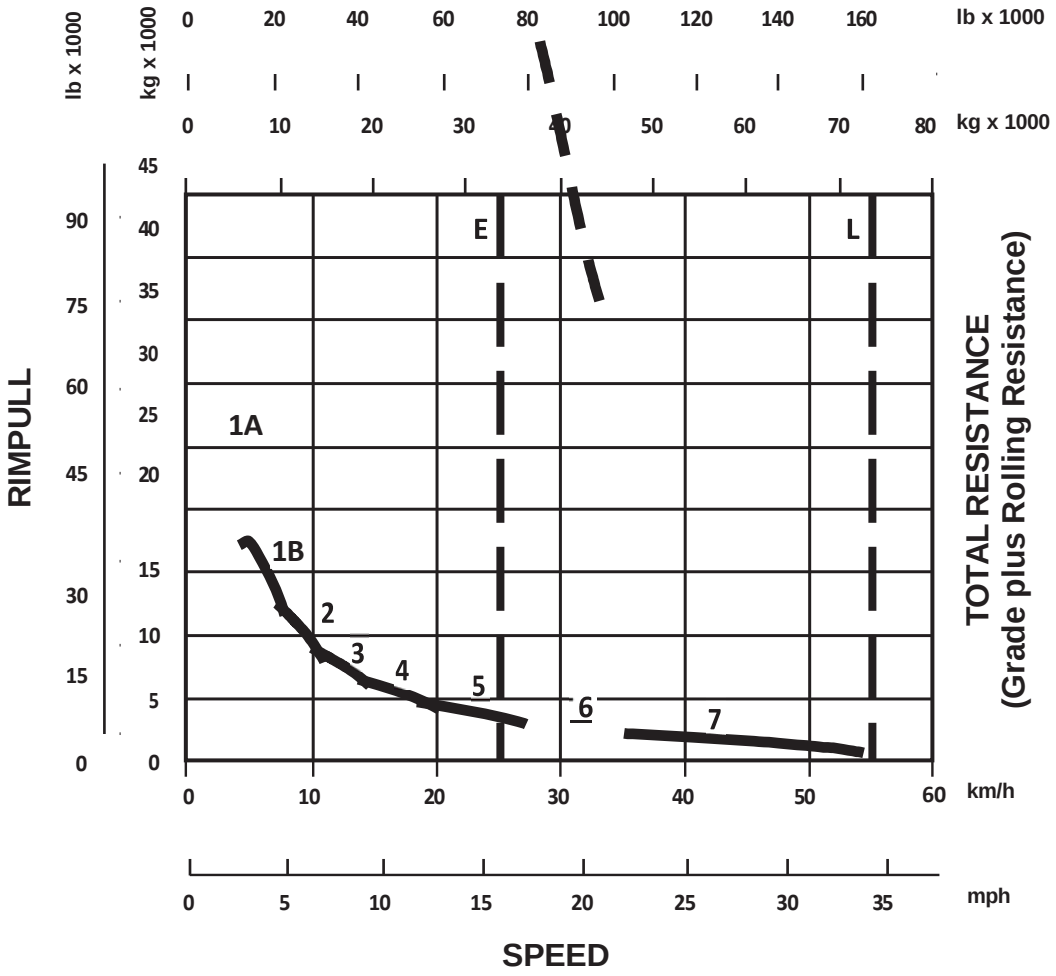
ALTITUDE DERATION (Continued)

MODEL	0-760 m (0-2500')	760-1500 m (2500-5000')	1500-2300 m (5000-7500')	2300-3000 m (7500-10,000')	3000-3800 m (10,000-12,500')	3800-4600 m (12,500-15,000')
120K	100	100	100	97	92	85
120K2	100	100	100	97	92	85
120M	100	100	100	100	95	88
120M AWD	100	98	96	94	89	85
120M2	100	100	100	100	94	82
120M2 AWD	100	100	100	100	94	82
12K	100	99	98	94	89	85
12M	100	100	100	100	95	88
12M2	100	100	100	100	100	100
12M2 AWD	100	100	100	100	100	99
12M3	100	100	100	100	100	100
12M3 AWD	100	100	100	100	100	98
140K	100	100	100	100	92	90
140K2	100	100	100	100	92	90
140M	100	100	100	100	92	90
140M AWD	100	100	100	100	92	90
140M2	100	100	100	100	100	99
140M2 AWD	100	100	100	100	97	93
140M3	100	100	100	100	100	98
140M3 AWD	100	100	100	100	100	90
160K	100	100	100	100	92	90
160M	100	100	100	100	92	90
160M AWD	100	100	100	100	92	90
160M2	100	100	100	99	95	91
160M2 AWD	100	100	100	99	94	88
160M3	100	100	100	100	100	90
160M3 AWD	100	100	100	100	98	83
14M3*	100	100	100	100	100	97
14M3**	100	100	100	100	100	100
14M3***	100	100	100	100	100	100
16M3*	100	100	100	100	100	100
16M3**	100	100	100	100	100	95
16M3***	100	100	100	100	100	100
18M3*	100	100	100	100	100	100
18M3**	100	100	100	100	100	95
18M3***	100	100	100	100	100	100
24M B9K**	100	100	95	90	80	70
24M B9K Unregulated	100	100	100	100	90	85
24M B93**	100	100	100	98	89	75
24M B93*	100	100	100	100	91	86

*Meets Tier 2/Stage II/Japan 2001 (Tier 2) equivalent emission standards.
**Meets Tier 3/Stage IIIA/Japan 2006 (Tier 3) equivalent emission standards.
***Meets Tier 4 Final/Stage IV/Japan 2014 (Tier 4 Final) emission standards.

STANDARD*

GROSS WEIGHT



KEY

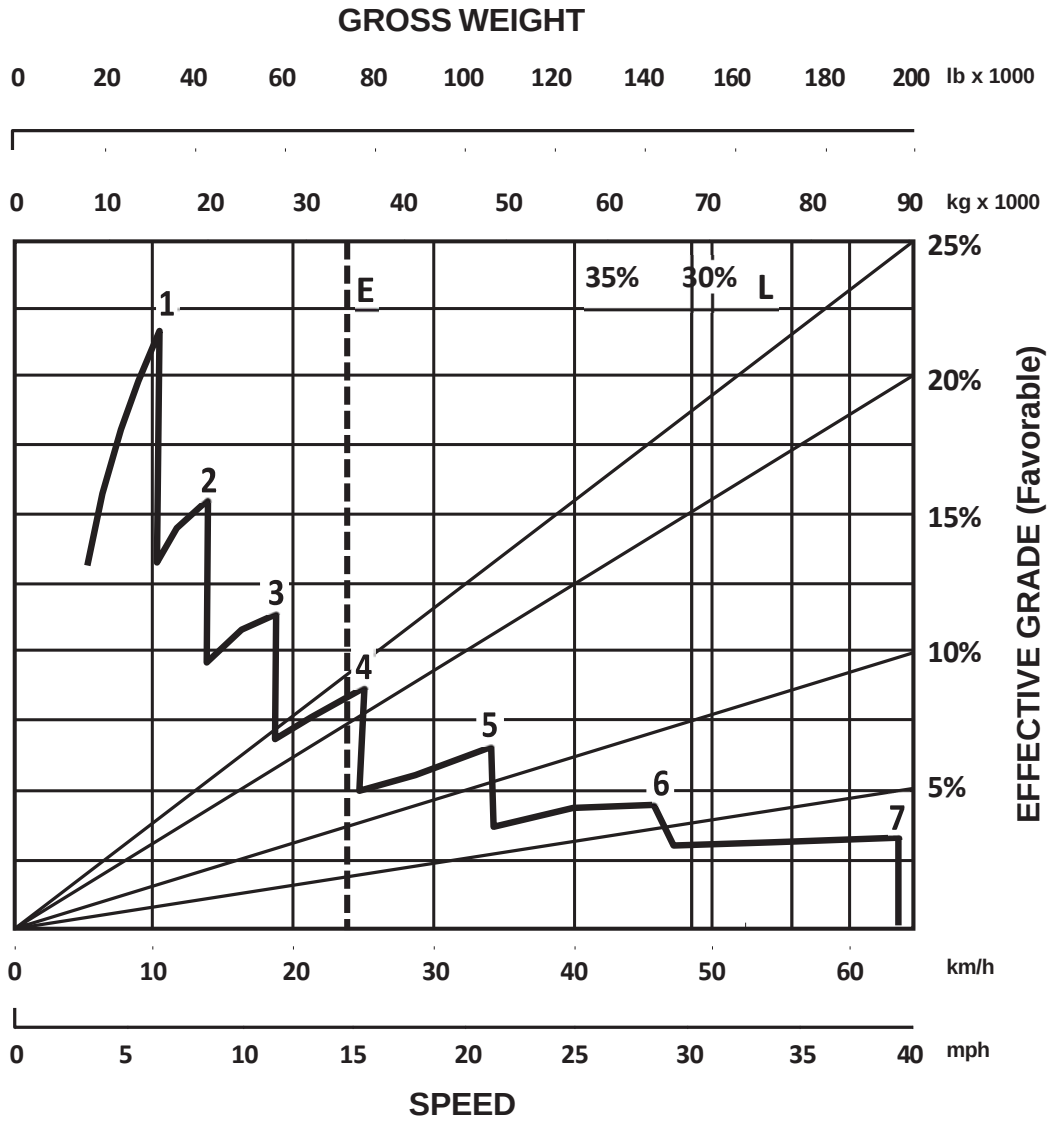
1A — 1st Gear (Converter Drive)
1B — 1st Gear (Direct Drive)
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear 7 — 7th Gear

KEY

E — Empty 34 393 kg (75,824 lb)
L — Loaded 73 975 kg (163,087 lb)

*At sea level.

740B Series Brake/Retarder Performance Curve
● 29.5R25 Tires



KEY

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2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear
7 — 7th Gear

KEY

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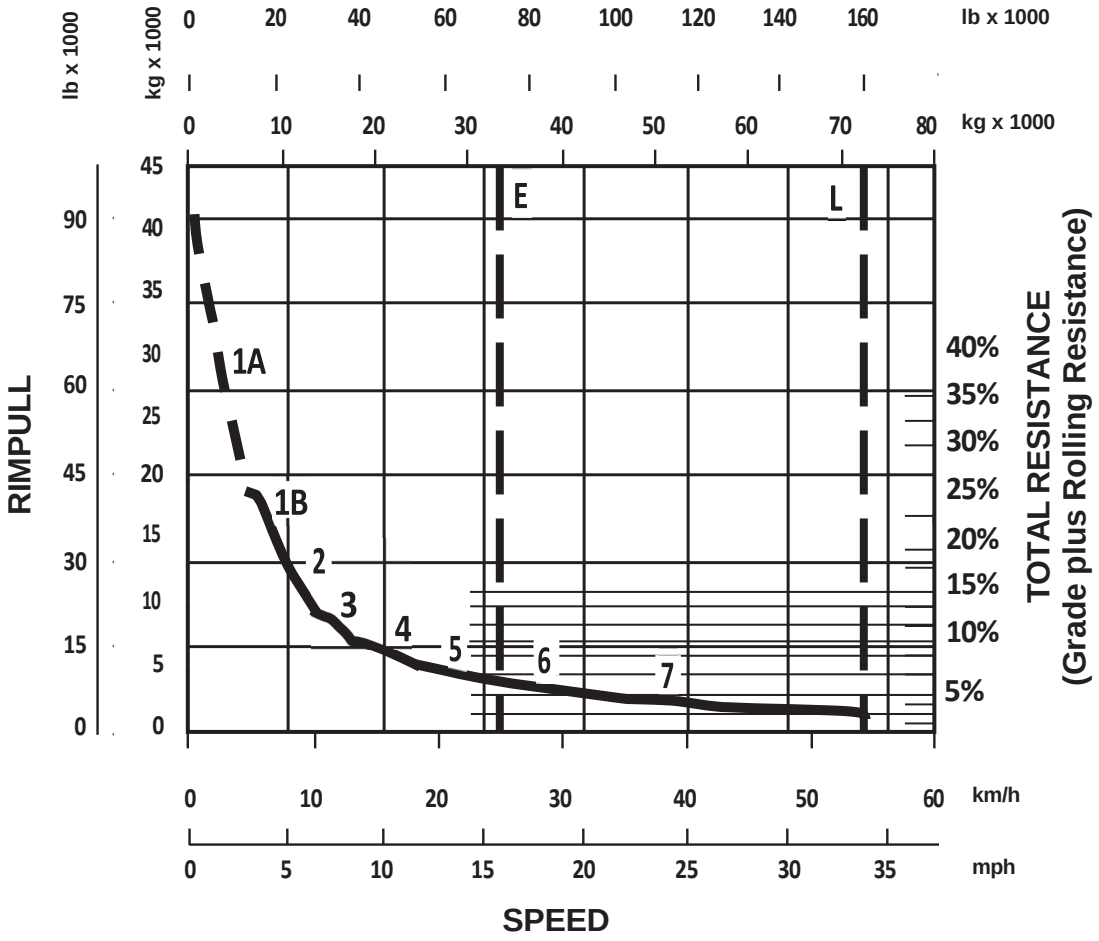
L — Loaded 73 975 kg (163,087 lb)

STANDARD*

GROSS WEIGHT



KEY

1A — 1st Gear (Converter Drive)
1B — 1st Gear (Direct Drive)
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear
7 — 7th Gear

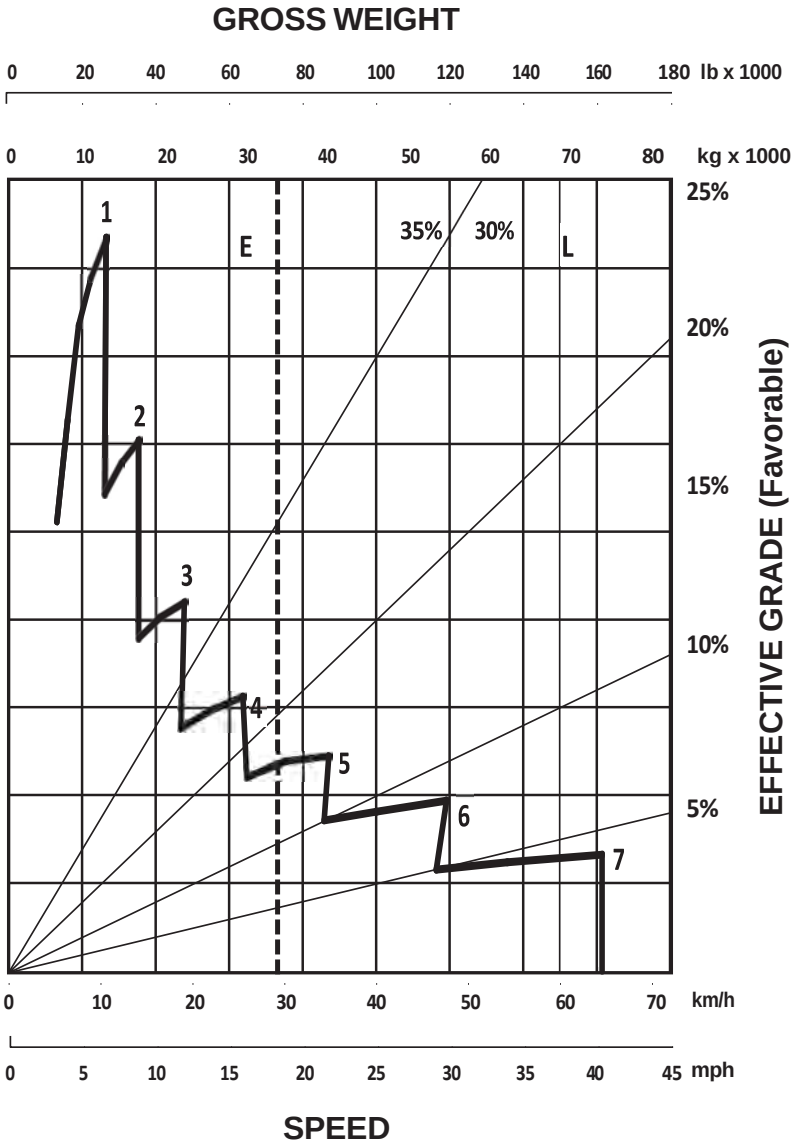
KEY

E — Empty 34 127 kg (75,237 lb)
L — Loaded 73 709 kg (162,500 lb)

*At sea level.

Articulated Trucks

740B Series Brake/Retarder Performance Curve
- 29.5R25 Tires
- Tier 2



KEY

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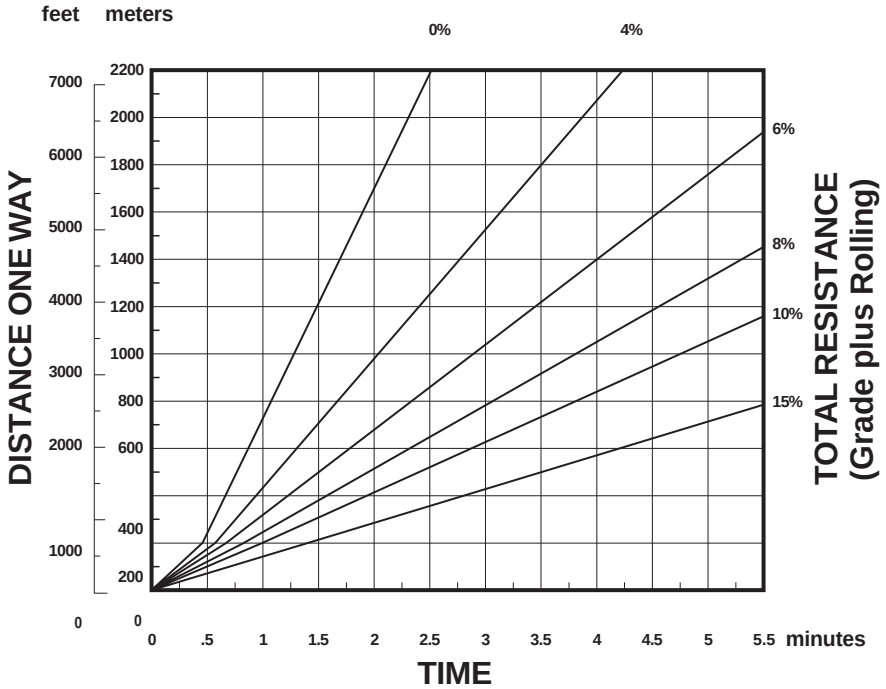
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear
7 — 7th Gear

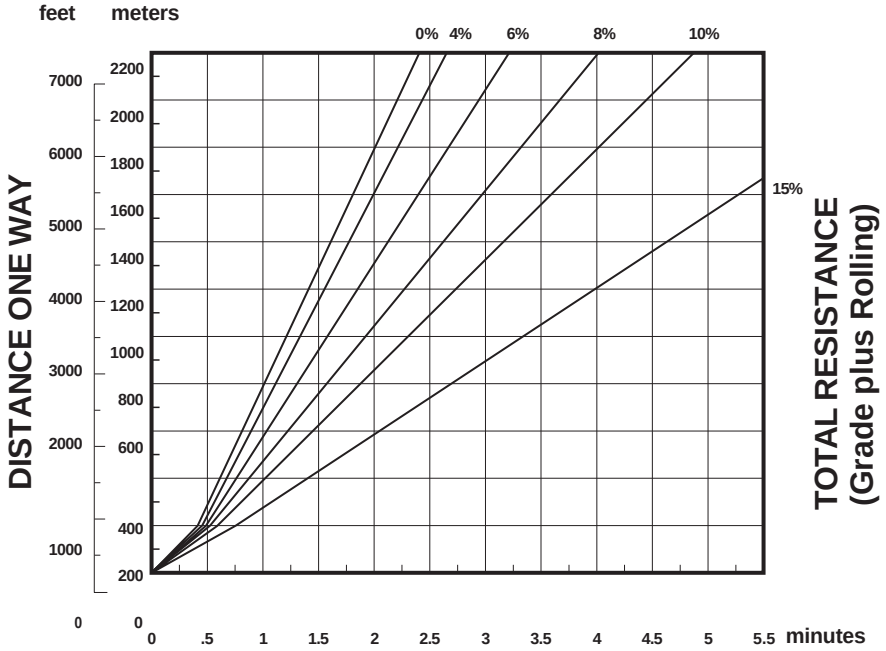
KEY

E — Empty 34 127 kg (75,237 lb)
L — Loaded 73 709 kg (162,500 lb)

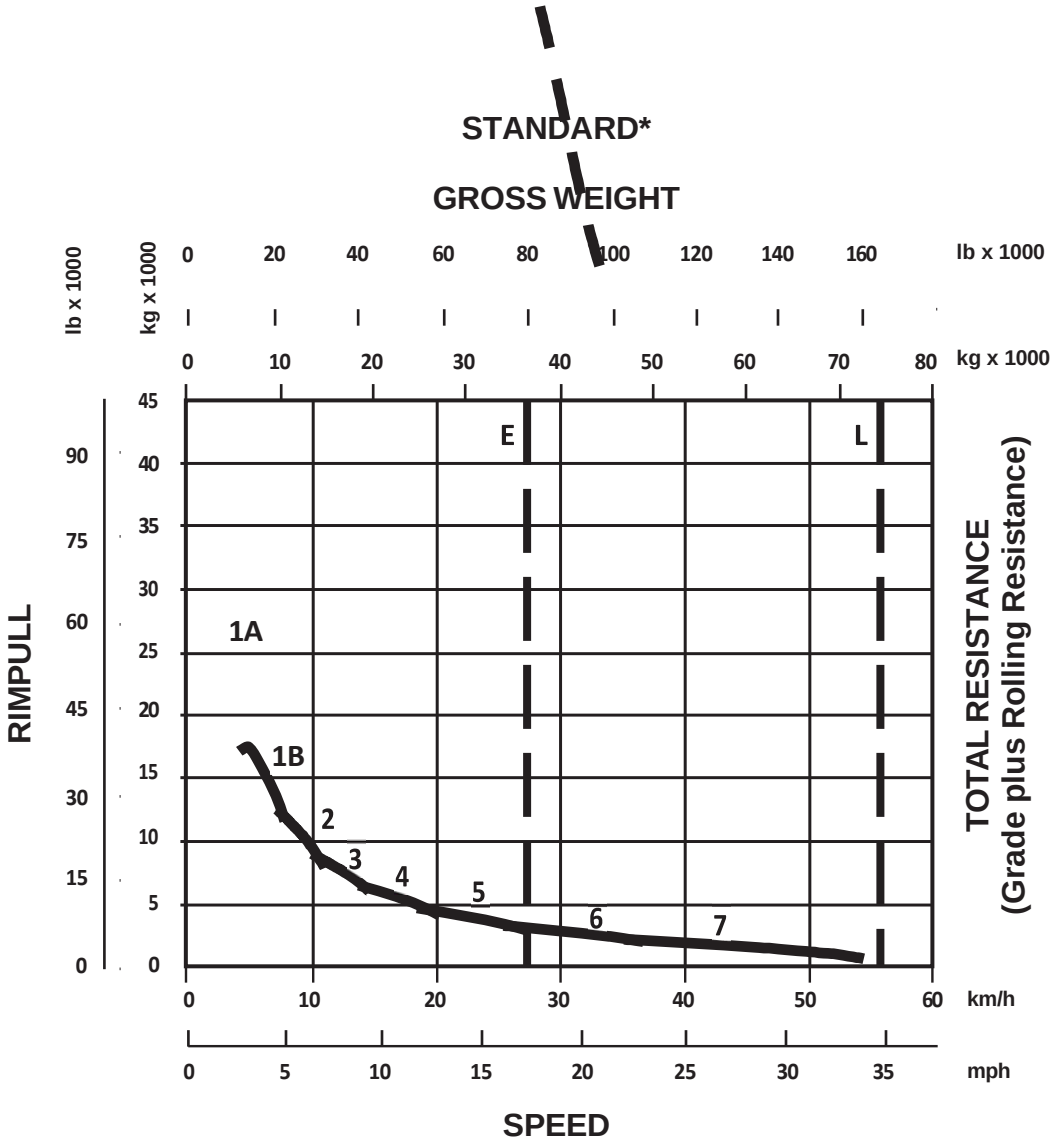
LOADED



EMPTY



740B EJ Series Rimpull-Speed-Gradeability
● 29.5R25 Tires



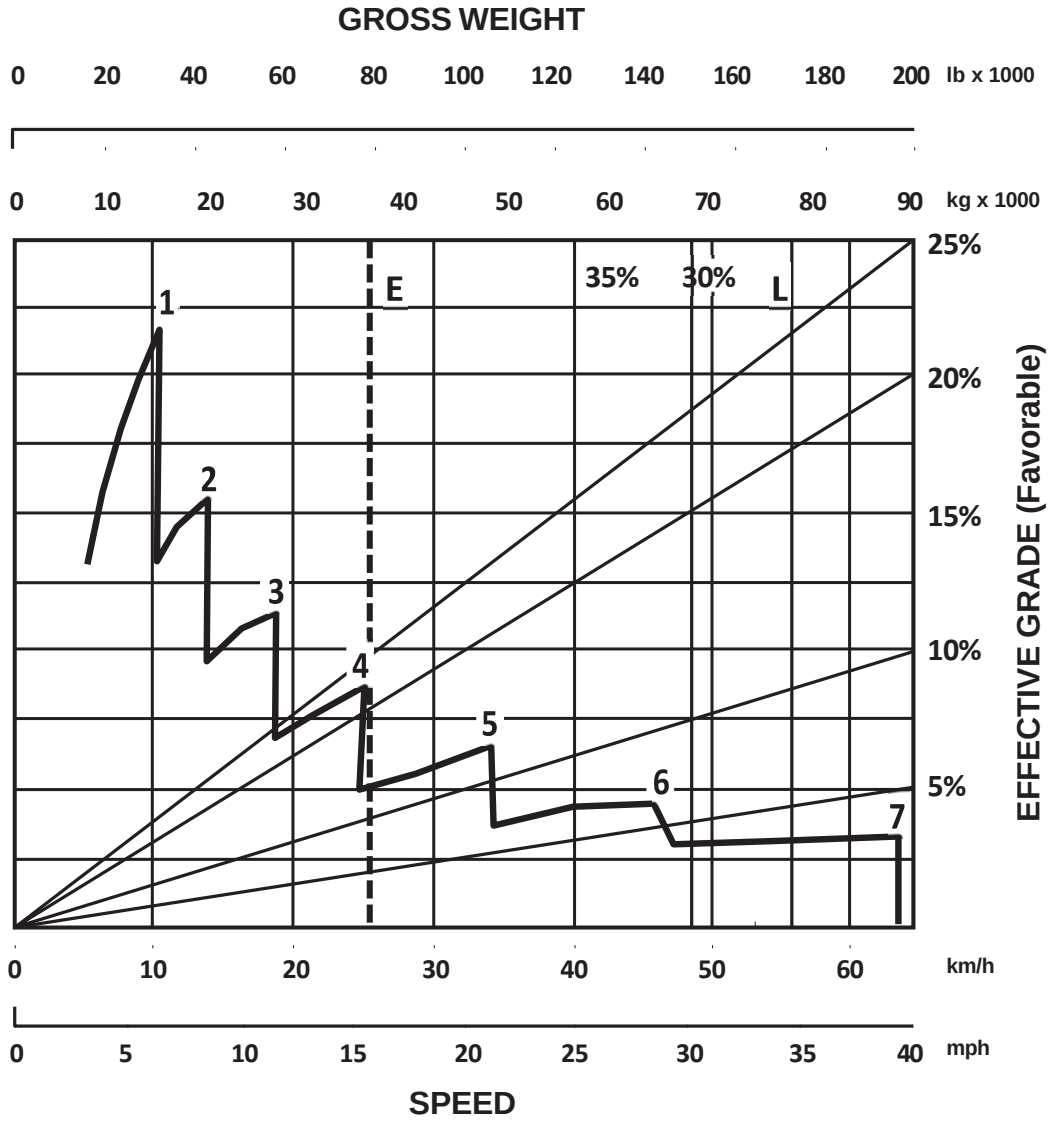
KEY

1A — 1st Gear (Converter Drive)
1B — 1st Gear (Direct Drive)
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear
7 — 7th Gear

KEY

E — Empty 36 895 kg (81,340 lb)
L — Loaded 74 895 kg (165,115 lb)

*At sea level.



KEY

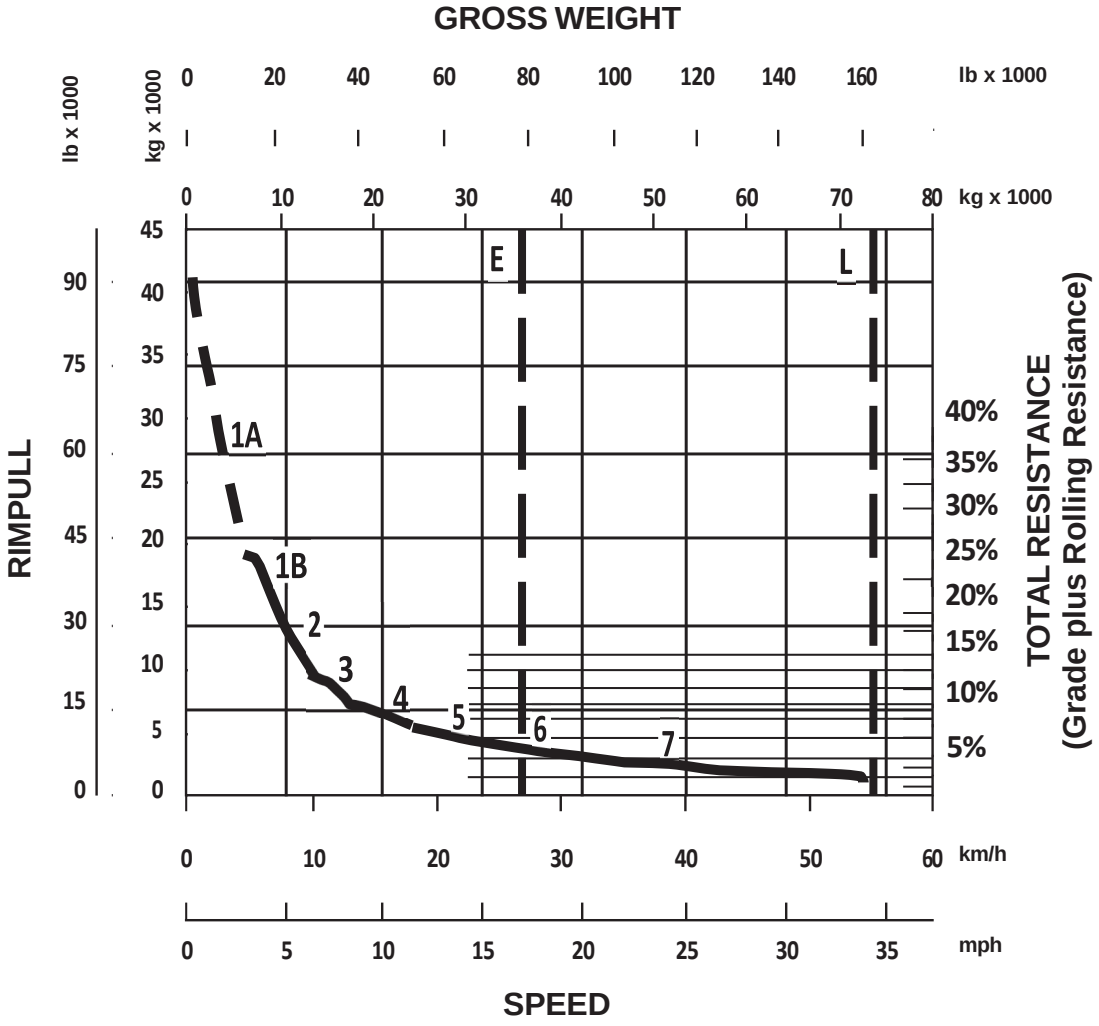
1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear
7 — 7th Gear

KEY

E — Empty 36 895 kg (81,340 lb)
L — Loaded 74 895 kg (165,115 lb)

740B EJ Series Rimpull-Speed-Gradeability
- 29.5R25 Tires
- Tier 2

STANDARD*



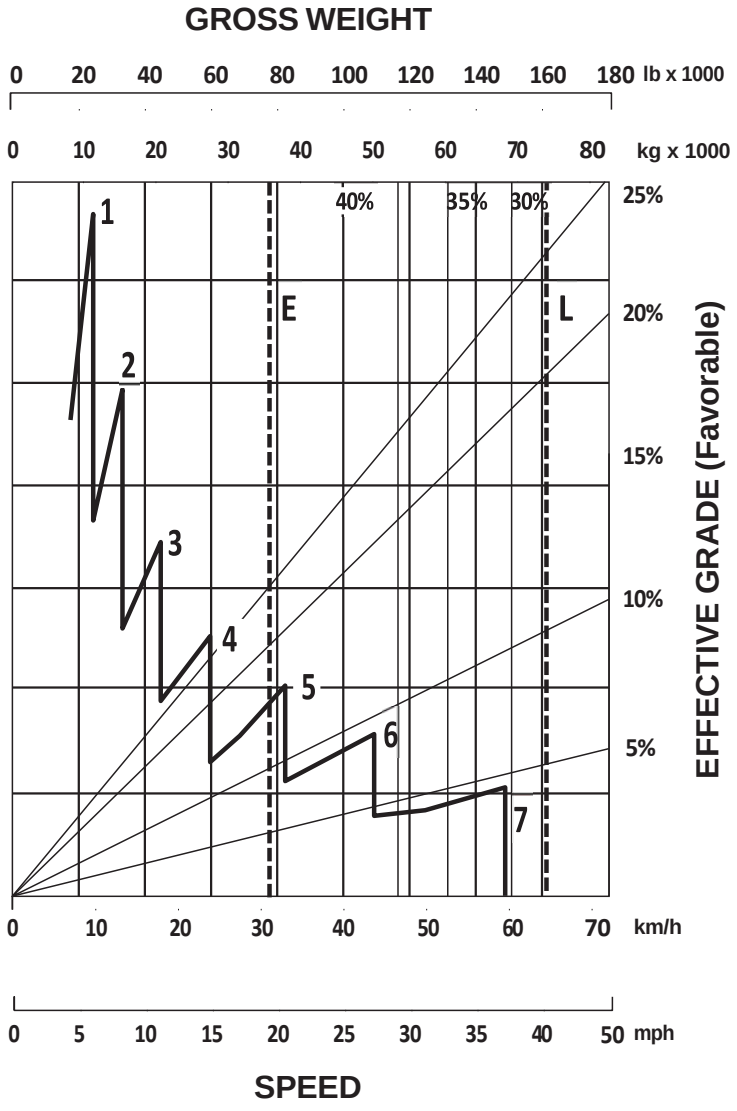
KEY

1A — 1st Gear (Converter Drive)
1B — 1st Gear (Direct Drive)
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear
7 — 7th Gear

KEY

E — Empty 36 629 kg (80,753 lb)
L — Loaded 74 629 kg (164,529 lb)

*At sea level.



KEY

1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear 7 — 7th Gear

KEY

E — Empty 36
629 kg
(80,753 lb)
L — Loaded
74 629 kg
(164,529 lb)

MODEL	735B Series		740B Series		740B EJ Series	
Gross Power — SAE J1995	337 kW	**452 hp**	365 kW	**489 hp**	365 kW	**489 hp**
Net Power — SAE J1349	326 kW	**437 hp**	354 kW	**474 hp**	354 kW	**474 hp**
Net Power — ISO 14396	333 kW	**447 hp**	361 kW	**484 hp**	361 kW	**484 hp**
Operating Weight (Empty)*	32 473 kg	**71,591 lb**	34 393 kg	**75,824 lb**	36 895 kg	**81,340 lb**
Top Speed (Loaded)	51.1 km/h	**31.7 mph**	54.7 km/h	**34 mph**	54.7 km/h	**34 mph**
GMW — Gross Machine Weight	65 173 kg	**143,682 lb**	73 975 kg	**163,087 lb**	74 895 kg	**165,115 lb**
Distribution Empty:						
Front	**61.9%**		**60.1%**		**58.0%**	
Center	**20.2%**		**21.0%**		**22.0%**	
Rear	**18.0%**		**18.9%**		**20.0%**	
Distribution Loaded:						
Front	**36.0%**		**35.0%**		**30.8%**	
Center	**33.0%**		**33.0%**		**35.1%**	
Rear	**32.0%**		**32.0%**		**34.1%**	
Max. Capacity**	32.7 t	**36 T**	39.5 t	**43.5 T**	38 t	**42 T**
Struck (SAE)	14.7 m^3	**19.2 yd^3**	18.5 m^3	**24.2 yd^3**	17.8 m^3	**23.3 yd^3**
Heaped (2:1) (SAE)	19.7 m^3	**25.8 yd^3**	24 m^3	**31.4 yd^3**	23.1 m^3	**30.2 yd^3**
Tailgate Heaped SAE 2:1	20.9 m^3	**27.3 yd^3**	25.5 m^3	**33.5 yd^3**	—	
Tailgate Struck	15.2 m^3	**19.9 yd^3**	19.5 m^3	**25.5 yd^3**	—	
Engine Model	**ACERT C15**		**ACERT C15**		**ACERT C15**	
No. Cylinders	**6**		**6**		**6**	
Bore	137 mm	**5.4"**	137 mm	**5.4"**	137 mm	**5.4"**
Stroke	171.5 mm	**6.75"**	171.5 mm	**6.75"**	171.5 mm	**6.75"**
Displacement	15.2 L	**926 in^3**	15.2 L	**926 in^3**	15.2 L	**926 in^3**
Tires, Front, Center, Rear	**26.5R25 Radials**		**29.5R25 Radials**		**29.5R25 Radials**	
Circular Clearance Diameter	17.2 m	**56'5"**	17.2 m	**56'5"**	18.2 m	**59'6"**
Fuel Tank Refill Capacity	565 L	**149.3 U.S. gal**	565 L	**149.3 U.S. gal**	565 L	**149.3 U.S. gal**
General Dimensions (Empty):						
Height to Cab Top	3.7 m	**12'1"**	3.75 m	**12'3"**	3.75 m	**12'3"**
Wheel Base (Front-Center of Bogie)	5.23 m	**17'2"**	5.23 m	**17'2"**	5.58 m	**18'3"**
Overall Length	10.99 m	**36'1"**	10.99 m	**36'1"**	11.69 m	**38'4"**
Loading Height (Empty)	2.98 m	**9'8"**	3.2 m	**10'6"**	3.07 m	**10'1"**
Height at Full Dump	6.81 m	**22'4"**	7.1 m	**23'4"**	—	
Body Length	6.09 m	**20'0"**	6.3 m	**20'6"**	6.73 m	**22'1"**
Width (Operating — Over Mirrors)	3.82 m	**12'6"**	3.82 m	**12'6"**	3.82 m	**12'6"**
Front Tire Tread	2.69 m	**8'8"**	2.69 m	**8'8"**	2.69 m	**8'8"**

*Includes coolant, lubricant and full fuel tank.
**Rating dependent on optional equipment. Maximum gross weight (empty weight plus payload) should not be exceeded.

MODEL	735B Series		740B Series		740B EJ Series	
Gross Power — SAE J1995	336 kW	**450 hp**	361 kW	**484 hp**	361 kW	**484 hp**
Net Power — SAE J1349	326 kW	**438 hp**	352 kW	**472 hp**	352 kW	**472 hp**
Net Power — ISO 9249	330 kW	**442 hp**	356 kW	**477 hp**	356 kW	**477 hp**
Net Power — EEC 80/1269	330 kW	**442 hp**	356 kW	**477 hp**	356 kW	**477 hp**
Operating Weight (Empty)*	32 206 kg	**71,002 lb**	34 127 kg	**75,237 lb**	36 629 kg	**80,753 lb**
Top Speed (Loaded)	51.1 km/h	**31.7 mph**	54.7 km/h	**34 mph**	54.7 km/h	**34 mph**
GMW — Gross Machine Weight	64 906 kg	**143,093 lb**	73 709 kg	**162,500 lb**	74 629 kg	**164,529 lb**
Distribution Empty:						
Front	**61.2%**		**59.5%**		**57.4%**	
Center	**20.5%**		**21.3%**		**22.3%**	
Rear	**18.3%**		**19.2%**		**20.3%**	
Distribution Loaded:						
Front	**35.6%**		**34.6%**		**30.4%**	
Center	**32.8%**		**33.2%**		**35.3%**	
Rear	**31.7%**		**32.2%**		**34.3%**	
Max. Capacity**	32.7 t	**36 T**	39.5 t	**43.5 T**	38 t	**42 T**
Struck (SAE)	14.7 m^3	**19.2 yd^3**	18.5 m^3	**24.2 yd^3**	17.8 m^3	**23.3 yd^3**
Heaped (2:1) (SAE)	19.7 m^3	**25.8 yd^3**	24 m^3	**31.4 yd^3**	23.1 m^3	**30.2 yd^3**
Tailgate Heaped SAE 2:1	20.9 m^3	**27.3 yd^3**	25.5 m^3	**33.5 yd^3**	—	
Tailgate Struck	15.2 m^3	**19.9 yd^3**	19.5 m^3	**25.5 yd^3**	—	
Engine Model	**ACERT C15**		**ACERT C15**		**ACERT C15**	
No. Cylinders	**6**		**6**		**6**	
Bore	137 mm	**5.4"**	137 mm	**5.4"**	137 mm	**5.4"**
Stroke	171.5 mm	**6.75"**	171.5 mm	**6.75"**	171.5 mm	**6.75"**
Displacement	15.2 L	**926 in^3**	15.2 L	**926 in^3**	15.2 L	**926 in^3**
Tires, Front, Center, Rear	**26.5R25 Radials**		**29.5R25 Radials**		**29.5R25 Radials**	
Circular Clearance Diameter	17.2 m	**56'5"**	17.2 m	**56'5"**	18.2 m	**59'6"**
Fuel Tank Refill Capacity	565 L	**149.3 U.S. gal**	565 L	**149.3 U.S. gal**	565 L	**149.3 U.S. gal**
General Dimensions (Empty):						
Height to Cab Top	3.7 m	**12'1"**	3.75 m	**12'3"**	3.75 m	**12'3"**
Wheel Base (Front-Center of Bogie)	5.23 m	**17'2"**	5.23 m	**17'2"**	5.58 m	**18'3"**
Overall Length	10.99 m	**36'1"**	10.99 m	**36'1"**	11.69 m	**38'4"**
Loading Height (Empty)	2.98 m	**9'8"**	3.2 m	**10'6"**	3.07 m	**10'1"**
Height at Full Dump	6.81 m	**22'4"**	7.1 m	**23'4"**	—	
Body Length	6.09 m	**20'0"**	6.3 m	**20'6"**	6.73 m	**22'1"**
Width (Operating — Over Mirrors)	3.82 m	**12'6"**	3.82 m	**12'6"**	3.82 m	**12'6"**
Front Tire Tread	2.69 m	**8'8"**	2.69 m	**8'8"**	2.69 m	**8'8"**

*Includes coolant, lubricant and full fuel tank.
**Rating dependent on optional equipment. Maximum gross weight (empty weight plus payload) should not be exceeded.

MODEL	777D†		777F	
Body Type	**Dual Slope Lined**		**Dual Slope Lined**	
Target Gross Machine Weight §	163 360 kg	**360,143 lb**	163 293 kg	**360,000 lb**
Basic Machine Weight*	33 951 kg	**74,849 lb**	33 438 kg	**73,718 lb**
Attachments**	17 377 kg	**38,310 lb**	17 114 kg	**37,730 lb**
Body Weight without Liners***	16 070 kg	**35,428 lb**	16 420 kg	**36,200 lb**
Full Liner	5432 kg	**11,975 lb**	5767 kg	**12,714 lb**
Operating Machine Weight	72 830 kg	**160,562 lb**	72 739 kg	**160,360 lb**
Debris (2% of Operating Machine Weight)	1457 kg	**3211 lb**	1455 kg	**3207 lb**
Empty Operating Weight	74 287 kg	**163,774 lb**	74 194 kg	**163,568 lb**
Target Payload §	90.9 m tons	**100 tons**	90.7 m tons	**100 tons**
Capacity:				
Heaped (2:1) (SAE) Base Body	60.1 m^3	**78.6 yd^3**	60.2 m^3	**78.8 yd^3**
Distribution Empty:				
Front	**47%**		**45%**	
Rear	**53%**		**55%**	
Distribution Loaded:				
Front	**33%**		**33%**	
Rear	**67%**		**67%**	
Engine Model	**3508B EUI**		**C32 ACERT**	
Number of Cylinders	**8**		**12**	
Bore	170 mm	**6.7"**	145 mm	**5.7"**
Stroke	190 mm	**7.5"**	162 mm	**6.4"**
Displacement	34.5 L	**2105 in^3**	32.1 L	**1959 in^3**
Net Power	699 kW	**938 hp**	700 kW	**938 hp**
Gross Power	746 kW	**1000 hp**	758 kW	**1016 hp**
Standard Tires	**27.00-R49 (E4)**		**27.00R49 (E4)**	
Machine Clearance Turning Circle	28.4 m	**93'2"**	28.4 m	**93'2"**
Fuel Tank Refill Capacity	1137 L	**300 U.S. gal**	1136 L	**300 U.S. gal**
Top Speed (Loaded)	60.4 km/h	**39.9 mph**	64.5 km/h	**40.1 mph**
GENERAL DIMENSIONS (Empty):				
Height to Canopy Rock Guard Rail	5.14 m	**16'10"**	5.17 m	**17'0"**
Wheelbase	4.57 m	**15'0"**	4.56 m	**15'0"**
Overall Length (Base Body)	9.78 m	**32'1"**	10.54 m	**34'7"**
Loading Height (Base Body)	4.38 m	**14'4"**	4.38 m	**14'4"**
Height at Full Dump	10.06 m	**33'0"**	10.33 m	**33'11"**
Body Length (Target Length)	7.23 m	**23'9"**	9.83 m	**32'3"**
Width (Operating)	6.11 m	**20'0"**	6.49 m	**21'4"**
Width (Shipping)***	3.51 m	**11'5"**	3.51 m	**11'5"**
Front Tire Tread	4.17 m	**13'8"**	4.17 m	**13'8"**

*See Weight Definitions and Relations on 9-11. Note: No mandatory or optional attachments or fuel.
**Typical selection of mandatory and optional attachments.
***Data provided is for a representative body and liner package. Several dual slope, flat floor, and mine specific design (MSD) bodies and liner packages are available. All weights, capacities, and dimensions are dependent on the machine configuration (body type, attachments, tires, and optional equipment selected).
§Reference Caterpillar's latest 10/10/20 Payload Policy for information on gross machine operating weight and target payload.
†India sourced, only available in Asia Pacific.

Attachment C.5
Direct Quotes

Fred Charles

From: Fawcett, Clayton <CFawcett@conteches.com>
Sent: Tuesday, February 5, 2019 9:25 AM
To: Fred Charles
Subject: RE: confirm or update costs for ACBs (reply requested by end of day Monday Feb 4, if possible)

Fred,

Hello and good morning. I hope this message finds you doing well. I made it back in to the office this morning and saw your e-mails.

Material and installation costs we discussed in September are still good. Please feel free to use those to complete your estimate.

Regarding your questions:

1. Yes, installation costs are the same for both downchutes and dissipator basins.
2. Yes, installation cost does include crushed stone infill (purchase and install)

Regarding your follow up e-mail with questions pertaining to cut-off walls.

1. Cut-off walls are not always required, however they are a good idea. The use of cut-off walls has increased in the last five years and as such, they are now recommended for inclusion at dissipator basins.
2. Material and installation costs for the installation of a cut-off wall <u>are not</u> included in the costs previously discussed and should be added.

I hope this information helps. Feel free to contact me directly with any additional questions.

Regards,

Clayton Fawcett PE (co)
Armortec Area Manager - West

CONTECH Engineered Solutions
970-290-2971 (cell)
cfawcett@conteches.com

From: Fred Charles [mailto:fcharles@telesto-inc.com]
Sent: Sunday, February 3, 2019 3:28 PM
To: Fawcett, Clayton <CFawcett@conteches.com>
Subject: confirm or update costs for ACBs (reply requested by end of day Monday Feb 4, if possible)

Hi Clayton. This email is a follow up to our email correspondence in September 2018 regarding material and installation costs for articulated concrete blocks (ACBs) used for downdrains at Chino. We've been using the cost info you passed along to me at that time. Now, I need you to confirm those costs or update them. We will use this information in a reclamation cost estimate (financial assurance for closure bonding) which we are currently finalizing for Chino and other mines in that area.

<u>Costs</u>
As we had discussed, the material costs for ACBs (includes non-woven geotextile and microgrid/geogrid) are as follows:

- $7.42/square foot (Block Class 40T, for the channel of each downdrain)

- $10.65/square foot (Block Class 70T, for the dissipation basin at bottom of each downdrain)

Also, you quoted $4.63/square foot for installation costs, which covers the following installation process: off-load the truck and place delivered ACBs in temporary storage area, fine grade base/subgrade soils, compact soils to 90% Standard Proctor (D698), place and secure filter fabric (non-woven geotextile), place 4-6" drainage layer overlaid by geogrid, place ACBs in final configuration, grout seams, and backfill ACBs with crushed stone.

2 questions

In addition to you confirming or updating the material and installation costs, I have two questions: (1) Is the installation cost ($4.63/square foot) the same for both channel downdrains and dissipation basins? (2) Does the installation or material cost include the crushed stone used to backfill the ACBs?

Please create a new email to me with updated unit costs or reply to this email to confirm what I show is still correct. I will present what you provide for documentation in the cost estimate we submit to the state agencies.

Thanks,

Fred Charles, Ph.D., P.E. Senior Engineer
Office: 970-484-7704, Ext 120 Cell: 720-318-5021
3801 Automation Way, Suite 201, Fort Collins, CO 80525
fcharles@telesto-inc.com

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Taryn Tigges

From: Clayton Fawcett <Clayton.Fawcett@ContechLLC.com>
Sent: Monday, January 11, 2021 10:45 AM
To: Taryn Tigges
Subject: RE: [EXTERNAL] RE: Tyrone Mine Armorflex Analysis 40T

That make sense.

We are including the geotextile, geogrid, ACB, and freight to the jobsite.

Clayton Fawcett PE (co)
Armortec Area Manager – West

CONTECH Engineered Solutions
970-290-2971 (cell)
cfawcett@conteches.com

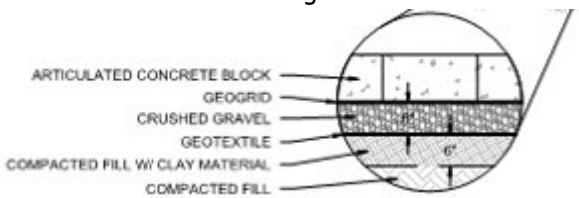
From: Taryn Tigges [mailto:ttigges@telesto-inc.com]
Sent: Monday, January 11, 2021 10:44 AM
To: Clayton Fawcett <Clayton.Fawcett@ContechLLC.com>
Subject: [EXTERNAL] RE: Tyrone Mine Armorflex Analysis 40T

CAUTION: This email originated from outside of the organization. Exercise caution when opening attachments or clicking links, especially from *UNKNOWN* senders.

Hi Clayton,

You too! Weekends go by too quickly.

Thanks for the information. They are just updating costing information. Can you also confirm again what's included in that cost? Our current design includes the following:



Can you let me know what I need to account for separately? I believe you had mentioned geotextile is part of the cost.

Thanks,

Taryn Tigges, PE | Civil Engineer
Office: 970-484-7704 | Cell: 515-520-9454
750 14th St SW | Loveland, CO 80537

www.telesto-inc.com

From: Clayton Fawcett <Clayton.Fawcett@ContechLLC.com>
Sent: Monday, January 11, 2021 10:39 AM
To: Taryn Tigges <ttigges@telesto-inc.com>; CFawcett@conteches.com
Cc: KMeyer@conteches.com
Subject: RE: Tyrone Mine Armorflex Analysis 40T

Hi Taryn,

I hope the weekend treated you well. Current pricing as of January 2021 is 10.27 / sf delivered for this material.

Are they getting ready to proceed or just updating the costing information?

Regards,

Clayton Fawcett PE (co)
Armortec Area Manager – West

CONTECH Engineered Solutions
970-290-2971 (cell)
cfawcett@conteches.com

From: Taryn Tigges [mailto:ttigges@telesto-inc.com]
Sent: Thursday, January 7, 2021 2:15 PM
To: CFawcett@conteches.com
Cc: KMeyer@conteches.com
Subject: FW: Tyrone Mine Armorflex Analysis 40T

Hi Clayton,

It has been a few months since I talked to you but I was wondering if you could send an updated cost for current (January 2021) prices for the Armorflex 50T ACB system? Let me know if you need any additional information.

Thanks,

Taryn Tigges, PE | Civil Engineer
Office: 970-484-7704 | Cell: 515-520-9454
750 14th St SW | Loveland, CO 80537

www.telesto-inc.com

From: Fawcett, Clayton <CFawcett@conteches.com>
Sent: Thursday, May 28, 2020 3:28 PM
To: Taryn Tigges <ttigges@telesto-inc.com>
Cc: Meyer, Kenneth <KMeyer@conteches.com>
Subject: RE: Tyrone Mine Armorflex Analysis 40T

Taryn,

Good speaking with you this afternoon. See attached for revised calculations per your direction below. That is, with the exception of the Manning's *n* value which is 0.025.

Cost for the Armorflex 50T ACB system is $9.77 / sf delivered. This does include ACB mats with galvanized cable, geotextile fabric, and freight to the jobsite via Over the Road Flatbed Trucks.

Feel free to let me know if you have any additional questions.

Regards,

Clayton Fawcett PE (co)
Armortec Area Manager - West

CONTECH Engineered Solutions
970-290-2971 (cell)
cfawcett@conteches.com

From: Taryn Tigges [mailto:ttigges@telesto-inc.com]
Sent: Thursday, May 28, 2020 2:16 PM
To: Fawcett, Clayton <CFawcett@conteches.com>
Subject: RE: Tyrone Mine Armorflex Analysis 40T

Hi Clayton,

You previously spoke with our intern, Jessica, for ACB selection on a Freeport project. I have a couple questions for you regarding that project:

1. I had run some calculations with the following factor of safety method, which is giving me different results than your spreadsheet: https://www.conteches.com/knowledge-center/pdh-article-series/articulated-concrete-block-design
   Are you using a newer method?

2. Can you revise your calculations for the following channel design and flow rate:
   a. Manning's n = 0.015
   b. Bed Slope = 0.05
   c. Side slope = 2:1
   d. Bottom width = 15 feet, Top width = 28 feet
   e. Hydraulic Depth = 3.3 feet
   f. Radius of curvature = 240 feet

g. Flow rate = 2717 cfs (velocity = 38.8 ft/s for area of 70.1 sf)

A side slope of 3:1 is not obtainable for this project so you don't need to run that calculation. Let me know if you need additional information and let me know what block type you recommend based on these conditions.

Thank you for your time!

Taryn Tigges, PE | Civil Engineer
Office: 970-484-7704 | Cell: 515-520-9454
750 14th St SW | Loveland, CO 80537

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From: Jessica Menconi <jmenconi@telesto-inc.com>
Sent: Wednesday, April 22, 2020 2:12 PM
To: Taryn Tigges <ttigges@telesto-inc.com>
Subject: FW: Tyrone Mine Armorflex Analysis 40T

From: Fawcett, Clayton <CFawcett@conteches.com>
Sent: Wednesday, April 22, 2020 12:29 PM
To: Jessica Menconi <jmenconi@telesto-inc.com>
Cc: Taryn Tigges <taryn.tigges@gmail.com>
Subject: RE: Tyrone Mine Armorflex Analysis 40T

Jessica,

I have to apologize. I thought I sent that already.

See attached. My guess is that Freeport won't accept it as it is below the minimum 1.8 Factor of Safety that they have previously established.

Regards,

Clayton Fawcett PE (co)
Armortec Area Manager – West

CONTECH Engineered Solutions
970-290-2971 (cell)
cfawcett@conteches.com

From: Jessica Menconi [mailto:jmenconi@telesto-inc.com]
Sent: Wednesday, April 22, 2020 12:15 PM

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FREEPORT MCMORAN – NEW MEXICO MINING OPERATIONS

PRICE ESTIMATES FOR REVEGETATION SERVICES FOR BUDGETING ESTIMATES

Table 1 –Freeport McMoRan, New Mexico Mining Operations – Price Estimates for Revegetation Services for Budgeting Estimates, prepared April, 2018.

	REVEGETATION OPERATION	ESTIMATED QUANTITY	UNITS	COST/UNIT ($)	TOTAL COST
I.	**OPERATIONS:**				
1	**SCARIFYING**	500	Acres	$30.00	$15,000.00
2	**DISCING**	500	Acres	$20.00	$10,000.00
3	**DRILL SEEDING (special Rangeland Drill)**	500	Acres	$80.00	$40,000.00
4	**MULCHING**	500	Acres	$148.00	$74,000.00
5	**CRIMPING**	500	Acres	$55.00	$27,500.00
6	**DAILY PER DIEM, ETC.**	50	Days	$385.00	$19,250.00
7	**MOBILIZATION**	1	Each	$13,500.00	$13,500.00
	Subtotal				**$199,250.00**
II.	**MATERIALS:**				
1	**SEED** at 8.9 PLS/acre	500	Acres	$210.00	$105,000.00
2	**HAY MULCH** - nox. weed free, native	1000	Tons	$245.00	$245,000.00
	Subtotal				**$350,000.00**
	TOTAL ESTIMATED REVEGETATION COST BEFORE TAX				**$549,250.00**
	Add New Mexico Gross Receipts Tax	5.9375	%		**$32,611.72**
	ESTIMATED REVEGETATION COST PER ACRE:			**$1,163.72**	
	TOTAL ESTIMATED REVEGETATION COST				**$581,861.72**

Estimate prepared by Ron Schreibeis, Rocky Mountain Reclamation, for use for Budgeting Estimates.

Attachment C.6
Fuel Cost

Fuel Price Data

Data 1: U.S. No 2 Diesel Retail Prices (Dollars per Gallon)	
Date	**U.S. No 2 Diesel Retail Prices[1]**
1995	1.109
1996	1.235
1997	1.198
1998	1.044
1999	1.121
2000	1.491
2001	1.401
2002	1.319
2003	1.509
2004	1.81
2005	2.402
2006	2.705
2007	2.885
2008	3.803
2009	2.467
2010	2.992
2011	3.84
2012	3.968
2013	3.922
2014	3.825
2015	2.707
2016	2.304
2017	2.65
2018	3.178
2019	3.056
2020	2.551
2021	3.125
Date	**U.S. No 2 Diesel Retail Prices[1]**
Aug 2021	3.350

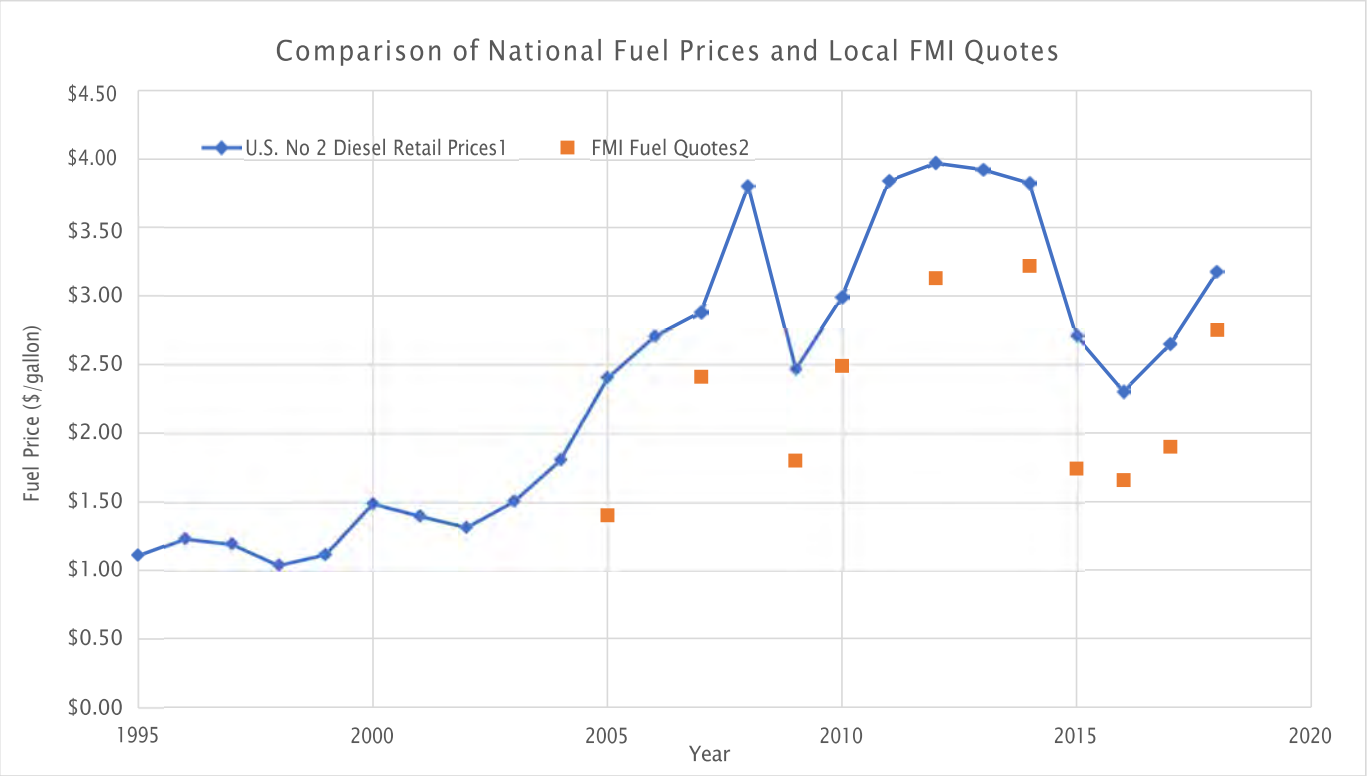
FMI Fuel Quotes[2]			
Site	**Date**	**Dyed, low-sulfur diesel**	**Notes**
Continental	1/21/2005	$1.40	Tom Shelley - quote from fuel broker
Chino & Tyrone	5/9/2007	$2.41	Porter Oil Quote (7500 gal capacity)
Continental	1/23/2009	$1.80	Porter Oil Quote (7500 gal capacity)
Tyrone (Little Rock)	1/14/2010	$2.49	Porter Oil Quote (7500 gal capacity)
Tyrone	7/7/2012	$3.13	Western Refining Oil
Continental	6/18/2014	$3.22	Western Refining Oil
Chino (North Lampbright)	11/5/2015	$1.74	Western Refining Oil
Chino	5/20/2016	$1.66	Western Refining Oil
Tyrone (Little Rock)	4/24/2017	$1.90	Western Refining Oil
Continental	3/12/2018	$2.75	Griffin Propane
Chino	10/10/2018	$2.75	Griffin Propane

1. U.S. Energy Information Administration
https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=EMD_EPD2D_PTE_NUS_DPG&f=M
2. Quotes obtained from Freeport-McMoRan (FMI)

Correlation Between U.S. No.2 Diesel Retail Prices and FMI Fuel Quotes Since 1995

Year	U.S. No 2 Diesel Retail Prices[1]	FMI Fuel Quotes[2]
1995	1.109	
1996	1.235	
1997	1.198	
1998	1.044	
1999	1.121	
2000	1.491	
2001	1.401	
2002	1.319	
2003	1.509	
2004	1.81	
2005	2.402	$1.40
2006	2.705	
2007	2.885	$2.41
2008	3.803	
2009	2.467	$1.80
2010	2.992	$2.49
2011	3.84	
2012	3.968	$3.13
2013	3.922	
2014	3.825	$3.22
2015	2.707	$1.74
2016	2.304	$1.66
2017	2.65	$1.90
2018	3.178	$2.75
2019	3.056	
2020	2.551	
2021	3.125	

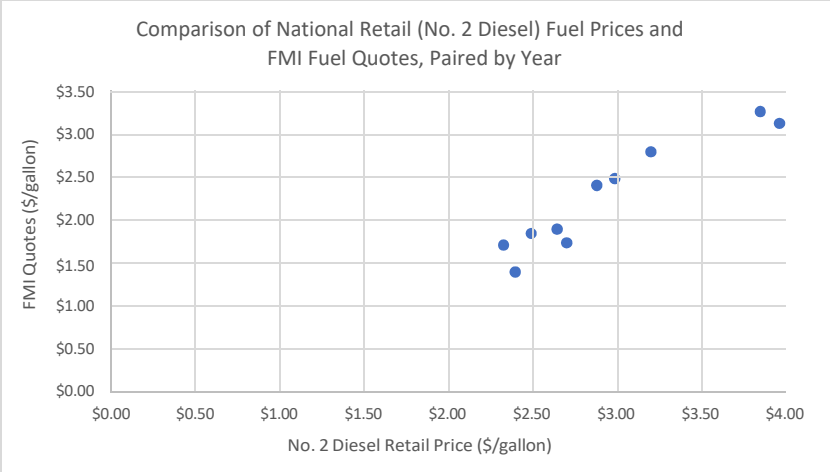
Correlation 0.952

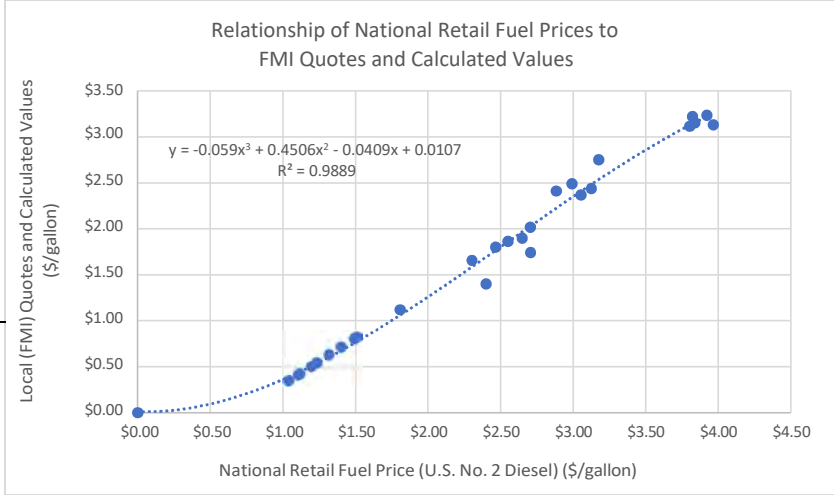


1. U.S. Energy Information Administration
https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=EMD_EPD2D_PTE_NUS_DPG&f=M
2. Quotes obtained from Freeport-McMoRan (FMI)

Calculations and Results for Fuel Price Prediction

U.S. No. 2 Diesel Retail Prices[1]	FMI Fuel Quotes[2]	Difference Between Retail Prices and FMI Quotes	Calculated FMI Values Based on Average Difference	Calculated FMI Values and Quotes	y = -0.05904x3 + 0.450612x2 - 0.04089x + 0.010713
$0.00				*$0.00*	$0.01
$1.11			$0.42	*$0.42*	$0.44
$1.24			$0.55	*$0.55*	$0.54
$1.20			$0.51	*$0.51*	$0.51
$1.04			$0.36	*$0.36*	$0.39
$1.12			$0.43	*$0.43*	$0.45
$1.49			$0.80	*$0.80*	$0.76
$1.40			$0.71	*$0.71*	$0.68
$1.32			$0.63	*$0.63*	$0.61
$1.51			$0.82	*$0.82*	$0.77
$1.81			$1.12	*$1.12*	$1.06
$2.40	$1.40	$1.00		$1.40	$1.69
$2.71			$2.02	*$2.02*	$2.03
$2.89	$2.41	$0.47		$2.41	$2.23
$3.80			$3.11	*$3.11*	$3.13
$2.47	$1.80	$0.67		$1.80	$1.77
$2.99	$2.49	$0.50		$2.49	$2.34
$3.84			$3.15	*$3.15*	$3.16
$3.97	$3.13	$0.84		$3.13	$3.25
$3.92			$3.23	*$3.23*	$3.22
$3.83	$3.22	$0.61		$3.22	$3.14
$2.71	$1.74	$0.97		$1.74	$2.03
$2.30	$1.66	$0.65		$1.66	$1.59
$2.65	$1.90	$0.75		$1.90	$1.97
$3.18	$2.75	$0.43		$2.75	$2.54
$3.06			$2.37	*$2.37*	$2.41
$2.55			$1.86	*$1.86*	$1.86
$3.13			$2.44	*$2.44*	$2.48
	Average	$0.69			





Correlations

Between No. 2 Retail Price and FMI Quotes	0.95
Between No. 2 Retail Price and 3rd order polynomial FMI Quotes	0.99
Between New FMI quotes and 3rd order polynomial FMI Quotes	0.96
Between FMI quotes and 3rd order polynomial FMI Quotes	0.99

New Fuel Rate	U.S. No 2 Diesel Retail Prices[1]		Proposed Fuel Quote
	Aug 2021	$3.35	$2.71

1. U.S. Energy Information Administration
https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=EMD_EPD2D_PTE_NUS_DPG&f=M
2. Quotes obtained from Freeport-McMoRan (FMI)

Appendix D
Costing Spreadsheet

North Lambright Leach RCE
Stockpile Spreadsheet Worksheet #1
3/18/2022

General Information

Applicant	Chino Mine Freeport=McMoRan Chino Mines Company Vanadium, New Mexico 88023
Disturbed Surface Area (acres)	121
Type of Operation	Surface/Copper
Current value of earthwork and O&M before escalation and discounting	**$2,496,965**
EOY 2026 Mine Plan	**Stockpiles, Reservoirs, Haul Roads and Disturbed Areas**

Material Handling Plan Summary Sheet

All activities for the NLLS RCE are listed on this sheet and carried through the succeeding worksheets of the RCE. The column labeled ID contains the codes for the facility location, activity, material and equipment used for that particular row of work. The description lists the activity, top or outslope (if applicable), and the material. The source location lists the stockpile name (or sub-area) for the location of the activity. If borrow material is involved, it is transported from a borrow stockpile to a destination stockpile. Blank cells indicate that that column is not relevant to a particular activity.

Notes and Assumptions:

1 - Haul/Push Distance based on 2021 NLLS CCP drawings
2 - Haul Grades based on 2021 NLLS CCP drawings
3 - Grade Factors from 2021 NLLS CCP drawings

ID	Description	Source Location 1	Destination Location 2	Total Haul/Push Distance (ft)[1]	Grade (%)[2,3]	Equipment
1001-A-a-Mg1b	Grade-Top of Stockpile-Existing Ground	North Lampbright Leach Stockpile-top	-	1,632	-1.0%	Cat 16M - Rough Grading
1001-A-a-Rp1	Grade-Top of Stockpile-Existing Ground	North Lampbright Leach Stockpile-top	-	1,632	-1.0%	Cat D11T CD Multi-shank (w/ MSR-359H)
1002-A-a-Dz1	Grade-Outslopes-Existing Ground	North Lampbright Leach Stockpile - West Outslope	-	180	-28.6%	Cat D11T, U Blade
1003-A-a-Dz1	Grade-Outslopes-Existing Ground	North Lampbright Leach Stockpile - East Outslope	-	180	-28.6%	Cat D11T, U Blade
1001-C-b-Ld2	Load-Cover	Rubio Peak	NLLS-1	1,632	-1.0%	Cat 988H
1002-C-b-Ld2	Load-Cover	Rubio Peak	NLLS-2	180	-28.6%	Cat 988H
1003-C-b-Ld2	Load-Cover	Rubio Peak	NLLS-3	180	-28.6%	Cat 988H
1001-B-b-Dz3	Dozer Assist-Cover	Rubio Peak	NLLS-1	1,632	-1.0%	Cat D9T, SU Blade
1002-B-b-Dz3	Dozer Assist-Cover	Rubio Peak	NLLS-2	180	-28.6%	Cat D9T, SU Blade
1003-B-b-Dz3	Dozer Assist-Cover	Rubio Peak	NLLS-3	180	-28.6%	Cat D9T, SU Blade
1001-D-b-Tk1	Haul-Cover	Rubio Peak	NLLS-1	11,733	6.3%	Komatsu HD-1500 5
1002-D-b-Tk1	Haul-Cover	Rubio Peak	NLLS-2	11,733	6.3%	Komatsu HD-1500 5
1003-D-b-Tk1	Haul-Cover	Rubio Peak	NLLS-3	11,733	6.3%	Komatsu HD-1500 5
1001-A-d-Mg1b	Grade-Top of Stockpile-Placed Cover	North Lampbright Leach Stockpile-top	-	1,632	-1.0%	Cat 16M - Rough Grading
1002-A-d-Mg1b	Grade-Outslopes-Placed Cover	North Lampbright Leach Stockpile - West Outslope	-	180	-28.6%	Cat 16M - Rough Grading
1003-A-d-Mg1b	Grade-Outslopes-Placed Cover	North Lampbright Leach Stockpile - East Outslope	-	180	-28.6%	Cat 16M - Rough Grading
1004-A-d-Mg1b	Grade-Haul Road to top-Placed Cover	North Lampbright Leach Stockpile - Haul Road	-	45	10.0%	Cat 16M - Rough Grading
1002-F-e-U3	Grade Benches-Outslopes-Final Grade	North Lampbright Leach Stockpile - West Outslope	-	180	-28.6%	-
1003-F-e-U3	Grade Benches-Outslopes-Final Grade	North Lampbright Leach Stockpile - East Outslope	-	180	-28.6%	-
1002-Hb-e-U8b	Construct Channels w/o Riprap-Outslopes-Final Grade	North Lampbright Leach Stockpile - West Outslope	-	180	-28.6%	-
1003-Hb-e-U8b	Construct Channels w/o Riprap-Outslopes-Final Grade	North Lampbright Leach Stockpile - East Outslope	-	180	-28.6%	-
1002-G-e-U6	Construct Downdrains-Outslopes-Final Grade	North Lampbright Leach Stockpile - West Outslope	-	180	-28.6%	-
1003-G-e-U6	Construct Downdrains-Outslopes-Final Grade	North Lampbright Leach Stockpile - East Outslope	-	180	-28.6%	-
1002-Gb-e-U7	Construct Downdrain Dissipators-Outslopes-Final Grade	North Lampbright Leach Stockpile - West Outslope	-	180	-28.6%	-
1003-Gb-e-U7	Construct Downdrain Dissipators-Outslopes-Final Grade	North Lampbright Leach Stockpile - East Outslope	-	180	-28.6%	-
1000-J-e-U2a	Revegetate-Entire Stockpile-Final Grade	North Lampbright Leach Stockpile	-	-	#N/A	-
1004-P-b-U26	Road Maintenance-Cover	Rubio Peak	NLLS-4	45	10.0%	-
1000-M-e-U	Post-Closure O&M-Entire Stockpile-Final Grade	North Lampbright Leach Stockpile	-	-	#N/A	-

Earthwork Quantity Worksheet

Notes and Assumptions:

1 - Acres and volumes based on 2021 NLLS CCP drawings
2 - Cover Material Swell: The 'Loose Volume' is calculated based on the acreage to be covered, cover depth, and accounts for appropriate swell factor.
3 - Has been agreed upon with State agencies that swell occurs when cover material is moved from source to haul truck but not from the truck to placement on stockpile

ID	Description	Source Location 1	Destination Location 2	Area (ac)[1]	Cover	Bank/Stockpile	Swell	Loose/Stockpile
1001-A-a-Mg1b	Grade-Top of Stockpile-Existing Ground	North Lampbright Leach Stockpile-top	-	90.345	-	-	0%	-
1001-A-a-Rp1	Grade-Top of Stockpile-Existing Ground	North Lampbright Leach Stockpile-top	-	90.345	-	-	0%	-
1002-A-a-Dz1	Grade-Outslopes-Existing Ground	North Lampbright Leach Stockpile - West Outslope	-	13.820	-	193,094	0%	193,094
1003-A-a-Dz1	Grade-Outslopes-Existing Ground	North Lampbright Leach Stockpile - East Outslope	-	14.417	-	201,435	0%	201,435
1001-C-b-Ld2	Load-Cover	Rubio Peak	NLLS-1	90.345	36.0	404,880	8%	437,270
1002-C-b-Ld2	Load-Cover	Rubio Peak	NLLS-2	13.820	36.0	61,934	8%	66,889
1003-C-b-Ld2	Load-Cover	Rubio Peak	NLLS-3	14.417	36.0	64,609	8%	69,778
1001-B-b-Dz3	Dozer Assist-Cover	Rubio Peak	NLLS-1	90.345	36.0	404,880	8%	437,270
1002-B-b-Dz3	Dozer Assist-Cover	Rubio Peak	NLLS-2	13.820	36.0	61,934	8%	66,889
1003-B-b-Dz3	Dozer Assist-Cover	Rubio Peak	NLLS-3	14.417	36.0	64,609	8%	69,778
1001-D-b-Tk1	Haul-Cover	Rubio Peak	NLLS-1	90.345	36.0	404,880	8%	437,270
1002-D-b-Tk1	Haul-Cover	Rubio Peak	NLLS-2	13.820	36.0	61,934	8%	66,889
1003-D-b-Tk1	Haul-Cover	Rubio Peak	NLLS-3	14.417	36.0	64,609	8%	69,778
1001-A-d-Mg1b	Grade-Top of Stockpile-Placed Cover	North Lampbright Leach Stockpile-top	-	90.345	36.0	437,270	0%	437,270
1002-A-d-Mg1b	Grade-Outslopes-Placed Cover	North Lampbright Leach Stockpile - West Outslope	-	13.820	36.0	66,889	0%	66,889
1003-A-d-Mg1b	Grade-Outslopes-Placed Cover	North Lampbright Leach Stockpile - East Outslope	-	14.417	36.0	69,778	0%	69,778
1004-A-d-Mg1b	Grade-Haul Road to top-Placed Cover	North Lampbright Leach Stockpile - Haul Road	-	1.327	36.0	6,421	0%	6,421
1002-F-e-U3	Grade Benches-Outslopes-Final Grade	North Lampbright Leach Stockpile - West Outslope	-	13.820	-	193,094	0%	193,094
1003-F-e-U3	Grade Benches-Outslopes-Final Grade	North Lampbright Leach Stockpile - East Outslope	-	14.417	-	201,435	0%	201,435
1002-Hb-e-U8b	Construct Channels w/o Riprap-Outslopes-Final Grade	North Lampbright Leach Stockpile - West Outslope	-	13.820	-	193,094	0%	193,094
1003-Hb-e-U8b	Construct Channels w/o Riprap-Outslopes-Final Grade	North Lampbright Leach Stockpile - East Outslope	-	14.417	-	201,435	0%	201,435
1002-G-e-U6	Construct Downdrains-Outslopes-Final Grade	North Lampbright Leach Stockpile - West Outslope	-	13.820	-	193,094	0%	193,094
1003-G-e-U6	Construct Downdrains-Outslopes-Final Grade	North Lampbright Leach Stockpile - East Outslope	-	14.417	-	201,435	0%	201,435
1002-Gb-e-U7	Construct Downdrain Dissipators-Outslopes-Final Grade	North Lampbright Leach Stockpile - West Outslope	-	13.820	-	193,094	0%	193,094
1003-Gb-e-U7	Construct Downdrain Dissipators-Outslopes-Final Grade	North Lampbright Leach Stockpile - East Outslope	-	14.417	-	201,435	0%	201,435
1000-J-e-U2a	Revegetate-Entire Stockpile-Final Grade	North Lampbright Leach Stockpile	-	120.601	-	394,529	0%	394,529
1004-P-b-U26	Road Maintenance-Cover	Rubio Peak	NLLS-4	-	-	-	-	-
1000-M-e-U	Post-Closure O&M-Entire Stockpile-Final Grade	North Lampbright Leach Stockpile	-	120.601	-	394,529	0%	394,529

Productivity and Hours Required for Dozer Use---Earthmoving

Notes and Assumptions:
Uses volumes of outslope sections and dam breaches to calculate productivity
Uses push distances of outslope sections for grading productivity
Uses scraper push cycle time for dozer assist with scraper
Uses loader cycle time for dozer assist with loader at cover stockpiles
Grade Factor = -0.02(Grade %) + 1
May filter on equipement (D14) to show pertinent rows

Number of Dozers per Assist = 1

PERFORMANCE FACTORS

ID	Task Description	Source Location 1	Destination Location 2	Equipment	Type of Equipment to Assist (ID)	Type of Equipment to Assist (Name)	Number of Dozers per Assist	Loose /Stockpile Volume (cy)	Area (ac)	Productivity (cy/hr)	Productivity (ac/hr)	Total Task Time (hrs)	Material Factor	Grade Factor	Material Weight (lb/cy)	Production Method/ Blade	Centroid to Centroid Push Distance (ft)	Normal Production (cy/hr)	Effective Blade Width (ft)	Speed (mph)	Operator Factor	Work Hour (min/hr)	Visibility Factor	Elevation Factor	Direct Drive Trans.	Cut to Fill Haul Grade (%)
1002-A-a-Dz1	Grade-Outslopes-Existing Ground	North Lampbright Leach Stockpile - West	-	Cat D11T, U Blade	--	--	--	193,094	13.820	1,848	-	104.5	1.2	1.6	3,600	1.2	180	1,534	18	3	1.00	50	1.0	1.0	1.0	-29%
1003-A-a-Dz1	Grade-Outslopes-Existing Ground	North Lampbright Leach Stockpile - East	-	Cat D11T, U Blade	--	--	--	201,435	14.417	1,848	-	109.0	1.2	1.6	3,600	1.2	180	1,534	18	3	1.00	50	1.0	1.0	1.0	-29%
1001-B-b-Dz3	Dozer Assist-Cover	Rubio Peak	NLLS-1	Cat D9T, SU Blade	Ld2	Cat 988H Loader	1	437,270	90.345	-	-	777.7	-	-	-	-	-	-	-	-	-	50	-	-	-	-1%
1002-B-b-Dz3	Dozer Assist-Cover	Rubio Peak	NLLS-2	Cat D9T, SU Blade	Ld2	Cat 988H Loader	1	66,889	13.820	-	-	119.0	-	-	-	-	-	-	-	-	-	50	-	-	-	-29%
1003-B-b-Dz3	Dozer Assist-Cover	Rubio Peak	NLLS-3	Cat D9T, SU Blade	Ld2	Cat 988H Loader	1	69,778	14.417	-	-	124.1	-	-	-	-	-	-	-	-	-	50	-	-	-	-29%

Productivity and Hours Required for Dust Suppression and Road Maintenance

Notes and Assumptions:
6,000 gal water truck and 14M motor grader for dust suppression and site maintenance (water truck hours and 14M hours tied to loading time for cover material)
May filter on equipement (D14) to show pertinent rows

Sheet to which to tie hrs 11 Loader Shovel
Equipment for hrs Sh1
Equipment for hrs Ld1

ID	Task Description	Source Location 1	Destination Location 2	Equipment	Operational Maintenance Time (hrs)
1004-P-b-U26	Road Maintenance-Cover	Rubio Peak	NLLS-4	-	-

No
Stockpile S

Productivity and Hours Required for Ripper---Equipped Dozer Use

Notes and Assumptions:
Uses area to calculate task time
88 ft/min = 1 mph
May filter on equipement (D14) to show pertinent rows

						PERFORMANCE FACTORS										
ID	**Task Description**	**Source Location 1**	**Destination Location 2**	**Equipment**	**Area (ac)**	**Productivity (ac/hr)**	**Task Time (hrs)**	**Ripping Length (ft)**	**Ripper Penetration (in)**	**Pocket Spacing (in)**	**Distance b/n Passes (in)**	**Number of Shank Pockets**	**Turn Time (min/pass)**	**Work Hour (min/hr)**	**Speed (mph)**	**1000 Ft Passes/Acre**
1001-A-a-Rp1	Grade-Top of Stockpile-Existing Ground	North Lampbright Leach Stockpile-top	-	Cat D11T CD Multi-shank (w/ MSR-359H)	90.35	2.9	31.1	816	18	59	59	3	0.25	50	1.0	1.8

Productivity and Hours Required for Ripper---Equipped Dozer Use

Notes and Assumptions:
Uses area to calculate task time
88 ft/min = 1 mph
May filter on equipement (D14) to show pertinent rows

Task Description	Source Location 1	Destination Location 2	Equipment	Ripped Width Plus Distance b/n Passes (ft)
Grade-Top of Stockpile-Existing Ground	North Lampbright Leach Stockpile-top	-	Cat D11T CD Multi-shank (w/ MSR-359H)	30

Productivity and Hours Required for Truck Use

Months 5.80

Notes and Assumptions:
Uses haul distance to calculate haul and return time (total task time includes loading, manuevering, dumping, hauling and return time) - moves from cover stockpile to destination stockpile
Volume of cover material based on area of destination
Cycles per truck = the greater of Heaped capacity or Struck capacity divided by Loader's per bucket capacity
1 mph = 88 ft/min
1 m/min = 0.03728227153424 mph
See Truck Optimization optimum number of trucks per loader
Haul Grade (%) assumes postive is uphill while the Effective Haul Grade (%) and Effective Return Grade (%) are postive for downhill and uphill
May filter on equipement (D14) to show pertinent rows

PERFORMANCE FACTORS

5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
ID	**Task Description**	**Source Location 1**	**Destination Location 2**	**Equipment**	**Loading Equipment ID**	**Loose/Stockpile Volume (cy)**	**Truck Cycle Time (min)**	**Optimum Number of Trucks**	**Loader/Shovel/Excavator Net Bucket Capacity (cy)**	**Productivity (cy/hr)**	**Loader/Shovel/Excavator Task Time(hrs)**	**Truck Task Time (hrs)**	**Struck Capacity (cy)**	**Heaped Capacity (cy)**	**Loader/Shovel Cycles per Truck**	**Total Haul Distance (ft)**	**Haul Distance Segment 1 (ft)**	**Haul Distance Segment 2 (ft)**	**Haul Distance Segment 3 (ft)**	**Haul Grade Segment 1 (%)**	**Haul Grade Segment 2 (%)**	**Haul Grade Segment 3 (%)**	**Rolling Resistance (%)**	**Haul Distance Segment 1 (meters)**	**Haul Distance Segment 2 (meters)**	**Haul Distance Segment 3 (meters)**
1001-D-b-Tk1	Haul-Cover	Rubio Peak	NLLS-1	Komatsu HD-1500	Ld2	437,270	25.3	3	7.3	562.3	689.9	777.7	71.0	102.0	13.0	11,733	3,919	4,935	2,880	6.5%	1.6%	7.7%	2.5%	1,194	1,504	878
1002-D-b-Tk1	Haul-Cover	Rubio Peak	NLLS-2	Komatsu HD-1500	Ld2	66,889	25.3	3	7.3	562.3	105.5	119.0	71.0	102.0	13.0	11,733	3,919	4,935	2,880	6.5%	1.6%	7.7%	2.5%	1,194	1,504	878
1003-D-b-Tk1	Haul-Cover	Rubio Peak	NLLS-3	Komatsu HD-1500	Ld2	69,778	25.3	3	7.3	562.3	110.1	124.1	71.0	102.0	13.0	11,733	3,919	4,935	2,880	6.5%	1.6%	7.7%	2.5%	1,194	1,504	878

Productivity and Hours Required for Truck Use

Notes and Assumptions:
Uses haul distance to calculate haul and return time (total task time includes loading, manuevering, dumping, hauling and return time) - moves from cover stockpile
Volume of cover material based on area of destination
Cycles per truck = the greater of Heaped capacity or Struck capacity divided by Loader's per bucket capacity
1 mph = 88 ft/min
1 m/min = 0.03728227153424 mph
See Truck Optimization optimum number of trucks per loader
Haul Grade (%) assumes postive is uphill while the Effective Haul Grade (%) and Effective Return Grade (%) are postive for downhill and uphill
May filter on equipement (D14) to show pertinent rows

6	7	8	9	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
Task Description	**Source Location 1**	**Destination Location 2**	**Equipment**	**Effective Haul Grade Segment 1 (%)**	**Effective Haul Grade Segment 2 (%)**	**Effective Haul Grade Segment 3 (%)**	**Effective Return Grade Segment 1 (%)**	**Effective Return Grade Segment 2 (%)**	**Effective Return Grade Segment 3 (%)**	**Haul Time (min)**	**Return Time (min)**	**Loading Time (min)**	**Truck Exchange Time (min)**	**Dump/Maneuver Time (min)**	**Work Hour (min/hr)**	**Travel Time Loaded Segment 1 (min/m)**	**Travel Time Loaded Segment 2 (min/m)**	**Travel Time Loaded Segment 3 (min/m)**	**Travel Time Empty Segment 1 (min/m)**	**Travel Time Empty Segment 2 (min/m)**	**Travel Time Empty Segment 3 (min/m)**
Haul-Cover	Rubio Peak	NLLS-1	Komatsu HD-150(	9.0%	4.1%	10.2%	4.0%	0.9%	5.2%	12.2	3.8	7.48	0.7	1.1	50	0.00426	0.00180	0.00501	0.00106	0.00106	0.00106
Haul-Cover	Rubio Peak	NLLS-2	Komatsu HD-150(	9.0%	4.1%	10.2%	4.0%	0.9%	5.2%	12.2	3.8	7.48	0.7	1.1	50	0.00426	0.00180	0.00501	0.00106	0.00106	0.00106
Haul-Cover	Rubio Peak	NLLS-3	Komatsu HD-150(	9.0%	4.1%	10.2%	4.0%	0.9%	5.2%	12.2	3.8	7.48	0.7	1.1	50	0.00426	0.00180	0.00501	0.00106	0.00106	0.00106

Productivity and Hours Required for Front End Loader Use or Hydraulic Shovel Use

Assumptions:
Uses cover volume to calculate loading time of cover material
May filter on equipement (D14) to show pertinent rows

											PERFORMANCE FACTORS	
5	6	7	8	9	10	11	12	13	14	15	16	17
ID	**Task Description**	**Source Location 1**	**Destination Location 2**	**Equipment**	**Hauling Equipment ID**	**Loose/Stockpile Volume (cy)**	**Loader/ Shovel Cycle Time (min)**	**Per Loader/Shovel Productivity (cy/hr)**	**Loader/ Shovel Task Time (hrs)**	**Max of Loader/Shovel or Truck Task Time (hrs)**	**Net Bucket Capacity (cy)**	**Work Hour (min/hr)**
1001-C-b-Ld2	Load-Cover	Rubio Peak	NLLS-1	Cat 988H	Tk1	437,270	0.58	633.8	689.9	777.7	7.3	50
1002-C-b-Ld2	Load-Cover	Rubio Peak	NLLS-2	Cat 988H	Tk1	66,889	0.58	633.8	105.5	119.0	7.3	50
1003-C-b-Ld2	Load-Cover	Rubio Peak	NLLS-3	Cat 988H	Tk1	69,778	0.58	633.8	110.1	124.1	7.3	50

Productivity and Hours Required for Motorgrader Use---Grading

Notes and Assumptions:
Productivity (based on area of overall stockpile) = Sq.ft per hour = Speed x (Eff. Blade L -Blade Overlap) x Efficiency (*Cat. Handbook Edition 47* pg 11-27)
Max. safe slope for motor graders is 2:1 (50%), proposed final grade for Tyrone cover grading on stockpiles is 33%, therefore use of graders an option (Cat. Handbook Edition 46 pg 11-30)
Grade Factor = -0.02(Grade %) + 1
May filter on equipement (D14) to show pertinent rows

ID	Task Description	Source Location 1	Destination Location 2	Grading Equipment	Area (ac)	Grading Shaping Productivity (ac/hr)	Task Time (hrs)	Grade Factor	Material Factor	Material Weight (lb/cy)	Production Method/Blade	Effective Blade Width (ft)	Pass Overlap (ft)	Speed (mph)	Work Hour (min/hr)	Operator Factor
1001-A-a-Mg1b	Grade-Top of Stockpile-Existing Ground	North Lampbright Leach Stockpile-top	-	Cat 16M - Rough Grading	90	3	32.7	1.0	1.0	3,600	1.20	16.00	2.00	2.50	50	1.00
1001-A-d-Mg1b	Grade-Top of Stockpile-Placed Cover	North Lampbright Leach Stockpile-top	-	Cat 16M - Rough Grading	90	2	36.3	1.0	1.2	3,600	1.20	16.00	2.00	2.50	50	0.75
1002-A-d-Mg1b	Grade-Outslopes-Placed Cover	North Lampbright Leach Stockpile - West Ou	-	Cat 16M - Rough Grading	14	4	3.6	1.6	1.2	3,600	1.20	16.00	2.00	2.50	50	0.75
1003-A-d-Mg1b	Grade-Outslopes-Placed Cover	North Lampbright Leach Stockpile - East Ou	-	Cat 16M - Rough Grading	14	4	3.8	1.6	1.2	3,600	1.20	16.00	2.00	2.50	50	0.75
1004-A-d-Mg1b	Grade-Haul Road to top-Placed Cover	North Lampbright Leach Stockpile - Haul Ro	-	Cat 16M - Rough Grading	1	2	0.7	0.8	1.2	3,600	1.20	16.00	2.00	2.50	50	0.75

Summary Calculation of Earthmoving Costs

Summarizes costs for line items involving earthworks

Notes and Assumptions:
Productivity (based on area of overall stockpile) = Sq.ft per hour = Speed x (Eff. Blade L -Blade Overlap) x Efficiency (*Cat. Handbook Edition 47* pg 11-27)
Max. safe slope for motor graders is 2:1 (50%), proposed final grade for NLLS cover grading on stockpiles is 33%, therefore use of graders an option (Cat. Handbook Edition 46 pg 11-30)
Grade Factor = -0.02(Grade %) + 1
May filter on equipement (D14) to show pertinent rows

ID	Description	Source Location 1	Destination Location 2	Equipment	Fuel Cost ($/hr)	Lube, Tires, GEC, & Field Parts Adjusted Rental Cost (w/o fuel) ($/hr)	Labor Cost ($/hr)	Number of Units (Equipment)	Time Req'd Per Unit (hrs)	Direct Fuel Cost ($)	Direct Lube, Tires, GEC, & Field Parts Adjusted Rental Cost (w/o fuel) ($)	Direct Labor Cost ($)	Total Equipment Cost ($)	Total Production Volume (CY)	Total Production Area (AC)
1001-A-a-Mg1b	Grade-Top of Stockpile-Existing Ground	North Lampbright Leach Stockpile-top	-	Cat 16M - Rough Grading	$25.75	$85.54	$28.95	1	32.7	$841	$2,795	$946	$4,583	-	90.3
1001-A-a-Rp1	Grade-Top of Stockpile-Existing Ground	North Lampbright Leach Stockpile-top	-	Cat D11T CD Multi-shank (w/ MSR-359H)	$71.92	$250.85	$28.65	1	31.1	$2,239	$7,811	$892	$10,942	-	90.3
1002-A-a-Dz1	Grade-Outslopes-Existing Ground	North Lampbright Leach Stockpile - West Outslope	-	Cat D11T, U Blade	$71.92	$258.01	$28.65	1	104.5	$7,517	$26,965	$2,994	$37,476	193,094	-
1003-A-a-Dz1	Grade-Outslopes-Existing Ground	North Lampbright Leach Stockpile - East Outslope	-	Cat D11T, U Blade	$71.92	$258.01	$28.65	1	109.0	$7,839	$28,119	$3,122	$39,080	201,435	-
1001-C-b-Ld2	Load-Cover	Rubio Peak	NLLS-1	Cat 988H	$24.74	$121.23	$28.97	1	777.7	$19,242	$94,283	$22,530	$136,056	437,270	-
1002-C-b-Ld2	Load-Cover	Rubio Peak	NLLS-2	Cat 988H	$24.74	$121.23	$28.97	1	119.0	$2,943	$14,422	$3,446	$20,812	66,889	-
1003-C-b-Ld2	Load-Cover	Rubio Peak	NLLS-3	Cat 988H	$24.74	$121.23	$28.97	1	124.1	$3,071	$15,045	$3,595	$21,711	69,778	-
1001-B-b-Dz3	Dozer Assist-Cover	Rubio Peak	NLLS-1	Cat D9T, SU Blade	$35.31	$203.92	$28.65	1	777.7	$27,462	$158,593	$22,281	$208,336	437,270	-
1002-B-b-Dz3	Dozer Assist-Cover	Rubio Peak	NLLS-2	Cat D9T, SU Blade	$35.31	$203.92	$28.65	1	119.0	$4,201	$24,260	$3,408	$31,869	66,889	-
1003-B-b-Dz3	Dozer Assist-Cover	Rubio Peak	NLLS-3	Cat D9T, SU Blade	$35.31	$203.92	$28.65	1	124.1	$4,382	$25,308	$3,556	$33,245	69,778	-
1001-D-b-Tk1	Haul-Cover	Rubio Peak	NLLS-1	Komatsu HD-1500 5	$72.79	$190.84	$25.16	3	777.7	$169,829	$445,252	$58,701	$673,783	437,270	-
1002-D-b-Tk1	Haul-Cover	Rubio Peak	NLLS-2	Komatsu HD-1500 5	$72.79	$190.84	$25.16	3	119.0	$25,979	$68,109	$8,979	$103,067	66,889	-
1003-D-b-Tk1	Haul-Cover	Rubio Peak	NLLS-3	Komatsu HD-1500 5	$72.79	$190.84	$25.16	3	124.1	$27,101	$71,051	$9,367	$107,519	69,778	-
1001-A-d-Mg1b	Grade-Top of Stockpile-Placed Cover	North Lampbright Leach Stockpile-top	-	Cat 16M - Rough Grading	$25.75	$85.54	$28.95	1	36.3	$935	$3,106	$1,051	$5,092	-	90.3
1002-A-d-Mg1b	Grade-Outslopes-Placed Cover	North Lampbright Leach Stockpile - West Outslope	-	Cat 16M - Rough Grading	$25.75	$85.54	$28.95	1	3.6	$93	$308	$104	$506	-	13.8
1003-A-d-Mg1b	Grade-Outslopes-Placed Cover	North Lampbright Leach Stockpile - East Outslope	-	Cat 16M - Rough Grading	$25.75	$85.54	$28.95	1	3.8	$97	$322	$109	$527	-	14.4
1004-A-d-Mg1b	Grade-Haul Road to top-Placed Cover	North Lampbright Leach Stockpile - Haul Road	-	Cat 16M - Rough Grading	$25.75	$85.54	$28.95	1	0.7	$18	$58	$20	$95	-	1.3
1002-F-e-U3	Grade Benches-Outslopes-Final Grade	North Lampbright Leach Stockpile - West Outslope	-	-	$0.00	$0.00	$0.00	1	-	$0	$0	$0	$0	-	-
1003-F-e-U3	Grade Benches-Outslopes-Final Grade	North Lampbright Leach Stockpile - East Outslope	-	-	$0.00	$0.00	$0.00	1	-	$0	$0	$0	$0	-	-
1002-Hb-e-U8b	Construct Channels w/o Riprap-Outslopes-Final Grade	North Lampbright Leach Stockpile - West Outslope	-	-	$0.00	$0.00	$0.00	1	-	$0	$0	$0	$0	-	-
1003-Hb-e-U8b	Construct Channels w/o Riprap-Outslopes-Final Grade	North Lampbright Leach Stockpile - East Outslope	-	-	$0.00	$0.00	$0.00	1	-	$0	$0	$0	$0	-	-
1002-G-e-U6	Construct Downdrains-Outslopes-Final Grade	North Lampbright Leach Stockpile - West Outslope	-	-	$0.00	$0.00	$0.00	1	-	$0	$0	$0	$0	-	-
1003-G-e-U6	Construct Downdrains-Outslopes-Final Grade	North Lampbright Leach Stockpile - East Outslope	-	-	$0.00	$0.00	$0.00	1	-	$0	$0	$0	$0	-	-
1002-Gb-e-U7	Construct Downdrain Dissipators-Outslopes-Final Grade	North Lampbright Leach Stockpile - West Outslope	-	-	$0.00	$0.00	$0.00	1	-	$0	$0	$0	$0	-	-
1003-Gb-e-U7	Construct Downdrain Dissipators-Outslopes-Final Grade	North Lampbright Leach Stockpile - East Outslope	-	-	$0.00	$0.00	$0.00	1	-	$0	$0	$0	$0	-	-
1000-J-e-U2a	Revegetate-Entire Stockpile-Final Grade	North Lampbright Leach Stockpile	-	-	$0.00	$0.00	$0.00	1	-	$0	$0	$0	$0	-	-
1004-P-b-U26	Road Maintenance-Cover	Rubio Peak	NLLS-4	-	$0.00	$0.00	$0.00	1	-	$0	$0	$0	$0	-	-
1000-M-e-U	Post-Closure O&M-Entire Stockpile-Final Grade	North Lampbright Leach Stockpile	-	-	$0.00	$0.00	$0.00	1	-	$0	$0	$0	$0	-	-

Revegetation Costs

Description:
Includes scarifying (ripping), discing, rangeland drill seeding, mulching, crimping, and daily per diem
May filter on equipement (D14) to show pertinent rows

ID	Description	Source Location 1	Destination Location 2	Area (ac)	Fuel Unit Cost ($/ac)	Reveg w/o Fuel Unit Cost ($/ac)	Fuel Direct Cost ($)	Reveg w/o Fuel Direct Cost ($)
1000-J-e-U2a	Revegetate-Entire Stockpile-Final Grade	North Lampbright Leach Stockpile	-	120.6	$ 4.46	$ 852.45	$ 537	$ 102,806
			TOTAL	121			$ 537	$ 102,806

Other Reclamation Activity Costs

Assumptions:
1 - Cost to construct drain or channel on re-graded stockpile
2 - The downdrain, ACB, well plug & abandon, and well replacement costs include fuel
May filter on equipement (D14) to show pertinent rows

ID	Description	Source Location 1	Destination Location 2	Quantity	Unit	Fuel Unit Cost ($/unit)	Unit Cost w/o Fuel ($/unit)[1,2]	Fuel Direct Cost ($)	Direct w/o Fuel Cost ($)
1002-F-e-U3	Grade Benches-Outslopes-Final Grade	North Lampbright Leach Stockpile - West Outslope	-	3,267	ft	$ 0.42	$ 1.60	$ 1,377.10	$ 5,216
1003-F-e-U3	Grade Benches-Outslopes-Final Grade	North Lampbright Leach Stockpile - East Outslope	-	5,038	ft	$ 0.42	$ 1.60	$ 2,123.59	$ 8,044
1002-Hb-e-U8b	Construct Channels w/o Riprap-Outslopes-Final Grade	North Lampbright Leach Stockpile - West Outslope	-	3,267	ft	$ 0.13	$ 0.48	$ 428.71	$ 1,564
1003-Hb-e-U8b	Construct Channels w/o Riprap-Outslopes-Final Grade	North Lampbright Leach Stockpile - East Outslope	-	5,038	ft	$ 0.13	$ 0.48	$ 661.10	$ 2,411
1002-G-e-U6	Construct Downdrains-Outslopes-Final Grade	North Lampbright Leach Stockpile - West Outslope	-	287	ft	$ -	$ 392.04	$ -	$ 112,461
1003-G-e-U6	Construct Downdrains-Outslopes-Final Grade	North Lampbright Leach Stockpile - East Outslope	-	329	ft	$ -	$ 392.04	$ -	$ 128,982
1002-Gb-e-U7	Construct Downdrain Dissipators-Outslopes-Final Grade	North Lampbright Leach Stockpile - West Outslope	-	1	ea	$ -	$ 15,106.89	$ -	$ 15,107
1003-Gb-e-U7	Construct Downdrain Dissipators-Outslopes-Final Grade	North Lampbright Leach Stockpile - East Outslope	-	1	ea	$ -	$ 15,106.89	$ -	$ 15,107
1004-P-b-U26	Road Maintenance-Cover	Rubio Peak	NLLS-4	6	months	$ 222.32	$ 875.40	$ 1,333.92	$ 5,252
1000-M-e-U	Post-Closure O&M-Entire Stockpile-Final Grade	North Lampbright Leach Stockpile	-	-	-	$ -	$ -	$ -	$ -
							TOTAL	$ 5,924	$ 294,144

North Lambright Leach RCE

Reclamation Summary Stockpiles, Haul Roads, Reservoirs, and Disturbed Areas

			Current Value
DIRECT COSTS	Facility and Structure Removal		$0
	Earthmoving		$1,434,700
	Revegetation		$103,344
	Other		$300,069
	Subtotal, Direct Costs		**$1,838,112**
INDIRECT COSTS	**Subtotal, Indirect Costs**	**30.0%**	**$551,434**
TOTAL COST			**$2,389,546**

Notes:

Indirect costs are based on 2019 agreement between FMI and agencies

Indirect costs include but are not limited to mobilization and demobilization, engineering redesign fee, contingencies, contractor profit and overhead, project management fee, and state procurement cost

North Lambright Leach RCE

Operations and Maintenance Summary

			Current Value
DIRECT COSTS	Facility and Structure Removal		$0
	Earthmoving		$0
	Vegetation		$24,802
	Other		$66,618
	Subtotal, Direct Costs		**$91,421**
INDIRECT COSTS	**Subtotal, Indirect Costs**	**17.5%**	**$15,999**
TOTAL COST			**$107,419**

Notes:

Indirect costs are based on 2019 agreement between FMI and agencies

Indirect costs include but are not limited to mobilization and demobilization, engineering redesign fee, contingencies, contractor profit and overhead, project management fee, and state procurement cost

Component	Current Cost
Earthwork & Demo	$2,389,546
Other O&M	$78,276
Veg O&M	$29,143
Total	**$2,496,965**

	Earthwork			
Year	Earthwork Current Cost	Vegetation Maint. Current Cost	O&M Current Cost	Total Earthwork Current Cost
1	238,955		-	238,955
2	955,818		-	955,818
3	955,818	2,242	-	958,060
4	238,955	2,242	-	241,196
5		2,242	-	2,242
6		2,242	-	2,242
7		2,242	-	2,242
8		2,242	-	2,242
9		2,242	-	2,242
10		2,242	-	2,242
11		2,242	-	2,242
12		2,242	-	2,242
13		2,242	-	2,242
14		2,242	-	2,242
15		2,242	-	2,242
16	-		-	-
17	-		-	-
18	-		-	-
19	-		-	-
20	-		-	-
21	-	-	-	-
22	-	-	-	-
23	-	-	-	-
24	-	-	-	-
25	-	-	-	-
26	-	-	-	-
27	-	-	-	-
28	-	-	-	-
29	-	-	-	-
30	-	-	-	-
31	-	-	-	-
32	-	-	-	-
33	-	-	-	-
34	-	-	-	-
35	-	-	-	-
36	-	-	-	-
37	-	-	-	-
38	-	-	-	-
39	-	-	-	-
40	-	-	-	-
41	-	-	-	-
42	-	-	-	-
43	-	-	-	-
44	-	-	-	-
45	-	-	-	-
46	-	-	-	-
47	-	-	-	-
48	-	-	-	-
49	-	-	-	-
50	-	-	78,276	78,276
51	-	-	-	-
52	-	-	-	-
53	-	-	-	-
54	-	-	-	-
55	-	-	-	-
56	-	-	-	-
57	-	-	-	-
58	-	-	-	-
59	-	-	-	-
60	-	-	-	-
61	-	-	-	-
62	-	-	-	-
63	-	-	-	-
64	-	-	-	-
65	-	-	-	-
66	-	-	-	-
67	-	-	-	-
68	-	-	-	-
69	-	-	-	-
70	-	-	-	-
71	-	-	-	-
72	-	-	-	-
73	-	-	-	-
74	-	-	-	-
75	-	-	-	-
76	-	-	-	-
77	-	-	-	-
78	-	-	-	-
79	-	-	-	-
80	-	-	-	-
81	-	-	-	-
82	-	-	-	-
83	-	-	-	-
84	-	-	-	-
85	-	-	-	-
86	-	-	-	-
87	-	-	-	-
88	-	-	-	-
89	-	-	-	-
90	-	-	-	-
91	-	-	-	-
92	-	-	-	-
93	-	-	-	-
94	-	-	-	-
95	-	-	-	-
96	-	-	-	-
97	-	-	-	-
98	-	-	-	-
99	-	-	-	-
100	-	-	-	-
Total	2,389,546	29,143	78,276	2,496,965

Continental Mine - NPV Calculation

NLLS

March 18, 2022

		Yr 1-10	Yr 11-100
Escalation Rate		2.24%	2.54%
Discount Rate		5.09%	6.12%

Component	Current Cost	NPV
Earthwork	$ 2,496,965	$ 2,331,014
Water Management	$ -	$ -
Total	**$2,496,965**	**$ 2,331,014**

	Earthwork				Water Management and Treatment			
	Current Cost				Current Cost			
Year	Capital[1]	O&M[2]	Total	NPV	Capital Cost[3]	O&M[4]	Total	NPV
1	238,955	0	238,955	238,955	0	0	0	0
2	955,818	0	955,818	929,897	0	0	0	0
3	955,818	2,242	958,060	906,800	0	0	0	0
4	238,955	2,242	241,196	222,100	0	0	0	0
5	0	2,242	2,242	2,008	0	0	0	0
6	0	2,242	2,242	1,954	0	0	0	0
7	0	2,242	2,242	1,901	0	0	0	0
8	0	2,242	2,242	1,849	0	0	0	0
9	0	2,242	2,242	1,799	0	0	0	0
10	0	2,242	2,242	1,750	0	0	0	0
11	0	2,242	2,242	1,591	0	0	0	0
12	0	2,242	2,242	1,537	0	0	0	0
13	0	2,242	2,242	1,485	0	0	0	0
14	0	2,242	2,242	1,435	0	0	0	0
15	0	2,242	2,242	1,387	0	0	0	0
16	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0
50	0	78,276	78,276	14,566	0	0	0	0
51	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0
57	0	0	0	0	0	0	0	0
58	0	0	0	0	0	0	0	0
59	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0
61	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0
63	0	0	0	0	0	0	0	0
64	0	0	0	0	0	0	0	0
65	0	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0	0
67	0	0	0	0	0	0	0	0
68	0	0	0	0	0	0	0	0
69	0	0	0	0	0	0	0	0
70	0	0	0	0	0	0	0	0
71	0	0	0	0	0	0	0	0
72	0	0	0	0	0	0	0	0
73	0	0	0	0	0	0	0	0
74	0	0	0	0	0	0	0	0
75	0	0	0	0	0	0	0	0
76	0	0	0	0	0	0	0	0
77	0	0	0	0	0	0	0	0
78	0	0	0	0	0	0	0	0
79	0	0	0	0	0	0	0	0
80	0	0	0	0	0	0	0	0
81	0	0	0	0	0	0	0	0
82	0	0	0	0	0	0	0	0
83	0	0	0	0	0	0	0	0
84	0	0	0	0	0	0	0	0
85	0	0	0	0	0	0	0	0
86	0	0	0	0	0	0	0	0
87	0	0	0	0	0	0	0	0
88	0	0	0	0	0	0	0	0
89	0	0	0	0	0	0	0	0
90	0	0	0	0	0	0	0	0
91	0	0	0	0	0	0	0	0
92	0	0	0	0	0	0	0	0
93	0	0	0	0	0	0	0	0
94	0	0	0	0	0	0	0	0
95	0	0	0	0	0	0	0	0
96	0	0	0	0	0	0	0	0
97	0	0	0	0	0	0	0	0
98	0	0	0	0	0	0	0	0
99	0	0	0	0	0	0	0	0
100	0	0	0	0	0	0	0	0
Total	**2,389,546**	**107,419**	**2,496,965**	**2,331,014**	**0**	**0**	**0**	**0**

Notes

1 Includes all earthwork direct and indirect costs - Refer to Earthwork Cash Flow sheets from the S Stockpile_Tailing Earthwork cost estimate spreadsheets

2 Includes all revegetation and all other maintenance costs -Refer to Earthwork Cash Flow sheets from the S Stockpile_Tailing Earthwork cost estimate spreadsheets

3 Includes water management capital and capital removal costs - Refer to Water Management Summary and Water Management Worksheet #3

4 Includes routine maintanance and replacement O&M-Refer to Water Management Summary and Water Management Worksheet #3

Appendix E
Equations and Calculations

Attachment E.1
Earthwork RCE Calculation Summary

Calculation Documentation

Problem Statement:

Freeport-McMoRan (FMI) utilizes a spreadsheet developed by the New Mexico Mining and Minerals Division (MMD) to estimate the earthwork's closure costs associated with the Emma Closure/Closeout Plan (CCP). The spreadsheet calculations are intricate and complex and require careful study to master their structure. Each worksheet groups similar activities, and each line on each worksheet documents one construction step required to complete reclamation. All lines totaled equal the entire earthworks for the CCP. The sheer amount of information in the spreadsheet makes review of the cost estimate difficult for a complex site.

Objective:

1. Provide a guide to the earthwork spreadsheets.
2. Note that this calculation set presents the approach, data and assumptions, and calculations and results for developing the unit cost. It is intended to serve as a guide/example even if the actual quantities and/or cost data used in these calculations change due to updates or application to a different Freeport NM Operations mine. The example screenshots shown are from the Tyrone Mine CCP.

Approach:

1. Identify worksheets within the spreadsheet.
2. Provide a general equation or explanation of the calculation performed in each worksheet.
3. Use a graphic of each worksheet to illustrate the equations and augment the explanations pertaining to the specific worksheet.

Results:

The following worksheets are included within the earthwork RCE spreadsheet and covered in this calculation documentation:

Databases:

1. Quantities
2. Activity-Material Codes
3. Unit Rates
4. Equipment

Earthwork Calculations:

1. General
2. Demo
3. Material
4. Earthwork
5. Dozer
6. Road Maint
7. Ripper
8. Excavator
9. Trucks
10. Loader Shovel
11. Scrapers
12. M'grader
13. Earth Sum
14. Revegetation
15. Other
16. Summary
17. Facility Characteristics

Results:

The following worksheets are included within the earthwork RCE spreadsheet and covered in separate calculation documentations or are self-explanatory:

Equipment Optimization:

1. Truck Optimization

O&M:

1. Full Site Vegetation Maintenance
2. Full Site O&M
3. Full Site O&M Summary

Unit Costs:

1. Bench Grading
2. Bench Channel (and Riprap/Gravel)
3. Downdrain
4. Revegetation

Results Cont'd

Sheet 1 – General: A summary of the overall costs (before escalation and discounting for the time-value of money) are included on this sheet along with the applicant's information.

	A	B	C
1			Tyrone Mine
2			Stockpile Spreadsheet Worksheet #1
3	***General Information***		4/29/2019
4			
5	Applicant	Tyrone Mine Company	
6		Tyrone, New Mexico 88065	
7			
8			
9			
10			
11	Disturbed Surface Area (acres)	3,031	
12	*(does not include previously reclaimed areas)*		
13			
14	Type of Operation	Existing/Surface/Copper	
15			
16			
17			
18	*Current value of earthwork and O&M before escalation and discounting*	**$101,470,627**	
19			
20			
21			
22			
23			**Stockpiles, Tailing,**
24			**Reservoirs, Haul Roads**
25			**and Disturbed Areas**

Quantities Sheet: This sheet assigns an item code to a facility and corresponding sub-area code with a description of the facility and sub-area. This sheet provides raw data and factors (such as area, volume, distances, grades, etc.) to be used in calculations within all the other worksheets. Each facility is broken down into sub-areas to account for differing reclamation quantities to more accurately determine the amount of work required for each facility. The Quantities sheet includes 36 columns of hard-wired (hand entered) data associated with each facility. Columns A through H for 1A and 1B Leach, 1C, 2A Leach and 2B Waste, and 3A/3B Stockpiles are shown as an example:

	A	B	C	D	E	F	G	H
1								
2	1	2	3	4	5	6	7	8
3	**Item**	**Facility**	**Sub Area or Destination for Cover Material**	**Description**	**Area (sf)**	**Volume (cy)**	**Push Distance (ft) Berm Length (ft) or Fence Length(ft)**	**Coarse Regrading and Fine Grading (%)**
4	1000	1A and 1B Leach	1A1B-0	Entire Stockpile	11,891,880	1,548,670	-	-
5	1001	1A and 1B Leach	1A1B-1	Top	740,520	79,000	430	1.0%
6	1002	1A and 1B Leach	1A1B-2	Outslopes - Regrade benches from pullback	-	1,329,670	90	-29.0%
7	1003	1A and 1B Leach	1A1B-3	Outslopes - Area outside of pullback	11,151,360	140,000	250	-29.0%
8	1100	1C	1C-0	Top (Haul Road)	740,700	-	-	
9	1200	2A Leach and 2B Waste	2A2B-0	Entire Stockpile	21,213,358	8,203,000	-	-
10	1201	2A Leach and 2B Waste	2A2B-1	Top	1,568,160	143,000	370	1.0%
11	1202	2A Leach and 2B Waste	2A2B-2	Outslopes	19,845,198	8,060,000	470	-29.0%
12	1300	3A / 3B	3A3B-0	Entire Stockpile	19,819,800	5,289,064	-	-
13	1301	3A / 3B	3A3B-1	Top	1,437,480	199,000	560	1.0%
14	1302	3A / 3B	3A3B-2	Outslopes Pullback	-	17,500,000	-	-29.0%
15	1303	3A / 3B	3A3B-3	Outslopes - Regrade benches from pullback	-	1,590,064	90	-29.0%
16	1304	3A / 3B	3A3B-4	Outslopes (total area, volume outside of pullback)	18,382,320	3,500,000	560	-29.0%

For example use only. Values may not match the current spreadsheet.

Results Cont'd

Activity-Material Codes Sheet: This sheet assigns an activity code (column A) to each activity (column B)

	A	B	C
1	**Item**	**Activity**	**Description**
2	-	-	Place holder for item
3	A	Grade	Rough grading original material or fine grading cover material
4	B	Dozer Assist	Dozer is used to assist loader or shovel at cover stockpile or assist scrapers during rough grading
5	C	Load	Cover material is loaded at borrow areas onto haul trucks
6	D	Haul	Haul trucks transport cover material from borrow areas to destination stockpiles
7	E	Rip	Tops of stockpiles are ripped before placing cover to compensate for compaction of soil during rough grading. Stockpiles are also ripped before rough grading with a scraper. Borrow stockpile ripped
8	F	Grade Benches	Benches are graded at stockpiles and tailings after fine grading
9	G	Construct Downdrains	Downdrains are constructed after fine grading and consist of articulated concrete blocks (ACB's)
10	Gb	Construct Downdrain Dissipators	Energy dissipators are specified as part of the downdrains
11	H	Construct Bench Channels w/ Riprap	Bench channels are constructed along benches after bench grading. Construction includes excavation and wasting, riprap production, riprap and filter placement, and final grading.
12	Hb	Construct Bench Channels w/o Riprap	Bench channels are constructed along benches after bench grading. Construction includes excavation and wasting and final grading.
13	I	Construct Top/Outslope Channels	Top and outslope channels are not part of this RCE
14	J	Revegetate	Occurs after final grading and channel construction and includes tractor rental and maintenance, fuel, scarifying, discing, drill seeding, mulching, crimping, seed, and mulch
15	K	Perforate Liner	Reservoir liners are perforated prior to reclamation
16	L	Replace Infrastructure	Replacing infrastructure is not part of this RCE
17	M	Post-Closure O&M	Includes vegetation maintenance for 12 years after reclamation and erosion control, road maintenance, and groundwater monitoring for 100 years after reclamation
18	N	Plug and Abandon Well	Well borehole is backfilled with cement grout
19	O	Replace Well	Includes borehole drilling, casing, and cementing
20	P	Road Maintenance	Dust suppression and road maintenance with water truck and motor grader
21	Q	Construct Haul Road	For shorter hauls etc.
22	R	Construct Berms	Berming for stormwater runoff control
23	S	Fencing	Fencing for pits
24	T	Build Grade Control Walls	Grade control in each drainage of Tailing Launder Line removal
25	U	Vehicle Gates	Limited access at 1-mile intervals around open pits
26	V	Signs Every 500 ft	Warning signs posted every 500 feet around open pits

The same is done by assigning a material code (column A) to differentiate the materials used in the spreadsheet.

	A	B	C
28			
29	**Item**	**Material**	**Description**
30	-	-	Placeholder
31	a	Existing Ground	Existing ground before rough grading
32	b	Cover	Cover material from cover stockpiles, before being placed at destination location
33	c	Rough Graded Material	Exisiting ground after rough grading
34	d	Placed Cover	Cover material after being placed at destination location
35	e	Final Grade	Facility material and cover material after rough grading and fine grading
36	f	Backfill/Stockpile Material	Material used to backfill pit/ponds or stockpile material used in pullback
37			

These codes are used to assign an ID to each task, on the Materials sheet. The codes dictate which earthwork calculation is used for each row of work.

For example use only. Values may not match the current spreadsheet.

Results Cont'd

Unit Rates Sheet: This sheet applies the same concept as the Quantities and Activity-Material Codes sheets whereby unit rates for particular activities utilized in the development of costs within the spreadsheet are identified and assigned a unit rate code. The unit rates are used throughout the RCE spreadsheet and are referenced from this sheet.

	A	B	C	D	E	F	G
10	Code	Activity	Base Per Unit Cost	Fuel Per Unit Cost	Units	Source	Reference
11	U1	Fuel	$ 2.34	$ –	gal	-	Diesel fuel cost is estimated by correlating historical local quotes with public data, as agreed upon in November 2018 discussions with the agencies. Fuel cost
12	U2	Revegetation	$ 820.12	$ 3.85	ac	Revegetation Unit Cost Sheet	See unit rates calculations - Cost is based on a calculated unit rate that includes tractor rental and maintenance, fuel, scarifying, discing, drill seeding, mulching,
13	U3	Bench Grading Stockpile	$ 1.35	$ 0.33	ft	Bench Grading Unit Cost Sheet	See unit rates calculations
14	U4	Bench Grading Tailings Pond	$ 1.35	$ 0.33	ft	Bench Grading Unit Cost Sheet	See unit rates calculations
15	U5	Downdrain Construction	$ 374.38	$ –	ft	Downdrain Unit Cost Sheet	See unit rates calculations
16	U6	Downdrain Dissipater	$ 14,556.48	$ –	ea	Downdrain Unit Cost Sheet	See unit rates calculations
17	U7a	Bench Channel Construction w/	$ 6.60	$ 1.39	ft	N/A	See unit rates calculations
18	U7b	Bench Channel Construction w/o	$ 0.41	$ 0.10	ft	N/A	See unit rates calculations
19	U8	Erosion Control	$ 2,323.36	$ 382.26	day	Modified Crew B-13A	Erosion control for O&M - includes 1 foreman, 2 laborers, 1 equipment operator, 2 truck drivers, 1 loader (4 cy), 2 dump trucks (8 cy)
20	U9	Structure Demolition	$ 0.25	$ –	cf	Means Line Item 024116.13 0100	Building demolition, large urban projects, mixture of types, excludes foundation demolition, dump fees
21	U10	Concrete Slab Demolition	$ 0.62	$ –	sf	Means Line Item 024116.17 0400	Building footings and foundations demolition, floors, concrete slab on grade, plain concrete, 6" thick, excludes disposal costs and dump fees
22	U11	Storage Tank Demolition	$ 1,005.97	$ –	ea	Means Line Item 130505.75 0530	Selective Demolition - Storage Tanks, steel tank, single wall, above ground, not including foundations, pumps or piping, 5,000 thru 10,000 gallon
23	U12	Storage Tank Demolition	$ 2,168.93	$ –	ea	Means Line Item 130505.75-0540	Steel tank, single wall, above ground, 15,000 thru 30,000 gallon, selective demolition, excluding foundation, pumps or piping
24	U13	Storage Tank Demolition	$ 3,934.80	$ –	ea	Scaled Means Items	Storage Tanks, steel tank, single wall, above ground, not incl fdn, pumps or piping; scaled for a 45,500 gal tank
25	U14	Power Line Demolition	$ 0.63	$ –	ft	Means Line Item 260505.10 0370	in cost to overhead powerlines.
26	U15	Power Pole Demolition	$ 216.24	$ –	ea	Means Line Item 024113.80 0200	Selective Demolition - wood utility poles 35-45 ft high
27	U16	Pipeline (small HDPE pipe)	$ 2.29	$ –	ft	Means Line Item 024113.38 1700	excludes excavation
28	U17	Pipeline (medium HDPE pipe)	$ 3.82	$ –	ft	Means Line Item 024113.38 1800	excludes excavation
29	U18	Pipeline (large HDPE pipe)	$ 5.72	$ –	ft	Means Line Item 024113.38 1900	excludes excavation
30	U19	Well Plug & Abandon	$ 10.55	$ –	ft	N/A	Layne Christensen Company, 7/31/18 Tyrone estimate is $10,000 mobilization and demobilization plus $5,704.94 (escalated at 2% to $5819.04) for one 1500 ft well
31	U20	Well Replacement	$ 67.76	$ –	ft	N/A	Wilcox Professional Services, 8/2011, est. cost for 5 ½ in bore, $173,500 for 3000 ft total ($57.83/ft). Escalated 2% 2011-2019= $67.76/ft
32	U21	Reinforced Concrete Wall Demolition	$ 199.20	$ –	hr	Means Crew B-12C	Standard Union Crew: 1 equipment operator (crane), 1 laborer, 1 hydraulic excavator, 2 cy, approximately 40 hrs to demo 200 ft reinforced concrete dam.
33	U22	Disc harrow attachment, for tractor	$ 616.33	$ –	month	Means Line Item 015433.20 1500	Equipment rental costs
34	U23	Cast-In-Place Concrete	$ 254.97	$ –	cy	Means Line Item 033053.40 6200	reinforcement
35	U24	Cleanup & Disposal of Wastes Requiring Special Handling	$ 335.20	$ –	ton	Means Line Item 028120.10 1120/1130	Solid pickup; average of minimum and maximum
36	U25	Tranportation of Wastes Requiring Special Handling	$ 4.78	$ –	mile	Means Line Item 028120.10 1260/1270	Transporation to disposal site (Truckload = 80 drums or 25 cy or 18 tons); average of minimum and maximum
37	U26	Road Maintenance	$ 4,945.96	$ 1,240.32	month		water truck
38	U27	Tailing Cover Maintenance	$ 2,144.29	$ 269.57	day	Modified Crew B-13A	1 dump truck (12 ton)
39	U28	Berming	$ 0.06	$ –	ft		per ft. to 0.13 cy/ft; Finish grade volume is 1/3 X "Excavation Volume" or 0.04 ft/ft; The berm will be made from cover material; only applicable to the types of berms at the reclaimed borrow areas - These berms are only used to move water along an
40	U29	Fencing	$ 23.05	$ –	ft	Means Line Item 323113.20 0800	
41	U30	Vehicle Gates, Pit Perimeters	$ 1,002.88	$ –	ea	Means Line Item 323113.20 5070	Fence, chain link industrial, double swing gates, 6' high, 20' opening, includes excavation, posts & hardware in concrete
42	U31	Signs every 500 ft., pit perimeters	$ 65.19	$ –	ea	Means Line Item 101453.20 0600	Signs; guide and directional signs, reflectorized, 12" x 18", excludes posts
43	U32	Fire Hydrant Demolition	$ 396.73	$ –	ea	Means Line Item 024113.33 0900	Utility removal, hydrants, fire, remove only, excludes hauling
44	U33	Seepage Collection Replacement	$ 133,355.94	$ –	ea	Seepage Collection Unit Cost Sheet	See unit rates calculations
45	U34	Culvert Removal	$ 12.69	$ –	ft	Means Line Item 024113.40 0180	excludes excavation
46	U35	Grade Control Wall	$ 165.59	$ –	cy	Means Line Item 033053.40 3945	deep, unreinforced, includes forms(4 uses), concrete (Portland cement Type I), placing and finishing, excludes reinforcing
47	U36	Steel Trestle Demolition	$ 30,689.10	$ –	ea	Means Line Item 024116.33 0200	Bridge demolition, pedestrian, steel, 50' to 160' long, 8' to 10' wide
48	U37	Sludge Removal	$ 306.69	–	ea	Means Line Item 026510.30 0320	remove sludge, water and remaining product from tank bottom of tank with vacuum truck, 9,000 - 12,000 gallon tank
49	U38	Substation Demo	$ 12,470.55	$ –	ea	Substation Demo Unit Cost	See unit rates calculations

Unit rates are either derived from separate calculations, RSMeans pages, or direct quotes. The unit costs are broken into base per unit cost (column C) and fuel per unit cost (column D) when applicable. If a unit cost is obtained from RSMeans, the Las Cruces, New Mexico, area cost is utilized.

For example use only. Values may not match the current spreadsheet.

Results Cont'd

Equipment Sheet: This sheet assigns a code to the various types of heavy equipment (bulldozers, wheeled loaders, excavators, etc.) used for mine closure activities. It also delineates a multitude of equipment costs and factors as well as labor costs based on the 2019 New Mexico Department of Labor hourly labor rates associated with each piece of equipment.

Equipment Code

Rental & Operating Equipment Costs

See Dozer sheet (Sheet 5) for development of the Productivity Equation

$$\textbf{Productivity} = C * (Distance^{b})$$

C = Multiplier Constant and b = Exponent Constant

EARTHWORK AND O&M EQUIPMENT

Code	Equipment Description	Equipment Type	Fuel Consumption (gal/hr)	Fuel Cost ($/hr)	Lube Cost ($/hr)	Field Parts ($/hr)	Tire Cost ($/hr)	Ground Engaging Component Cost ($/hr)	Monthly Rental Rate ($/month)	Field Labor Time Cost ($/hr)	Rental Cost (w/o fuel, lube, tires, or field parts) ($/hr)[1]	Equip. Tires Dec. & Field Parts Adjusted Rental Cost (w/o fuel) ($/hr)	Dozing Production (lb/min)[2] Production = C(avg. dozing distance in ft)^b C	b
Comb1	Cat 14M, Off-Hwy Water Tanker Truck,6,000-gal	Combo 1	19.54	$ 45.72	$ 12.72	$ 3.75	$ 13.46	$ 1.16	$ 20,078.37	$ 8.23	$ 114.08	$ 154.40	-	-
Dz1	Cat D11T, U Blade	Dozer	29.75	$ 69.62	$ 26.23	$ 13.89	$ -	$ 12.22	$ 34,408.41	$ 8.60	$ 195.50	$ 264.44	158,861.60	-0.866861
Dz2	Cat D11T CD, U Blade	Dozer[2]	29.75	$ 69.62	$ 26.23	$ 13.89	$ -	$ 12.22	$ 34,408.41	$ 8.60	$ 195.50	$ 264.44	162,768.78	-0.866861
Dz3	Cat D9T, SU Blade	Dozer	14.35	$ 33.58	$ 11.22	$ 5.49	$ -	$ 3.98	$ 30,109.48	$ 9.60	$ 171.08	$ 198.37	52,161.03	-0.8455132
Dz4	Cat D6T, SU Blade	Dozer	7.22	$ 16.89	$ 4.83	$ 2.10	$ -	$ 2.10	$ 8,939.42	$ 3.83	$ 50.79	$ 53.65	13,582.45	-0.74851
Dz5	Cat D6T XL, SU Blade	Dozer	7.80	$ 18.25	$ 5.28	$ 2.32	$ -	$ 2.36	$ 9,104.55	$ 3.83	$ 51.73	$ 55.62	13,582.45[1]	-0.74851
Ex1	Cat 319D L	Excavator	5.25	$ 12.29	$ 3.47	$ 1.19	$ -	$ 0.94	$ 7,450.15	$ 4.55	$ 42.33	$ 52.26	-	-
Ld1	Cat 992K	Loader	25.51	$ 59.97	$ 22.05	$ 4.43	$ 35.39	$ 4.98	$ 25,527.98	$ 4.02	$ 145.05	$ 218.21	-	-
Ld2	Cat 988H	Loader	15.20	$ 35.57	$ 11.40	$ 2.11	$ 15.85	$ 1.93	$ 16,272.05	$ 4.02	$ 92.45	$ 128.76	-	-
Ld3	Cat 980H	Loader	10.90	$ 25.27	$ 8.70	$ 1.12	$ 7.58	$ 1.03	$ 19,039.76	$ 4.02	$ 56.99	$ 77.56	-	-
Ld4	Cat 966H	Loader	8.38	$ 19.61	$ 5.33	$ 0.84	$ 5.71	$ 0.75	$ 9,937.50	$ 4.02	$ 55.46	$ 73.11	-	-
Ld5	Cat 993K	Loader	30.40	$ 71.14	$ 26.70	$ 5.32	$ 42.47	$ 4.73	$ 25,027.98	$ 4.02	$ 145.05	$ 228.29	-	-
Mg1	Cat 16M	Motor Grader	9.50	$ 22.23	$ 8.69	$ 3.26	$ 10.13	$ 1.76	$ 11,905.70	$ 2.02	$ 67.65	$ 93.51	-	-
Mg2	Cat 14M	Motor Grader	8.29	$ 19.40	$ 6.57	$ 2.27	$ 7.04	$ 1.16	$ 11,905.70	$ 2.02	$ 67.65	$ 88.71	-	-
Rp1	Cat D11T CD Multi-shank (w/ MSR-359H)	Ripper	29.75	$ 69.62	$ 26.60	$ 14.20	$ -	$ 1.56	$ 36,793.56	$ 8.16	$ 208.83	$ 259.15	-	-
Sc1	Cat 637G	Scraper	38.00	$ 88.92	$ 17.97	$ 5.27	$ 7.57	$ 1.28	$ 25,070.00	$ 12.80	$ 142.44	$ 197.43	-	-
Sc2	Cat 657G	Scraper	42.86	$ 100.29	$ 20.41	$ 7.73	$ 9.34	$ 2.31	$ 26,070.00	$ 12.80	$ 142.44	$ 199.01	-	-
Sh1	Hitachi EX3600-5	Shovel[2]	82.72	$ 193.56	$ 59.15	$ 24.25	$ -	$ 16.56	$ 69,259.00	$ 14.45	$ 393.57	$ 507.98	-	-
Tc1	Deere 7430	Tractor	5.98	$ 13.99	$ 2.84	$ 0.61	$ 2.42	$ -	$ 5,210.05	$ 2.53	$ 29.60	$ 38.00	-	-
Tk1	Komatsu HD-1500 5	Truck[3]	28.12	$ 65.80	$ 19.90	$ 1.79	$ 25.19	$ -	$ 25,211.93	$ 7.47	$ 143.25	$ 197.60	-	-
Tk2	Cat 769D	Truck	9.74	$ 22.79	$ 8.77	$ 1.48	$ 13.72	$ -	$ 14,042.50	$ 4.25	$ 79.79	$ 108.01	-	-
Tk3	Cat 725	Truck	6.02	$ 14.09	$ 5.74	$ 0.94	$ 7.11	$ -	$ 9,849.60	$ 3.36	$ 55.86	$ 73.11	-	-
Tk4	Komatsu 730E	Truck[4]	33.48	$ 78.34	$ 20.49	$ 1.80	$ 21.21	$ -	$ 29,356.98	$ 11.49	$ 166.80	$ 221.79	-	-
Tk5	Cat 777F	Truck	18.76	$ 43.90	$ 10.31	$ 3.03	$ 26.81	$ -	$ 58,160.00	$ 6.38	$ 319.00	$ 374.62	-	-
Tw1	Off-Hwy Water Tanker Truck,6,000-gal.	WaterTruck	11.25	$ 26.33	$ 6.15	$ 1.48	$ 6.42	$ -	$ 8,171.67	$ 7.21	$ 46.43	$ 67.64	-	-
Tw2	Off-Hwy Water Tanker Truck,10,000-gal.	WaterTruck	15.43	$ 36.11	$ 9.04	$ 2.43	$ 10.47	$ -	$ 12,849.87	$ 10.30	$ 73.58	$ 105.62	-	-
X1	2 Deck Screening Plant (5X16, 48X60)	ScreenPlant	4.85	$ 11.35	$ 2.39	$ 1.15	$ 0.40	$ -	$ 5,738.88	$ 4.46	$ 32.61	$ 41.01	-	-
X2	3 Deck Screening Plant (5X16, 48X60)	ScreenPlant	4.85	$ 11.35	$ 2.43	$ 1.24	$ 0.39	$ -	$ 5,994.24	$ 4.62	$ 34.06	$ 42.74	-	-
X3	1 Deck Screening Plant (5X16, 48X60)	ScreenPlant	4.85	$ 11.35	$ 2.37	$ 1.14	$ 0.39	$ -	$ 5,671.66	$ 4.46	$ 32.23	$ 40.56	-	-
X4	3 Deck Screening Plant (5X16, 42X60)	ScreenPlant	4.85	$ 11.35	$ 2.38	$ 1.16	$ 0.37	$ -	$ 5,743.38	$ 4.62	$ 32.53	$ 41.19	-	-

The equipment sheet also contains the production equation coefficients for dozing (columns N-O) and scraper haul travel time coefficients (columns P-AI)

See Trucks sheet (Sheet 9) for development of the Haul Travel Time Equation

Haul Travel Time (min/m) $= A(\text{Eff. Grade }\%)^4 + B(\text{Eff. Grade }\%)^3 + C(\text{Eff. Grade }\%)^2 + D(\text{Eff. Grade }\%) + E$

where effective grade is the sum of the measured grade and rolling resistance

EARTHWORK AND O&M EQUIPMENT

Code	Equipment Description	Equipment Type	Haul Travel Time (min/m) = A(Eff. Grade %)^4 + B(Eff. Grade %)^3 + C(Eff. Grade %)^2 + D(Eff. Grade %) + E																				
			Loaded Uphill					Empty Uphill					Loaded Downhill					Empty Downhill					
			A	B	C	D	E	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E	
Comb1	Cat 14M, Off-Hwy Water Tanker Truck,6,000-gal.	Combo 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Dz1	Cat D11T, U Blade	Dozer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Dz2	Cat D11T CD, U Blade	Dozer[2]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Dz3	Cat D9T, SU Blade	Dozer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Dz4	Cat D6T, SU Blade	Dozer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Dz5	Cat D6T XL, SU Blade	Dozer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Ex1	Cat 319D L	Excavator	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Ld1	Cat 992K	Loader	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Ld2	Cat 988H	Loader	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Ld3	Cat 980H	Loader	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Ld4	Cat 966H	Loader	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Ld5	Cat 993K	Loader	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Mg1	Cat 16M	Motor Grader	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Mg2	Cat 14M	Motor Grader	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Rp1	Cat D11T CD Multi-shank (w/ MSR-359H)	Ripper	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Sc1	Cat 637G	Scraper	3.2483	-1.9562	0.4337	-0.0026	0.001	0	-0.3247	0.1601	-0.0038	0.0011	0.6464	-0.6147	0.1749	-0.0004	0.0011	0	0	0.0367	0.0018	0.0009	
Sc2	Cat 657G	Scraper	0.3036	-0.4512	0.2181	-0.0034	0.0013	0	-0.1016	0.0774	-0.0013	0.0012	0	-0.1612	0.1031	-0.0081	0.0016	0	0.1668	-0.094	0.0207	0.0004	
Sh1	Hitachi EX3600-5	Shovel[2]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Tc1	Deere 7430	Tractor	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Tk1	Komatsu HD-1500 5	Truck[3]	4.494	-2.4571	0.6319	-0.0051	0.0011	0	-0.2561	0.1351	-0.0004	0.001	0	0	0.0856	0.0135	0.0009	0	0	0	0.0143	0.0005	
Tk2	Cat 769D	Truck	0.5429	-0.487	0.1823	0.0151	0.0007	0	0.0224	-0.0076	0.0141	0.0007	0	0	-0.0808	0.426	-0.0008	5.6146	-3.6353	0.7823	-0.0535	0.002	
Tk3	Cat 725	Truck	0.1363	0.1636	-0.04	0.0342	0.0009	0	-0.024	0.0309	0.0099	0.001	0	2.5262	-0.7562	0.095	-0.002	0	0	0	0.0103	0.0009	
Tk4	Komatsu 730E	Truck[4]	7.5599	-2.711	0.4209	0.005	0.0011	0	-0.0689	0.0501	0.0052	0.001	-	-1.1878	0.325	0.0042	0.001	-3.4907	2.4171	-0.55	0.0643	-0.0011	
Tk5	Cat 777F	Truck	6.43	-3.2933	0.6548	-0.005	0.0009	0	-0.0197	0.0276	0.011	0.0008	2.147	-1.9812	0.5102	-0.0158	0.0009	0.7651	-0.3831	0.0898	-0.001	0.0008	
Tw1	Off-Hwy Water Tanker Truck,6,000-gal.	WaterTruck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Tw2	Off-Hwy Water Tanker Truck,10,000-gal.	WaterTruck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
X1	2 Deck Screening Plant (5X16, 48X60)	ScreenPlant	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
X2	3 Deck Screening Plant (5X16, 48X60)	ScreenPlant	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
X3	1 Deck Screening Plant (5X16, 48X60)	ScreenPlant	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
X4	3 Deck Screening Plant (5X16, 42X60)	ScreenPlant	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Results Cont'd

Equipment Sheet cont'd:

Other equipment specifications listed in the equipment sheet can also be found in the RCE report. It is important to note that each piece of equipment is assigned an operator group by which labor rates are assigned according to the most up to date labor rates from NMDOL.

50		**EARTHWORK AND O&M LABOR**	
51		NMDOL Type A	Rate
52		Operator Group	($/hr)
53		Equipment Operator IV	$ 27.41
54		Equipment Operator V	$ 27.52
55		Equipment Operator VI	$ 27.70
56		Laborer I	$ 23.09
57		Laborer II	$ 23.84
58		Truck Driver III	$ 24.27

Sheet 2 – Demolition: Costs are based on square footage (ex: buildings), linear footage (ex: pipeline or power line length), or lump sum per item (ex: power pole, well casing). The costs are derived from the 2019 R.S. Means Online Heavy Construction cost data or actual on-site experience and bids.

Example calculation: (10,300 feet of powerline) x ($0.63 per linear foot)=$6,489

Tyrone Mine
Stockpile Spreadsheet Worksheet #2
4/29/2019

Demolition

Building Demolition costs are calculated in "1 BuildingDemo", "2 BuildingCover", "3 BuildingVeg", and "4BuildingWaste" and summarized on the last line of this table.

Item	Activity	Quantity	Unit	Unit Cost ($/unit)	Direct Item Cost ($)	Reference	Means Line Item	Description
Power line Demolition (3 PLS to 1x1 Pond installed 2012)	-	10,300	ft	$0.63	$6,489	Means	Means Line Item 260505.10 0370	Nonmetallic sheathed cable 3 wire; assume similar enough in cost to overhead power lines.
Power pole Demolition (3 PLS to 1x1 Pond installed 2012)	-	36	ea	$216.24	$7,785	Means	Means Line Item 024113.80 0200	wood utility poles 35-45 feet high
Power line Demolition (San Salvador Pit)	-	5,222	ft	$0.63	$3,290	Means	Means Line Item 260505.10 0370	Nonmetallic sheathed cable 3 wire; assume similar enough in cost to overhead power lines.
Power pole Demolition (San Salvador Pit)	-	17	ea	$216.24	$3,676	Means	Means Line Item 024113.80 0200	wood utility poles 35-45 feet high
Power lines to substations or spurs for buildings to be demolished	-	66,200	ft	$0.63	$41,706	Means	Means Line Item 260505.10 0370	Nonmetallic sheathed cable 3 wire; assume similar enough in cost to overhead power lines.
Power Poles to substations or spurs for buildings to be demolished	-	135	ea	$216.24	$29,192	Means	Means Line Item 024113.80 0200	wood utility poles 35-45 feet high
Telephone Lines around buildings to be demolished	-	1,400	ft	$0.63	$882	Means	Means Line Item 260505.10 0370	Nonmetallic sheathed cable 3 wire; assume similar enough in cost to overhead power lines.
Light Poles around to be demolished buildings	-	13	ea	$216.24	$2,811	Means	Means Line Item 024113.80 0200	wood utility poles 35-45 feet high
Fire Hydrants Mainly by SXEW	-	14	ea	$396.73	$5,554	Means	Means Line Item 024113.33 0900	Minor Site Demolition; remove fire hydrants
Little Rock Dewatering Pipeline Alighnment #1 and #2 (Year 34 of Closure)	6"-8" Diameter Plastic	4,940	ft	$1.88	$9,266	-	-	See Pipeline UC
Water Treatment Pipelines (Year 99 of Closure)	assume 20-36-inch diameter	74,500	ft	$4.57	$340,282	-	-	See Pipeline UC
Sewer Pipelines (Year 6 of Closure)	assume 20-36-inch diameter	1,414	ft	$4.57	$6,459	-	-	See Pipeline UC
PLS Pipelines (Year 6 of Closure)	assume 20-36-inch diameter	18,893	ft	$4.57	$86,295	-	-	See Pipeline UC
2A East PLS Tank and 2A West PLS Tank (Year 6 of Closure)	Tank Demolition	2	ea	$3,934.80	$7,870	Means	Scaled Means Items	Storage Tanks, steel tank, single wall, above ground, not incl fdn, pumps or piping, 15,000 thru 30,000; scaled for a 45,500 gal tank - assuming 22 ft diameter and 16 ft high
1A and 1B PLS Tanks (Year 99 of Closure)	Tank Demolition	2	ea	$3,934.80	$7,870	Means	Scaled Means Items	Storage Tanks, steel tank, single wall, above ground, not incl fdn, pumps or piping, 15,000 thru 30,000 gal; scaled for a 45,500 gal tank - assuming 22 ft diameter and 16 ft high
Culverts at Tailing Launder Line	Culvert Removal	22	ea	$12.69	$279	Means	Means Line Item 024113.40 0190	Selective demolition, metal drainage piping, CMP, steel, 48"-60", diameter, excludes
Steel Trestle at Tailing Launder Line	Steel Trestle Demo	1	ea	$30,689.10	$30,689	-	-	Bridge demolition, pedestrian, steel, 50' to 160' long, 8' to 10' wide
Substation Removal at Mangus Pumphouse	Substation Demo	1	ea	$12,470.55	$0	-	-	See Substation Demo UC
Buildings and Associated Facilities	Demolition	See Demo Sheets	-	-	$4,499,228	-	-	-
				Total Direct Cost:	$5,089,622			

For example use only. Values may not match the current spreadsheet.

Results cont'd:

Sheet 3 – Material: No calculations are included on this sheet. Four codes, which can be referenced from the Quantities, Activity-Material Codes, and Equipment or Unit Rates sheets, are entered by hand for each row in Columns A – D. The column labeled ID concatenates the codes. The ID contains the codes for facility location (with sub-area if applicable), work activity, material and equipment used for that particular row of work. This combination determines which equipment production and cost equations are used in the rest of the spreadsheet. The other columns on this sheet then reference the ID to lookup the description from the Activity Material Codes sheet, the source and destination locations from the Quantities sheet, the total haul or push distance and grade from the Quantities sheet, and the equipment (when applicable) from the Equipment sheet.

All activities for the Tyrone RCE are listed on this sheet and carried through the succeeding worksheets of the RCE. The description (F123) lists the activity, top or outslope (if applicable), and the material. The source location (G123) lists the stockpile name (or sub-area) for the location of the activity. If borrow material is involved, it is transported from a borrow stockpile to a destination stockpile (H123). Push or haul distance (I123) is used as part of calculating equipment production on Sheets 5, 9, and 11. Grade (J123 - haul grade or facility slope) is used as part of calculating equipment production on Sheets 5, 9, 11, and 12. Equipment (K123) lists the name of the equipment referenced in the ID. Blank cells indicate that that column is not relevant to a particular activity.

The ID for the example below is 1300-D-b-Tk4. This indicates that a Komatsu 730E truck (Tk4) will be used to haul (D) cover material (b) from the Gila Borrow Area to the 3A/3B (1300). The total haul distance from STS2 to the Raffinate Pond is 11,221 feet, with an average haul grade of 1.3%.

2300-Facility and 23-Sub-area

D-Activity and b-Material

Tk4-Equipment to be used

Tyrone Mine
Stockpile Spreadsheet Worksheet #3
4/29/2019

Material Handling Plan Summary Sheet

All activities for the Tyrone RCE are listed on this sheet and carried through the succeeding worksheets of the RCE. The column labeled ID contains the codes for the facility location, activity, material and equipment used for that particular row of work. The description lists the activity, top or outslope (if applicable), and the material. The source location lists the stockpile name (or sub-area) for the location of the activity. If borrow material is involved, it is transported from a borrow stockpile to a destination stockpile. Blank cells indicate that that column is not relevant to a particular activity.

Notes and Assumptions:

1 - Haul/Push Distance based on 2015 Tyrone RCE Submittal or measured/assumed as shown in documentation
2 - Weighted Average Haul Grades based on 2015 Tyrone RCE Submittal
3 - Grade Factors from 2015 Tyrone RCE Submittal
4 - Cover haul distance for 2A/3B stockpile is volume-weighted average of Gila Borrow Area (1/3) & 9AX Stockpile (2/3)

	Item	Activity	Material	Eq	ID	Description	Source Location 1	Destination Location 2	Total Haul/Push Distance (ft)[1]	Grade (%)[2,3]	Equipment
123	1300	D	b	Tk4	1300-D-b-Tk4	Haul-Cover	Gila Borrow Area	3A / 3B	11,221	1.3%	Komatsu 730E
124	1500	D	b	Tk4	1500-D-b-Tk4	Haul-Cover	Gila Borrow Area	5A Overburden	4,750	1.9%	Komatsu 730E
125	2200	D	b	Tk4	2200-D-b-Tk4	Haul-Cover	Leach Stockpile	San Salvador Pit	12,570	1.8%	Komatsu 730E
126	2300	D	b	Tk4	2300-D-b-Tk4	Haul-Cover	Gila Borrow Area	Savanna In-Pit Leach Stockpile	5,730	1.6%	Komatsu 730E
127	1400	D	b	Tk4	1400-D-b-Tk4	Haul-Cover	Gila Borrow Area	4C Leach	17,830	5.0%	Komatsu 730E
128	1800	D	b	Tk4	1800-D-b-Tk4	Haul-Cover	Gila Borrow Area	2C, 4A, 4B, 7B Leach	13,990	3.9%	Komatsu 730E
129	1900	D	b	Tk4	1900-D-b-Tk4	Haul-Cover	Gila Borrow Area	6C	5,730	1.6%	Komatsu 730E
130	1600	D	b	Tk4	1600-D-b-Tk4	Haul-Cover	Gila Borrow Area	6B	10,050	2.0%	Komatsu 730E
131	1700	D	b	Tk4	1700-D-b-Tk4	Haul-Cover	Gila Borrow Area	6C	11,633	2.5%	Komatsu 730E
132	2701	D	b	Tk4	2701-D-b-Tk4	Haul-Cover	Gila Borrow Area	Cntmnt-1	10,811	2.9%	Komatsu 730E
133	3300	D	b	Tk4	3300-D-b-Tk4	Haul-Cover	Gila Borrow Area	Unplanned Disturbance Area	10,811	2.9%	Komatsu 730E
134	2100	D	b	Tk4	2100-D-b-Tk4	Haul-Cover	9AX Stockpile Toe	9AX	6,343	7.7%	Komatsu 730E
135	2600	D	b	Tk2	2600-D-b-Tk2	Haul-Cover	9AX Stockpile	Tailing Launder Line	17,721	-1.8%	Cat 769D
136	2300	D	b	Tk2	2300-D-b-Tk2	Haul-Cover	Tailing Launder Line	Mangus Pumphouse	14,100	-1.8%	Cat 769D

For example use only. Values may not match the current spreadsheet.

Results cont'd:

Sheet 4 – Earthwork: Repeats the ID, Description, Source Location, and Destination Location for each row from the Materials sheet. The acreage (I123), cover depth (J123), swell factor (L123), and loose/stockpile volume (M123) are referenced from the Quantities sheet. The in-place (i.e., bank) volume (K123) is calculated from the loose/stockpile volume by dividing by the swell factor. Swell is assumed to occur when cover material is moved from the borrow stockpile to the haul truck. Material left in place is assumed to have no swell, meaning the bank and loose volumes are equal.

$$Volume_{se_cve} = area * depth_{cve}$$

I325*J325/12*43560/27

	E	F	G	H	I	J	K	L	M
1									Tyrone Mine
2									Stockpile Spreadsheet Worksheet #4
3	*Earthwork Quantity Worksheet*								04/29/19
4									
5	**Notes and Assumptions:**								
6	1 - Acres and volumes based on 2015 Tyrone RCE Submittal								
7	2 - Cover Material Swell: The 'Loose Volume' is calculated based on the acreage to be covered, cover depth, and accounts for appropriate swell factor.								
8	3 - No swell factor for Tyrone								
9	4 - Has been agreed upon with State agencies that swell occurs when cover material is moved from source to haul truck but not from the truck to placement on stockpile								
10									
11									
12									
13									
14	ID	Description	Source Location 1	Destination Location 2	Area (ac)[1]	Cover Depth (in)	Bank/Stockpile Volume (bcy)[1,4]	Swell Factor (%)[3]	Loose/Stockpile Volume (lcy)[2]
123	1300-D-b-Tk4	Haul-Cover	Gila Borrow Area	3A / 3B	455.0	36	2,039,074	8%	2,202,200

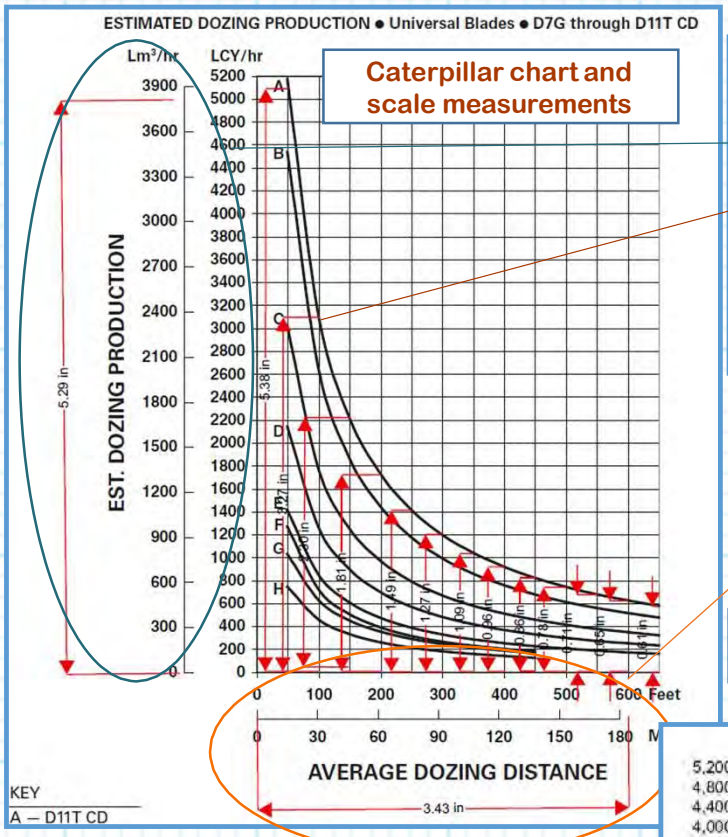
M325/(1+L325)

$$Volume_{bk} = \frac{Volume_{se}}{(1 + F_{swe})_{bk}}$$

Sheet 5 – Dozer: Dozers are used for rough grading facilities, assisting loaders or shovels at borrow stockpiles, or pushing scrapers for grading facilities. See page 11 of this calculation documentation for a screenshot of the Dozer sheet. Columns E through K repeats ID, activity, locations, equipment from Sheet 3 (Material) and volumes from Sheet 4 (Earthwork). Columns O, P, and Z are the results of the dozer productivity calculations for grading (the multiplier and exponent coefficients C and b, respectively, for the normal productivityequation can be found in columns N and O of the Equipment sheet). Column T is the calculated task time. If the task is for dozer assist of scrapers or loaders/shovels, the dozer task time is equal to the task time of the scraper or loader/shovel, respectively. Columns Q, R, and S are calculated on the scraper and loader sheets and repeated on the dozer sheet. The remaining columns are the input factors that produce the calculation result of bulldozer material handling productivity in cubic yards per hour or acres per hour based on material weight, grade, dozing type, push distance, and operating conditions such as visibility, operator experience, and elevation.

Results cont'd:

Sheet 5 – Dozer cont'd: Input values, power curves and capacities are taken from the 2017 and 2018 Caterpillar (Cat) Performance Handbook (CPH) (Editions 47 and 48) for the specific model dozer. Determining actual productivity starts by calculating the *normal* production factor using a formula derived by curve fit to productivity graphs provided in the CPH for the specific dozer. This is accomplished by scaling values from the figures and using the curve fitting tools within Microsoft Excel:

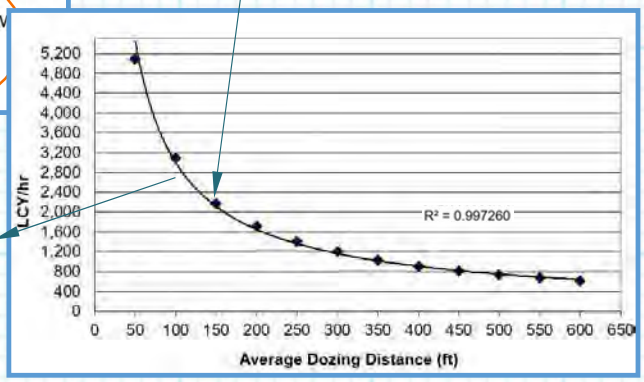


Caterpillar chart and scale measurements

	A	B	C	D	E	F	G	H
1	D11T CD							
2	Dozer production data (based on Caterpillar Handbook)							
3						PDF		
4	Maximum					Caterpillar Image Conversions		
5	Push	Adobe	Normal			Scaled Value (in)	Chart Value	
6	Distance	Measuremen	Production			5.29	5000	LCY
7	(feet)	(in)	(cy/hr)			3.43	600	Ft
8								
9	50	5.38	5,085					
10	100	3.27	3,091					
11	150	2.3	2,174					
12	200	1.81	1,711					
13	250	1.49	1,408					
14	300	1.27	1,200					
15	350	1.09	1,030					
16	400	0.96	907					
17	450	0.86	813					
18	500	0.78	737					
19	550	0.71	671					
20	600	0.65	614					
21	650	0.61	577					

=B10/F6*G6

Graph these two columns and find best fit equation



$$Productivity = 159{,}372.008958 * Distance_{sh}^{-0.862481}$$

For example use only. Values may not match the current spreadsheet.

Results cont'd:

Sheet 5 – Dozer cont'd: The *normal* production curves assume a flat surface with a pushed material density of 2,300 lb/cy and a material that is not loose. To account for slope, operator experience, equipment specifications, and other site-specific factors, the CPH modifies the normal production curve by multiplying various factors to obtain the overall productivity:

Productivity and Hours Required for Dozer Use---Earthmoving

Notes and Assumptions:

Uses volumes of outslope sections and dam breaches to calculate productivity
Uses push distances of outslope sections for grading productivity
Uses scraper push cycle time for dozer assist with scraper
Uses loader cycle time for dozer assist with loader at cover stockpiles
Grade Factor = -0.02(Grade %) + 1
May filter on equipement (D14) to show pertinent rows

Number of Dozers per Assist = 1
2 dozers per assist at 3A/3B and San Salvador Pit (manually entered)

ID	Task Description	Source Location 1	Destination Location 2	Equipment	Type of Equipment to Assist (ID)	Type of Equipment to Assist (Name)	Number of Dozers per Assist	Loose /Stockpile Volume (cy)	Area (ac)	Productivity (cy/hr)	Productivity (ac/hr)
1502-A-a-Dz2	Grade-Outslopes-Existing Ground	5A Overburden	-	Cat D11T CD	--	--	--	6,300,000	308	768	-

Tyrone Mine
Stockpile Spreadsheet Worksheet #5
04/29/19

$$Production_{normal} = C * Distance^{b}_{sh}$$

Scraper Pusher Cycle Time (min)	Cycles per Scraper per Hr	Loader/ Shovel/ Excavator Cycle Time	Total Task Time (hrs)	PERFORMANCE FACTORS Material Factor	Grade Factor	Material Weight (lb/cy)	Production Method/ Blade	Centroid to Centroid Push Distance (ft)	Normal Production (cy/hr)	Effective Blade Width (ft)	Speed (mph)	Operator Factor	Work Hour (min/hr)	Visibility Factor	Elevation Factor	Direct Drive Trans.	Cut to Fill Haul Grade (%)
-	-	-	8,204.8	1.0	1.6	3,300	1.2	540	697	22	3	1.00	50	1.0	1.0	1.0	-23%

$$Productivity\left(\frac{cy}{hr}\right) = F_{tf} * F_{gde} * F_{pd-eth\,d} * F_{pet} * F_{visibility} * F_{eev} * F_{dive} * \frac{WorkHour}{60min/hr} * \frac{2{,}300\ lb/cy}{Mat\ l\ Weight} * Production$$

=U39*V39*X39*AC39*AE39*AF39*AG39*(AD39/60)*(2300/W39)*Z39

Sheet 6 –Road Maint: This sheet calculates the time required for a water truck and motor grader to be used for dust suppression and site maintenance during earthwork reclamation. Columns E through I repeats ID, activity, locations, and equipment. The Operational Maintenance Time (Column J) is assumed to be equal to the loader/shovel task time.

Tyrone Mine
Stockpile Spreadsheet Worksheet #6
04/29/19

Productivity and Hours Required for Dust Suppression and Road Maintenance

Notes and Assumptions:

6,000 gal water truck and 14M motor grader for dust suppression and site maintenance (water truck hours and 14M hours tied to loading time for cover material)
May filter on equipement (D14) to show pertinent rows

Sheet to which to tie hrs 10 Loader Shovel
Equipment for hrs Sh1
Equipment for hrs Ld2

ID	Task Description	Source Location 1	Destination Location 2	Equipment	Operational Maintenance Time
1000-P-b-Comb1	Road Maintenance	Gila Borrow Area	1A and 1B Leach	Cat 14M, Off-Hwy Water Tanker Truck,6,000-gal.	423

Equals loading time on Loader/Shovel sheet

For example use only. Values may not match the current spreadsheet.

Results cont'd:

Sheet 7 – Ripper: Rippers are used after rough grading, before placing cover, at all facilities (or before revegetation at borrow stockpiles) to promote revegetation. Rippers are also used to loosen the existing ground before rough grading with scrapers. Columns E through J repeat the ID, title of the activity, locations, equipment and areas from Sheets 3 & 4. Columns K and L are the results of the dozer ripper productivity calculations. The remaining columns are the inputs that allow the calculation of bulldozer ripper productivity in acres per hour based on ripper performance factors:

Tyrone Mine
Stockpile Spreadsheet Worksheet #7
04/29/19

Productivity and Hours Required for Ripper---Equipped Dozer Use

Notes and Assumptions:
Uses area to calculate task time
88 ft/min = 1 mph
May filter on equipement (D14) to show pertinent rows
Task time is less than 1 hour for areas smaller than productivity rate (ac/hr)

	Task Description	Source Location 1	Destination Location 2	Equipment	Area (ac)	Productivity (ac/hr)	Task Time (hrs)	PERFORMANCE FACTORS Ripping Length (ft)	Ripper Penetration (in)	Pocket Spacing (in)	Distance b/n Passes	Number of Shank Pockets	Turn Time (min/pass)	Work Hour (min/hr)	Speed (mph)	1000 Ft or 100 Ft Passes/Acre	Ripped Width Plus Distance b/n Passes (ft)
64	Rip-Top-Rough Graded Material	1A and 1B Leach	-	Cat D11T CD Multi-shank (s-MSR-355H)	17	2.9	5.8	1,000	18	59	59	3	0.25	50	1.0	1.5	30

=S64/((M64/(5280*T64/60)+R64)*U64)

=43560/(M64*V64)

=J64/K64

=Q64*(P64+O64)/12

Unit conversion factors

Sheet 8 – Excavator: An excavator with a sheepsfoot attachment is used for perforating liners before reclamation of lined impoundments. Columns E through J repeat the ID, title of the activity, locations, equipment and areas from Sheets 3 & 4. Task time (column Q) to complete compacting the entire area is calculated using the inputs from columns J-P, which are referenced from the Equipment sheet.

Tyrone Mine
Stockpile Spreadsheet Worksheet #8
#####

Productivity and Hours Required for Hydraulic Excavator

Notes and Assumptions:
Uses area to calculate time for perforating liners
3' sheepsfoot roller
Can be used for excavating and loading, or sheepsfoot compaction using a roller
May filter on equipment (D14) to show pertinent rows

	ID	Task Description	Source Location 1	Destination Location 2	Equipment	Area (ac) or Volume (lcy)	Unit (ac or lcy)	Sheepsfoot Roller Width (ft) or Bucket Capacity (cy)	Unit (ft or cy)	Maximum Reach at Ground Level (ft)	Cycle Time (min)	Work Hour (min/hr)	Task Time (hr)
78	2701-K-a-Ex1	Perforate Liner-Surface Impoundments	Surface Impoundments closed at year 99; some closed year 6	-	Cat 319D L	21.2	ac	3.0	ft	31.7	0.16	50.00	31.15

=O78*(J78*43560)/(L78*N78)/P78

Unit conversion factor

For example use only. Values may not match the current spreadsheet.

Results cont'd

Sheet 9 – Trucks: Trucks are used to haul cover material from borrow stockpiles to destination facilities. Columns E through J repeat the ID, title of the activity, locations, equipment and volumes from Sheets 3 & 4. Column K sums the truck cycle, which includes the haul time loaded, return time empty, loading time, truck exchange time, and the dump/maneuver time. Column L reports the optimum number of trucks as limited by the number and size of loaders (calculated on the Truck Optimization sheet, as shown in the Equipment Optimization calculation summary). Column M lists the loader or shovel net bucket capacity, referenced from the Shovel sheet. Column O lists the loader or shovel task time, referenced from the Shovel sheet. Columns N and P calculate the overall productivity and time required of the load-haul-dump operations, respectively. Column P calculates the time for the truck to complete that task and compares that time to the loader task time, because the truck will have to idle while the loader/shovel finishes loading if the loader/shovel task time is longer than the truck task time (or vice versa). If the loader task time is longer, the loader task time is listed. If the truck task time is longer, the truck task time is listed.

Productivity and Hours Required for Truck Use

Notes and Assumptions:
Uses haul distance to calculate haul and return time (total task time includes loading, maneuvering, dumping, hauling and return time) – moves from cover stockpile to destination stockpile
Volume of cover material based on area of destination
Cycles per truck = the greater of Heaped capacity or Struck capacity divided by Loader's per bucket capacity
1mph = 88 ft/min
1m/min = 0.0372822753424 mph
See Truck Optimization optimum number of trucks per loader
Haul Grade (%) assumes postive is uphill while the Effective Haul Grade (%) and Effective Return Grade (%) are postive for downhill and uphill
May filter on equipement (D14) to show pertinent rows

	E	F	G	H	I	J	K	L	M	N	O	P	Q
13	5		6	7	8	9	10	11	12	13	14	15	16	17
14	ID	Task Description	Source Location 1	Destination Location 2	Equipment	Loading Equipment ID	Loose/ Stockpile Volume (cy)	Truck Cycle Time (min)	Optimum Number of Trucks	Loader/Shovel/ Excavator Net Bucket Capacity (cy)	Productivity (cy/hr)	Loader/ Shovel/ Excavator Task Time(hrs)	Truck Task Time (hrs)
123	1300-D-b-Tk4	Haul-Cover	Gila Borrow Area	3A / 3B	Komatsu 730E	Sh1	2,202,200	18.4	8	28.1	3,052.2	705.7	721.5

=SUM(AL123:AP123)

=AQ123*T123*N123*M123/L123

=IF(OR(K123=0,O123=0),0,IF(K123/O123<P123,P123,K123/O123))

Columns R and S are equipment specifications from the CPH. Column T calculates the loader or shovel cycles per truck, based on loader/shovel bucket capacity and truck capacity. The total haul distance (column U) can be divided into three segments (columns V-X) if the route varies greatly in slope. The average grade for each segment is calculated and entered in Columns Y-AA. Columns U through AA are obtained from the Quantities sheet. Column AB is the rolling resistance for the assumed underfooting and tires per the CPH. Columns AC-AE convert segment distances from feet to meters for application of the performance equations from the CPH.

Tyrone Mine
Stockpile Spreadsheet Worksheet #3
04/29/19

PERFORMANCE FACTORS

	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE
13	18	19	20	21	22	23	24	25	26	27	28	29	30	31
14	Struck Capacity (cy)	Heaped Capacity (cy)	Loader/ Shovel Cycles per Truck	Total Haul Distance (ft)	Haul Distance Segment 1 (ft)	Haul Distance Segment 2 (ft)	Haul Distance Segment 3 (ft)	Haul Grade Segment 1 (%)	Haul Grade Segment 2 (%)	Haul Grade Segment 3 (%)	Rolling Resistance (%)	Haul Distance Segment 1 (meters)	Haul Distance Segment 2 (meters)	Haul Distance Segment 3 (meters)
123	101.0	145.0	5.0	11,221	4,411	6,810	-	-7.0%	6.6%	0.0%	2.5%	1,344	2,076	-

=TRUNC(R123/ N123)

=SUM(V123:X123)

For example use only. Values may not match the current spreadsheet.

Results cont'd

Sheet 9 – Trucks cont'd: Columns AF through AK calculate the effective grade of the segment (physical grade plus the rolling resistance). Haul time (column AL) and return time (column AM) are calculated by multiplying travel times (per distance) by haul/return distance. Loading time (column AN) is based on loader/shovel productivity (Sheet 10). Times in columns AO, AP, and AQ are referenced from the Equipment sheet.

=AR123*AC123+AS123*AD123+AE123*AT123

	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ
13	32	33	34	35	36	37	38	39	40	41	42	43
14	Effective Haul Grade Segment 1 (%)	Effective Haul Grade Segment 2 (%)	Effective Haul Grade Segment 3 (%)	Effective Return Grade Segment 1 (%)	Effective Return Grade Segment 2 (%)	Effective Return Grade Segment 3 (%)	Haul Time (min)	Return Time (min)	Loading Time (min)	Truck Exchange Time (min)	Dump/Maneuver Time (min)	Work Hour (min/hr)
123	4.5%	9.1%	2.5%	9.5%	4.1%	2.5%	9.6	4.7	2.25	0.7	1.1	50

=IF(Y123>=$AB123, Y123+$AB123, ABS(Y123+$AB123))

=IF(-Y123>=$AB123, -Y123+$AB123, ABS(-Y123+$AB123))

=AU123*AC123+AV123*AD123+AE123*AW123

Columns AR through AW calculate the travel time (per distance) from a curve fit based on CPH production factors, as explained on the following page. Travel time is dependent on effective grade. If the haul grade is positive (uphill), the loaded or empty uphill travel time is calculated, within the maximum speed of the truck. If the grade is negative (downhill), the loaded or empty downhill travel time is calculated, within the maximum speed of the truck.

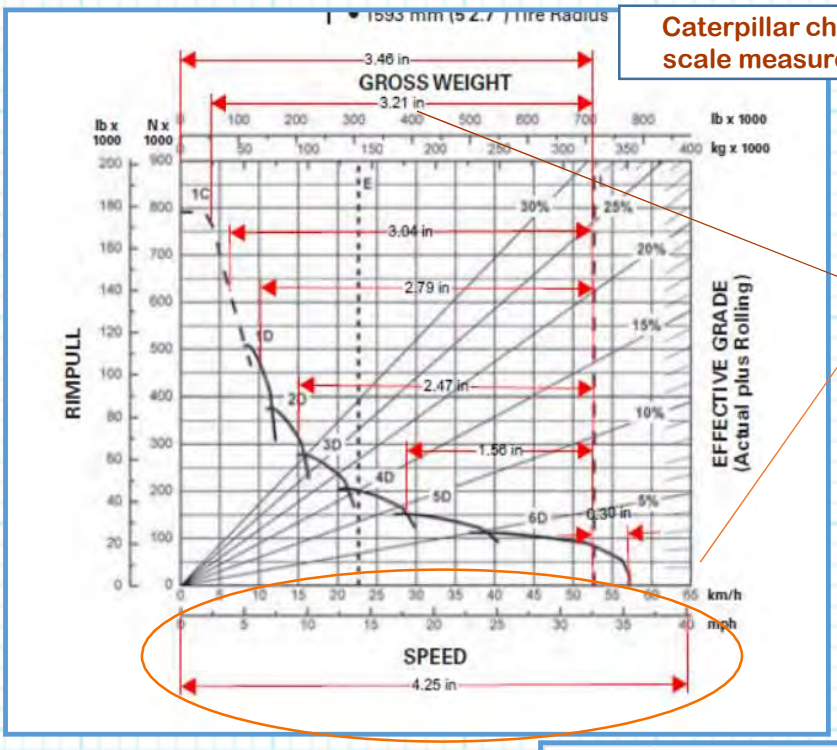
	AR	AS	AT	AU	AV	AW
1						Tyrone Mine
2						Stockpile Spreadsheet Worksheet #9
3						04/29/19
13	44	45	46	47	48	49
14	Travel Time Loaded Segment 1 (min/m)	Travel Time Loaded Segment 2 (min/m)	Travel Time Loaded Segment 3 (min/m)	Travel Time Empty Segment 1 (min/m)	Travel Time Empty Segment 2 (min/m)	Travel Time Empty Segment 3 (min/m)
123	0.00174	0.00352	0.00145	0.00189	0.00105	0.00105

For example use only. Values may not match the current spreadsheet.

Results cont'd

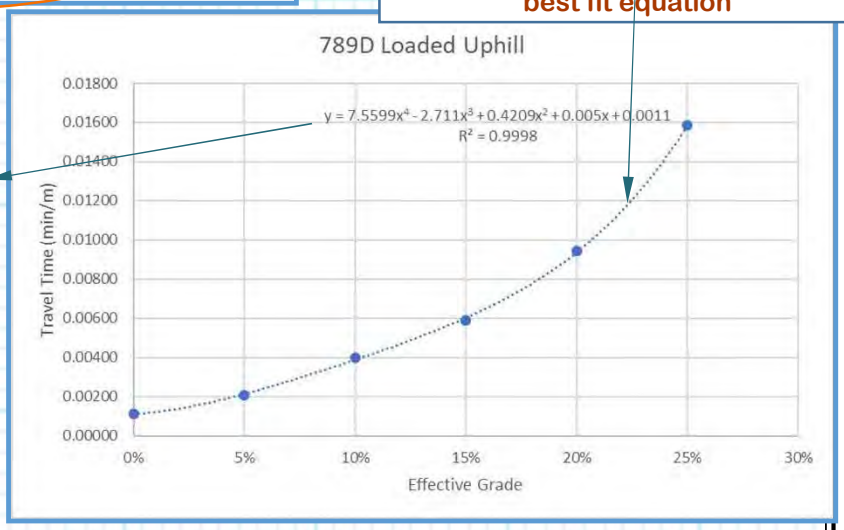
Sheet 9 – Trucks cont'd: Haul times are calculated for the trucks by using rimpull-speed-gradeability curves and retarding curves to create a relationship for travel time vs. effective resistance for travel uphill and downhill, respectively. A formula is derived by curve fit to the rimpull-speed-gradeability curves and retarding curves provided in the CPH for the specific truck. Similar to the dozer productivity curves, this is accomplished by scaling values from the figures and using the curve fitting tools within Microsoft Excel. Input values are taken from the 1998, 2011, 2017 and 2018 Caterpillar (Cat) Performance Handbook (CPH) (Editions 29, 41, 47, and 48) for the specific model truck. The example below shows how travel time is calculated for uphill routes, assuming a loaded truck:

Caterpillar chart and scale measurements



	B	C	D	E	F
1	Loaded Up Hill				
2	Measurement	Speed (mph)			
3	4.25	40			
4	3.46	32.6			
5					
6	Measurement	Speed (mph)	Travel Time (min/m)	Effective Grade	
7	3.21	2.35	0.01585	25%	
8	3.04	3.95	0.00943	20%	
9	2.79	6.31	0.00591	15%	
10	2.47	9.32	0.00400	10%	
11	1.56	17.88	0.00209	5%	
12	0	32.56	0.00114	0%	

Graph these two columns and find best fit equation

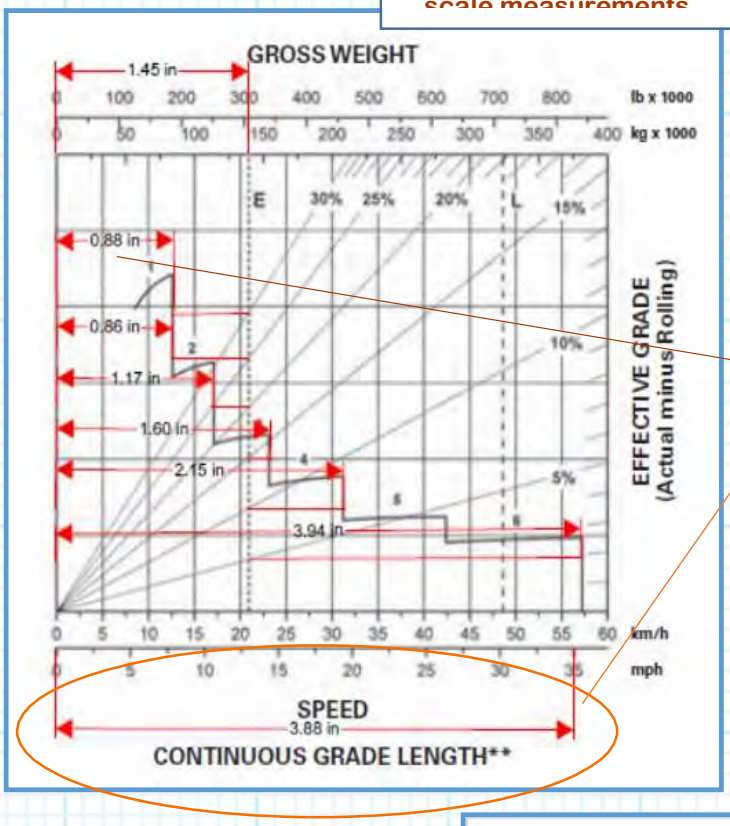


These coefficients are listed for each type of truck in columns P-AI of the Equipment sheet.

Results cont'd

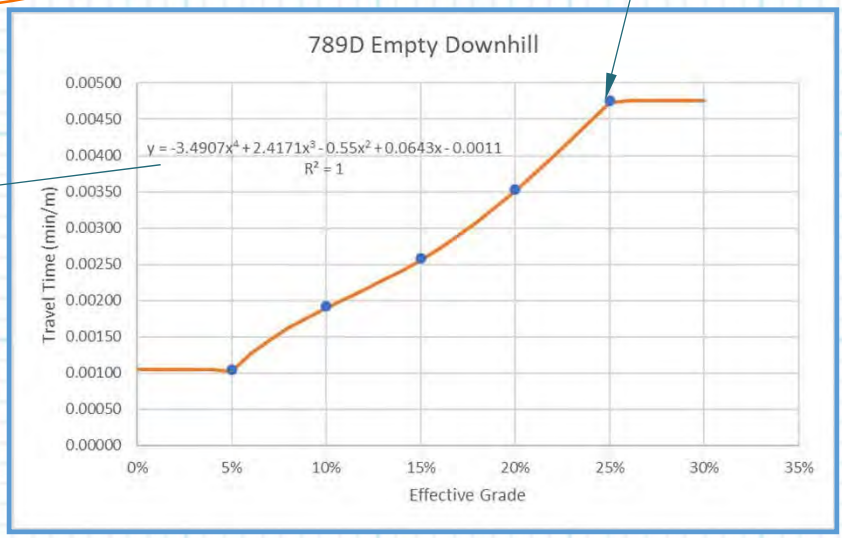
Sheet 9 – Trucks cont'd: The example below shows how travel time is calculated for downhill routes, assuming an empty truck:

Caterpillar chart and scale measurements



	B	C	D	E	F
1					
2	Measurement	Speed (mph)			
3	3.88	35			
4					
5	Measurement	Speed (mph)	Travel Time (min/m)	Effective Grade	
6	0.87	7.85	0.00475	30%	
7	0.87	7.85	0.00475	25%	
8	1.17	10.55	0.00353	20%	
9	1.6	14.43	0.00258	15%	
10	2.15	19.39	0.00192	10%	
11	3.95	35.63	0.00105	5%	
12	3.95	35.63	0.00105	0%	
13					

Graph these two columns and find best fit equation



These coefficients are listed for each type of truck in columns P-AI of the Equipment sheet.

For example use only. Values may not match the current spreadsheet.

Results cont'd:

Sheet 10 – Loader Shovel: Loaders or shovels are used to load cover material onto haul trucks at borrow stockpiles. Columns E through I repeat the ID, title of the activity, locations, and equipment from Sheet 3. Column J is the hauling equipment that is loaded by the loader or shovel. Column K is from Sheet 4 and contains the total amount of material to be loaded/moved. Loader/shovel cycle time (column L), net bucket capacity (column P), and work hour (column Q) are from the Equipment sheet. Per Loader/Shovel Productivity (cy/hr) (column M) and Loader/Shovel Task Time (hrs) (column N) are calculated directly. Similar to the truck task time calculation, the maximum of either the loader/shovel task time or the truck task time is used (column O).

	E	F	G	H	I	J	K	L	M	N	O	P	Q
1													Tyrone Mine
2	***Productivity and Hours Required for Front End Loader Use or Hydraulic Shovel Use***												Stockpile Spreadsheet Worksheet #10
3													4/29/2019
4	**Assumptions:**												
5	Uses cover volume to calculate loading time of cover material												
6	May filter on equipement (D14) to show pertinent rows												
7													
8													
9													
10													
11													
12													PERFORMANCE FACTORS
13	5	6	7	8	9	10	11	12	13	14	15	16	17
14	ID	Task Description	Source Location 1	Destination Location 2	Equipment	Hauling Equipment ID	Loose/Stockpile Volume (cy)	Loader/ Shovel Cycle Time (min)	Per Loader/Shovel Productivity (cy/hr)	Loader/ Shovel Task Time (hrs)	Max of Loader/Shovel or Truck Task Time (hrs)	Net Bucket Capacity (cy)	Work Hour (min/hr)
99	1000-C-b-Sh1	Load-Cover	Gila Borrow Area	1A and 1B Leach	Hitachi EX3600-5	Tk4	1,321,320	0.45	3,120.6	423.4	423.4	28.1	50

=P99/L99*Q99

=K99/M98

Sheet 11 – Scrapers: No scrapers are used in Tyrone RCE.

Results cont'd:

Sheet 12 – M'Grader: Motor graders are used for rough grading tops of stockpiles or for fine grading cover material. Columns E through I repeat the ID, title of the activity, locations, and equipment from Sheet 3. Column J is from Sheet 4 and contains the area of material to be graded. The grade factor (Column M) is calculated based on percent grade. Column K, shaping productivity, is calculated from the speed and effective blade width. Column L is calculated directly. Column N is an assumed material handling factor and Column U is a factor based on operator experience. Columns O-T are based on material properties and equipment information.

Tyrone Mine

Productivity and Hours Required for Motorgrader Use---Grading

Stockpile Spreadsheet Worksheet #12

4/29/2019

Notes and Assumptions:

Productivity (based on area of overall stockpile) = Sq.ft per hour = Speed x (Eff. Blade L -Blade Overlap) x Efficiency (*Cat. Handbook Edition 47* pg 11-27)

Max. safe slope for motor graders is 2:1 (50%), proposed final grade for Tyrone cover grading on stockpiles is 33%, therefore use of graders an option (Cat. Handbook Edition 46 pg 11-30)

Grade Factor = -0.02(Grade %) + 1

May filter on equipement (D14) to show pertinent rows

ID	Task Description	Source Location 1	Destination Location 2	Grading Equipment	Area (ac)	Grading Shaping Productivity (ac/hr)	Task Time (hrs)	Grade Factor	Material Factor	Material Weight (lb/cy)	Production Method/ Blade	Effective Blade Width (ft)	Pass Overlap (ft)	Speed (mph)	Work Hour (min/hr)	Operator Factor
1001-A-a-Mg1	Grade-Top-Existing Ground	1A and 1B Leach	-	Cat 16M	17	3	5.9	1.0	1.0	3,300	1.20	16.00	2.00	2.50	50	1.00

=(T46/60)*N46*(2300/O46)*P46*U46*M46*S46*(Q46-R46)*5280/43560

=IF(K115>0,J115/K115,0)

Unit conversion factors

Soil weight (lb/cy) assumed in CPH

Sheet 13 – EarthSum: This sheet summarizes all of the quantities and production rates on the individual sheets (5, and 7 through 12) and applies costs from Equipment Watch, the New Mexico labor rates table, fuel quotes, etc. Columns E through I repeat the ID, title of the activity, locations, equipment from Sheet 3. Columns J through L list the fuel, rental and maintenance, and labor unit costs from the Equipment sheet for the associated piece of equipment. The number of units of equipment is assumed to be one except for trucks and scrapers, which use an optimum number of units, calculated on the truck and scraper optimization sheets. The time required is taken from each of the equipment sheets (Sheets 5-12). The fuel, rental and maintenance, and labor costs are calculated by multiplying the unit costs by the time required for each task. The total equipment cost (column R) is the sum of the fuel, rental and maintenance, and labor costs. The total production volumes and areas are repeated from Sheet 4.

Summarizes costs for line items involving earthworks

Summary Calculation of Earthmoving Costs

Summarizes all earthmoving quantities and co

Notes and Assumptions:

Productivity (based on area of overall stockpile) = Sq.ft per hour = Speed x (Eff. Blade L -Blade Overlap) x Effici

Max. safe slope for motor graders is 2:1(50%), proposed final grade for Tyrone cover grading on stockpiles is 3

Grade Factor = -0.02(Grade %) + 1

May filter on equipement (D14) to show pertinent rows

ID	Description	Source Location 1	Destination Location 2	Equipment	Fuel Cost ($/hr)	Lube, Tires, GEC, & Field Parts Adjusted Rental Cost (w/o fuel) ($/hr)	Labor Cost ($/hr)
1202-A-a-Dz2	Grade-Outslopes-Existing Ground	2A Leach and 2B Waste	-	Cat D11T CD	$69.62	$254.44	$27.41

For example use only. Values may not match the current spreadsheet.

Results cont'd

Sheet 13 – EarthSum cont'd:

Tyrone Mine
Stockpile Spreadsheet Worksheet #13
04/29/19

ienoy (*Cat. Handbook Edition 47* pg 11-27)
3%, therefore use of graders an option. (Cat. Handbook Edition 46 pg 11-30)

=SUM(O15:Q15)

=J15*N15*M15

	Number of Units (Equipment)	Time Req'd (hrs)	Direct Fuel Cost ($)	Direct Lube, Tires, GEC, & Field Parts Adjusted Rental Cost (w/o fuel) (	Direct Labor Cost ($)	Total Equipment Cost ($)	Total Production Volume (CY)	Total Production Area (AC)
36	1	9,386.9	$647,897	$2,368,057	$255,101	$3,271,055	8,060,000	-

Sheet 14 – Revegetation: Columns E through I repeat the ID, title of the activity, locations, and areas from Sheets 3 & 4. The calculated unit rates for revegetation (reveg fuel cost and reveg cost without fuel) are multiplied by the corresponding areas to calculate the associated direct revegetation costs for each location. The total revegetation direct cost is then the sum of all direct costs related to each location.

Tyrone Mine
Stockpile Spreadsheet Worksheet #14
04/29/19

Revegetation Costs

Description:
Includes scarifying (ripping), discing, rangeland drill seeding, mulching, crimping, and daily per diem
May filter on equipement (D14) to show pertinent rows

	ID	Description	Source Location 1	Destination Location 2	Area (ac)	Fuel Unit Cost ($/ac)	Reveg w/o Fuel Unit Cost ($/ac)	Fuel Direct Cost ($)	Reveg w/o Fuel Direct Cost ($)
154	1000-J-e-U2	Revegetate-Entire Stockpile-Final Grade	1A and 1B Leach	-	273.0	$ 3.85	$ 820.12	$ 1,051	$ 223,893
155	1100-J-e-U2	Revegetate-Top (Haul Road)-Final Grade	1C	-	17.0	$ 3.85	$ 820.12	$ 65	$ 13,945
156	1200-J-e-U2	Revegetate-Entire Stockpile-Final Grade	2A Leach and 2B Waste	-	487.0	$ 3.85	$ 820.12	$ 1,874	$ 399,392
157	1300-J-e-U2	Revegetate-Entire Stockpile-Final Grade	3A / 3B	-	455.0	$ 3.85	$ 820.12	$ 1,751	$ 373,155
158	1500-J-e-U2	Revegetate-Entire Stockpile-Final Grade	5A Overburden	-	371.0	$ 3.85	$ 820.12	$ 1,428	$ 304,265
159	2200-J-e-U2	Revegetate-Entire Pit-Final Grade	San Salvador Pit	-	115.0	$ 3.85	$ 820.12	$ 443	$ 94,314
160	2300-J-e-U2	Revegetate-Entire Stockpile-Final Grade	Savanna In-Pit Leach Stockpile	-	65.0	$ 3.85	$ 820.12	$ 250	$ 53,308
161	1400-J-e-U2	Revegetate-Entire Stockpile-Final Grade	4C Leach	-	183.0	$ 3.85	$ 820.12	$ 704	$ 150,082
162	1800-J-e-U2	Revegetate-Entire Stockpile-Final Grade	2C, 4A, 4B, 7B Leach	-	375.0	$ 3.85	$ 820.12	$ 1,443	$ 307,545
163	1900-J-e-U2	Revegetate-Sludge Disposal Area-Final Grade	8C	-	47.4	$ 3.85	$ 820.12	$ 182	$ 38,841
164	1600-J-e-U2	Revegetate-Entire Stockpile-Final Grade	6B	-	54.0	$ 3.85	$ 820.12	$ 208	$ 44,286
165	1700-J-e-U2	Revegetate-Entire Stockpile-Final Grade	6C	-	66.0	$ 3.85	$ 820.12	$ 254	$ 54,128
166	2000-J-e-U2	Revegetate-Entire Stockpile-Final Grade	9A Overburden	-	129.0	$ 3.85	$ 820.12	$ 496	$ 105,796
167	2600-J-e-U2	Revegetate-Tailing Launder Line-Final Grade	Tailing Launder Line	-	7.4	$ 3.85	$ 820.12	$ 28	$ 6,072
168	2900-J-e-U2	Revegetate-Mangus Pumphouse-Final Grade	Mangus Pumphouse	-	7.0	$ 3.85	$ 820.12	$ 27	$ 5,741
169	2701-J-e-U2	Revegetate-Surface Impoundments closed at year 99; some closed year 6-	Surface Impoundments closed at year 99; some closed year 6	-	21.2	$ 3.85	$ 820.12	$ 82	$ 17,411
170	2702-J-e-U2	Revegetate-Surface Impoundments graded over at closure-Final Grade	Surface Impoundments graded over at closure	-	0.5	$ 3.85	$ 820.12	$ 2	$ 394
171	3300-J-e-U2	Revegetate-Unplanned Disturbance Area-Final Grade	Unplanned Disturbance Area	-	125.0	$ 3.85	$ 820.12	$ 481	$ 102,515
172	2100-J-e-U2	Revegetate-Entire Stockpile-Final Grade	9AX	-	63.7	$ 3.85	$ 820.12	$ 245	$ 52,242
173	2803-J-e-U2	Revegetate-Revegetation Area-Final Grade	Tailing Repositories Borrow Areas	-	74.7	$ 3.85	$ 820.12	$ 287	$ 61,263
290									
291				TOTAL	####			$ 11,301	$ 2,408,586

=I173*J173

=SUM(M15:M290)

Page 1

For example use only. Values may not match the current spreadsheet.

Sheet 15 – Other: This sheet contains the direct costs associated with miscellaneous (other) earthwork tasks. These tasks include grading benches, constructing downdrains, constructing downdrain dissipators, constructing bench channels (including filter and riprap production and placement), replacing infrastructure, plugging and abandoning wells, replacing wells, constructing berms, fencing (including vehicle gates and signs), and building grade control walls. Columns E through H repeat the ID, description, and locations from Sheet 3. Columns I and J document the quantity and unit associated with each quantity for each task (referenced from the Quantities sheet). The unit costs (columns K and L) are referenced from the Unit Cost sheet. The quantity multiplied by the unit costs give the direct costs for each activity. The direct costs are totaled at the bottom of the sheet.

Other Reclamation Activity Costs

Tyrone Mine
Stockpile Spreadsheet Worksheet #15
04/29/19

Assumptions:
1 - Cost to construct drain or channel on re-graded stockpile
2 - The downdrain, ACB, well plug & abandon, and well replacement costs include fuel
May filter on equipement (D14) to show pertinent rows

	ID	Description	Source Location 1	Destination Location 2	Quantity	Unit	Fuel Unit Cost ($/unit)	Unit Cost w/o Fuel ($/unit)[1]	Fuel Direct Cost ($)	Direct w/o Fuel Cost ($)
238	1700-G-e-U5	Construct Downdrains-Entire Stockpile-Final Grade	6C	-	550	ft	$ -	$ 374.38	$ -	$ 205,909
239	2000-G-e-U5	Construct Downdrains-Entire Stockpile-Final Grade	9A Overburden	-	2,500	ft	$ -	$ 374.38	$ -	$ 935,951
240	1000-Gb-e-U6	Construct Downdrain Dissipators-Entire Stockpile-Final Grade	1A and 1B Leach	-	4	ea	$ -	$ 14,556.48	$ -	$ 58,226
241	1200-Gb-e-U6	Construct Downdrain Dissipators-Entire Stockpile-Final Grade	2A Leach and 2B Waste	-	5	ea	$ -	$ 14,556.48	$ -	$ 72,782
242	1300-Gb-e-U6	Construct Downdrain Dissipators-Entire Stockpile-Final Grade	3A / 3B	-	4	ea	$ -	$ 14,556.48	$ -	$ 58,226
243	1500-Gb-e-U6	Construct Downdrain Dissipators-Entire Stockpile-Final Grade	5A Overburden	-	2	ea	$ -	$ 14,556.48	$ -	$ 29,113
244	2200-Gb-e-U6	Construct Downdrain Dissipators-Entire Pit-Final Grade	San Salvador Pit	-	1	ea	$ -	$ 14,556.48	$ -	$ 14,556
245	1400-Gb-e-U6	Construct Downdrain Dissipators-Entire Stockpile-Final Grade	4C Leach	-	3	ea	$ -	$ 14,556.48	$ -	$ 43,669
246	1800-Gb-e-U6	Construct Downdrain Dissipators-Entire Stockpile-Final Grade	2C, 4A, 4B, 7B Leach	-	3	ea	$ -	$ 14,556.48	$ -	$ 43,669
247	1600-Gb-e-U6	Construct Downdrain Dissipators-Entire Stockpile-Final Grade	6B	-	1	ea	$ -	$ 14,556.48	$ -	$ 14,556
248	1700-Gb-e-U6	Construct Downdrain Dissipators-Entire Stockpile-Final Grade	6C	-	1	ea	$ -	$ 14,556.48	$ -	$ 14,556
249	2000-Gb-e-U6	Construct Downdrain Dissipators-Entire Stockpile-Final Grade	9A Overburden	-	1	ea	$ -	$ 14,556.48	$ -	$ 14,556
250	1000-H-e-U7a	Construct Bench Channels w/ Riprap-Entire Stockpile-Final Grade	1A and 1B Leach	-	50,013	ft	$ 1.39	$ 6.60	$ 69,277.99	$ 330,108
251	1200-H-e-U7a	Construct Bench Channels w/ Riprap-Entire Stockpile-Final Grade	2A Leach and 2B Waste	-	68,062	ft	$ 1.39	$ 6.60	$ 94,279.45	$ 449,240
252	1300-H-e-U7a	Construct Bench Channels w/ Riprap-Entire Stockpile-Final Grade	3A / 3B	-	65,980	ft	$ 1.39	$ 6.60	$ 91,395.47	$ 435,497
253	1500-H-e-U7a	Construct Bench Channels w/ Riprap-Entire Stockpile-Final Grade	5A Overburden	-	50,330	ft	$ 1.39	$ 6.60	$ 69,717.09	$ 332,200
254	2200-H-e-U7a	Construct Bench Channels w/ Riprap-Entire Pit-Final Grade	San Salvador Pit	-	9,940	ft	$ 1.39	$ 6.60	$ 13,768.88	$ 65,608
255	1400-H-e-U7a	Construct Bench Channels w/ Riprap-Entire Stockpile-Final Grade	4C Leach	-	23,501	ft	$ 1.39	$ 6.60	$ 32,553.57	$ 155,117
256	1800-H-e-U7a	Construct Bench Channels w/ Riprap-Entire Stockpile-Final Grade	2C, 4A, 4B, 7B Leach	-	26,700	ft	$ 1.39	$ 6.60	$ 36,984.83	$ 176,232
257	1700-H-e-U7a	Construct Bench Channels w/ Riprap-Entire Stockpile-Final Grade	6C	-	4,100	ft	$ 1.39	$ 6.60	$ 5,679.32	$ 27,062
258	2000-H-e-U7a	Construct Bench Channels w/ Riprap-Entire Stockpile-Final Grade	9A Overburden	-	25,148	ft	$ 1.39	$ 6.60	$ 34,835.00	$ 165,988
259	2800-Hb-e-U7b	Construct Bench Channels w/o Riprap-Borrow Areas-Final Grade	Tailing Repositories Borrow Areas	-	13,501	ft	$ 0.10	$ 0.41	$ 1,381.33	$ 5,593
260	2800-R-e-U28	Construct Berms-Borrow Areas-Final Grade	Tailing Repositories Borrow Areas	-	3,142	ft	$ -	$ 0.06		$ 195
261	2600-T-e-U35	Build Grade Control Walls-Tailing Launder Line-Final Grade	Tailing Launder Line	-	1,002	ft	$ -	$ 165.59	$ -	$ 165,992
281								TOTAL	$ 547,382	$ 19,979,626

=I259*K259

=SUM(M15:M261)

Results cont'd

Sheet 16 – Sum: This sheet summarizes the direct costs from Sheets 2, 13, 14 and 15. The indirect costs are added as a percentage of the direct costs.

	A	B	C	D	E
1					Tyrone Mine
2					Stockpile Spreadsheet Worksheet #16
3					4/29/2019
4					
5	***Tyrone Mine***				
6	Reclamation Summary Stockpiles, Haul Roads, Reservoirs, and Disturbed Areas				
7					
8				**Current Value**	
9	**DIRECT COSTS**	Facility and Structure Removal		$5,089,622	
10		Earthmoving		$43,140,197	
11		Revegetation		$2,419,888	
12		Other		$20,527,008	
13		**Subtotal, Direct Costs**		**$71,176,714**	
14					
15	**INDIRECT COSTS**	**Subtotal, Indirect Costs**	**30.0%**	**$21,353,014**	
16					
17					
18	**TOTAL COST**			**$92,529,729**	
19		Twelve Year Annual Expenditure		**$7,710,811**	
20					
21					
22	Notes:				
23	Indirect costs are based on 2019 agreement between FMI and agencies				
24	Indirect costs include but are not limited to mobilization and demobilization, engineering redesign fee,				
25	contingencies, contractor profit and overhead, project management fee, and state procurement cost				

Page 1

='2 Demo'!F31

='13 EarthSum'!R295

='14 Revegetation'!M291+'14 Revegetation'!L291

='15 Other'!N291+'15 Other'!M291

=SUM(D9:D12)

=C15*D13

=(D13+D15)

=D18/12

Total indirect costs of 30% are applied to the capital direct costs based on discussions involving the FA Work Group completed in December 2018 and as agreed in January 2019. The FA Work Group involved representatives of Freeport-McMoRan New Mexico Operations (FNMO), MMD, NMED, and Gila Resources Information Project (GRIP). The indirect costs incorporate Mobilization and Demobilization, Contingencies, Engineering Redesign Fee, Contractor Profit and Overhead, Project Management Fee, and other administrative costs. The RCE report provides further information on the FA Work Group agreement.

For example use only. Values may not match the current spreadsheet.

Results cont'd:

Sheets 17-Facility Characteristics- This sheet summarizes direct and indirect cost for each facility in the Tyrone RCE spreadsheet. The first four facilities listed on this sheet are shown below:

	A	B	C	D	E	F
1						
2						
3	**Facility Characteristics**					
4	Facilities are categorized in this listing to meet the MMD reporting					
5	requirement					
6			1000	1100	1200	1300
7		Facility	**1A and 1B Leach**	**1C**	**2A Leach and 2B Waste**	**3A / 3B**
8						
9		**Reclaimed Acres[6]**	273.00	17.00	486.99	455.00
10						
11		**Item**	**Capital Cost**	**Capital Cost**	**Capital Cost**	**Capital Cost**
12	Direct Costs	Cover Material Excav, Haul, Grade[1]	$1,262,102	$95,723	$3,231,529	$3,105,876
13		Pullback or Backfill	$0	$0	$0	$13,577,409
14		Top/Outslope Adjustment Grading[2]	$164,600	$0	$3,277,233	$1,659,024
15		Scarify, Seed & Mulch, Reveg[3]	$224,943	$14,011	$401,266	$374,906
16		Channels & Benches[4]	$1,928,349	$0	$3,709,623	$2,968,998
17		Demolition	$0	$0	$0	$0
18		Other[5]	$0	$0	$0	$0
19		**Capital Cost Totals**	**$3,579,994**	**$109,734**	**$10,619,651**	**$21,684,211**
20		**Capital Cost/Acre**	**$13,114**	**$6,453**	**$21,807**	**$47,658**
21						
22	Indirect Costs	Cover Material Excav, Haul, Grade1	$378,631	$28,717	$969,459	$931,763
23		Pullback or Backfill	$0	$0	$0	$4,073,223
24		Top/Outslope Adjustment Grading[2]	$49,380	$0	$983,170	$497,707
25		Scarify, Seed & Mulch, Reveg[3]	$67,483	$4,203	$120,380	$112,472
26		Channels & Benches[4]	$578,505	$0	$1,112,887	$890,099
27		Demolition	$0	$0	$0	$0
28		Other[5]	$0	$0	$0	$0
29		**Indirect Cost Totals**	**$1,073,998**	**$32,920**	**$3,185,895**	**$6,505,263**
30		**Indirect Cost/Acre**	**$3,934**	**$1,936**	**$6,542**	**$14,297**
31						
32						
33						
34		**Total Cost**	**$4,653,992**	**$142,654**	**$13,805,546**	**$28,189,475**
35		Total Cost Cover	$1,640,733	$124,440	$4,200,988	$4,037,638
36		Pullback or Backfill	$0	$0	$0	$17,650,631
37		Total Cost Top/Outslope Adjustment	$213,980	$0	$4,260,403	$2,156,731
38		Total Cost Earthwork	$1,854,712	$124,440	$8,461,391	$23,845,001
39		Capital Cost Re-Veg	$292,426	$18,214	$521,645	$487,377
40		Capital Cost Other[5]	$0	$0	$0	$0
41						
42		**Total Cost/Acre**	**$17,048**	**$8,389**	**$28,349**	**$61,955**
43		Total Cost/Acre Cover	**$6,010**	**$7,318**	**$8,626**	**$8,874**
44		Pullback or Backfill	**$0**	**$0**	**$0**	**$38,793**
45		Total Cost/Acre Top/Outslope Adjustment	**$784**	**$0**	**$8,748**	**$4,740**
46		Total Cost/Acre Earthwork	**$6,794**	**$7,318**	**$17,375**	**$52,407**
47		Capital Cost/Acre Re-Veg	**$1,071**	**$1,071**	**$1,071**	**$1,071**
48		Capital Cost/Acre Other[5]	**$0**	**$0**	**$0**	**$0**
49						

The Direct and Indirect Costs are each broken down into the following sections: Cover Material, Pullback or Backfill, Top/Outslope Adjustment Grading, Revegetation, Channels & Benches, Demolition, and Other. Demolition is not divided by location but is given as a total.

For example use only. Values may not match the current spreadsheet.

Results cont'd:

Remaining Sheets: The remaining sheets and data supporting the earthwork calculations described in this calculation documentation are described in the following calculation summaries:

- Equipment Optimization
- O&M
- Bench Grading Unit Cost
- Bench Channel Unit Cost (and Riprap/Gravel Unit Cost)
- Downdrain Unit Cost
- Revegetation Unit Cost
- Fuel Unit Cost

Attachment E.2
Fuel Cost Correlation

Calculation Documentation

Problem Statement:
Freeport-McMoRan (FMI) utilizes fuel price information as part of earthwork closure cost estimation associated with the Emma Closure/Closeout Plan (CCP). A reliable estimate of the local 2021 fuel price is needed, based on local and national data for past years.

Objective:

1. Develop an equation to predict the current estimated local fuel price for use in estimating earthwork closure costs at FMI's mining operations in Grant County, NM.

Approach:

1. Identify existing data used for the calculation.
2. Correlate local and national data for fuel price, paired by year.
3. Estimate current fuel price for use in the earthwork closure costs.

Data and Assumptions:

1. Data used for the calculations are shown below (1995-2018 as example) and include (a) U.S. No. 2 Diesel Retail Prices (annual national) and (b) FMI quotes (for specific dates within a year) for the local Silver City area. All prices are in $/gallon.

Fuel Price Data

Data 1: U.S. No 2 Diesel Retail Prices (Dollars per Gallon)

Date	U.S. No 2 Diesel Retail Prices[1]
1995	1.109
1996	1.235
1997	1.198
1998	1.044
1999	1.121
2000	1.491
2001	1.401
2002	1.319
2003	1.509
2004	1.81
2005	2.402
2006	2.705
2007	2.885
2008	3.803
2009	2.467
2010	2.992
2011	3.84
2012	3.968
2013	3.922
2014	3.825
2015	2.707
2016	2.304
2017	2.65
2018	3.178

Date	U.S. No 2 Diesel Retail Prices[1]
Jan 2019	2.98

FMI Fuel Quotes[2]

Site	Date	Dyed, low-sulfur diesel	Notes
Continental	1/21/2005	$1.40	Tom Shelley - quote from fuel broker
Chino & Tyrone	5/9/2007	$2.41	Porter Oil Quote (7500 gal capacity)
Continental	1/23/2009	$1.80	Porter Oil Quote (7500 gal capacity)
Tyrone (Little Rock)	1/14/2010	$2.49	Porter Oil Quote (7500 gal capacity)
Tyrone	7/7/2012	$3.13	Western Refining Oil
Continental	6/18/2014	$3.22	Western Refining Oil
Chino (North Lampbright)	11/5/2015	$1.74	Western Refining Oil
Chino	5/20/2016	$1.66	Western Refining Oil
Tyrone (Little Rock)	4/24/2017	$1.90	Western Refining Oil
Continental	3/12/2018	$2.75	Griffin Propane
Chino	10/10/2018	$2.75	Griffin Propane

1. U.S. Energy Information Administration
http://tonto.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=EMD_EPD2D_PTE_NUS_DPG&f=M
2. Quotes obtained from Freeport-McMoRan (FMI)

For example use only. Values may not match the current spreadsheet.

Data and Assumptions (continued):

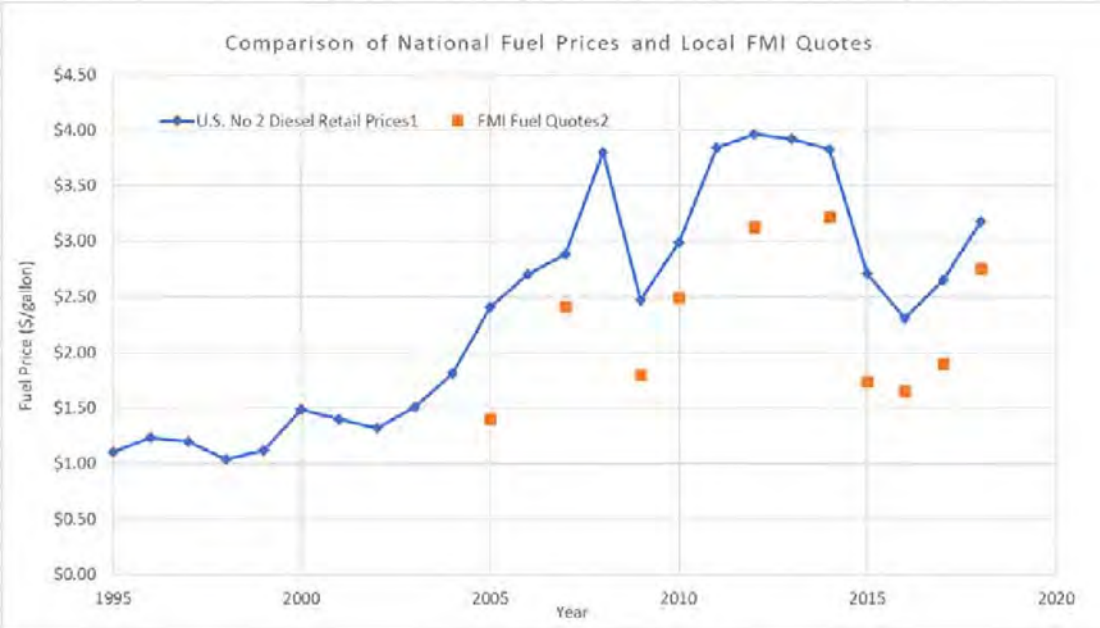
2. The local FMI fuel quotes and annual national retail fuel (U.S. No. 2) prices are assumed to trend similarly – if the national prices increase the local prices also increase.
3. A correlation between national and local fuel prices is assumed to be a reasonable predictor of local fuel prices for any time period (e.g., annual, monthly, etc).

Calculations and Results:

1. The annual national retail fuel prices (U.S. Energy Information Administration) dataset is tabulated and plotted for comparison with the available annual local FMI fuel quotes (note that quotes are not available for blank years).

Year	U.S. No 2 Diesel Retail Prices[1]	FMI Fuel Quotes[2]	Year	U.S. No 2 Diesel Retail Prices[1]	FMI Fuel Quotes[2]
1995	1.109		2007	2.885	$2.41
1996	1.235		2008	3.803	
1997	1.198		2009	2.467	$1.80
1998	1.044		2010	2.992	$2.49
1999	1.121		2011	3.84	
2000	1.491		2012	3.968	$3.13
2001	1.401		2013	3.922	
2002	1.319		2014	3.825	$3.22
2003	1.509		2015	2.707	$1.74
2004	1.81		2016	2.304	$1.66
2005	2.402	$1.40	2017	2.65	$1.90
2006	2.705		2018	3.178	$2.75

1. U.S. Energy Information Administration
http://tonto.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=EMD_EPD2D_PTE_NUS_DPG&f=M
2. Quotes obtained from Freeport-McMoRan (FMI)



For example use only. Values may not match the current spreadsheet.

Calculations and Results (continued):

2. The annual national fuel retail prices are ranked from lowest to highest, and corresponding local FMI fuel quotes are listed for matching years in which they are available. (see Col. A and B, below)
3. The difference between the national fuel retail prices and FMI fuel quotes is calculated for each pairing. Note that FMI fuel quotes are all lower than the corresponding national fuel retail prices. The differences for all pairs are averaged. (Col. C)
4. For each year without an FMI quote, the average difference ($0.69) is subtracted from the national fuel retail prices. This results in a calculated FMI value for each unpaired data year. (Col. D)
5. The available FMI fuel quotes and calculated FMI values are combined into one column for a full listing of calculated FMI values and FMI quotes. (Col. E)
6. The annual national fuel retail prices (Col. A) are plotted vs FMI calculated values and quotes (Col. E), and a correlation is developed with national fuel prices as the independent variable and FMI values and quotes as the dependent (i.e., estimated) variable. (see Col. F and graph below)

A	B	C	D	E	F
U.S. No. 2 Diesel Retail Prices[1]	FMI Fuel Quotes[2]	Difference Between Retail Prices and FMI Quotes	Calculated FMI Values Based on Average Difference	Calculated FMI Values and Quotes	y = -0.0617x3 + 0.4659x2 - 0.0611x + 0.0148
$0.00				$0.00	$0.01
$1.11			$0.42	$0.42	$0.44
$1.24			$0.55	$0.55	$0.53
$1.20			$0.51	$0.51	$0.50
$1.04			$0.36	$0.36	$0.39
$1.12			$0.43	$0.43	$0.44
$1.49			$0.80	$0.80	$0.75
$1.40			$0.71	$0.71	$0.67
$1.32			$0.63	$0.63	$0.60
$1.51			$0.82	$0.82	$0.77
$1.81			$1.12	$1.12	$1.06
$2.40	$1.40	$1.00		$1.40	$1.70
$2.71			$2.02	$2.02	$2.04
$2.89	$2.41	$0.47		$2.41	$2.23
$3.80			$3.11	$3.11	$3.13
$2.47	$1.80	$0.67		$1.80	$1.77
$2.99	$2.49	$0.50		$2.49	$2.35
$3.84			$3.15	$3.15	$3.16
$3.97	$3.13	$0.84		$3.13	$3.25
$3.92			$3.23	$3.23	$3.22
$3.83	$3.22	$0.61		$3.22	$3.14
$2.71	$1.74	$0.97		$1.74	$2.04
$2.30	$1.66	$0.65		$1.66	$1.59
$2.65	$1.90	$0.75		$1.90	$1.98
$3.18	$2.75	$0.43		$2.75	$2.89
	Average	$0.69			

1. U.S. Energy Information Administration
http://tonto.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=EMD_EPD2D_PTE_NUS_DPG&f=M
2. Quotes obtained from Freeport-McMoRan (FMI)

For example use only. Values may not match the current spreadsheet.

Calculations and Results (continued):

7. The prediction equation (and coefficient of determination, R^2) is shown in the above graph where x = national retail fuel price ($/gallon) and y = predicted local fuel price ($/gallon).
8. Based on this equation, and a national retail fuel price in December of 2020 of $2.59, the predicted local FMI fuel price for U.S. No. 2 diesel (December) is

$$LLLLLLLLL\ fffffffLL\ pppppppLLff = -0.0593(2.59^3) + 0.4528(2.59^2) - (0.0447)(2.59) + 0.012 = \$1.90/ggLLLLLLLgg$$

Summary and Conclusions:

1. National and local (FMI) fuel price data were used to develop a strongly-correlated (R^2 = 0.9888) prediction equation by which local FMI fuel prices can be predicted from national fuel price data. Note that the relationship developed in this analysis applies only to FMI operations in the Silver City (Grant County), NM area.
2. The following prediction equation developed in these calculations can be used to predict the estimated December 2020 local fuel price for use in earthwork closure costs:

$$LLLLLLLLL\ fffffffLL\ pppppppLLff = -0.0593xx^3 + 0.4528xx^2 - 0.0447xx + 0.012$$

where x = national retail fuel price ($/gallon) and y = predicted local fuel price ($/gallon)

Attachment E.3
Bench Grading Unit Cost

Calculation Documentation

Problem Statement:

Freeport-McMoRan (FMI) utilizes unit cost information for bench grading on side slopes of stockpiles and tailing ponds as part of earthwork closure cost estimation associated with the Emma Closure/Closeout Plan (CCP). The unit costs need to account for the earthwork process and site-specific conditions, equipment productivity, equipment rental rates, and associated equipment maintenance, fuel costs, and labor rates.

This calculation set presents a summary of the approach and results for estimating the unit cost for bench grading. Detailed information is presented in the earthwork reclamation cost estimate (RCE) spreadsheet file.

This calculation set is intended to serve as a guide/example even if the actual quantities and/or cost data used in these calculations change due to updates or application to a different Freeport NM Operations mine.

Objective:

1. Develop a bench grading unit cost ($/ft) for stockpile side slopes and tailing pond side slopes for use in estimating earthwork closure costs at FMI's mining operations in Grant County, NM. Account for equipment and fuel costs in the estimate.

Approach:

1. The data, assumptions, calculations, and results for the bench grading unit cost estimate are presented within the Tyrone earthwork RCE spreadsheet file in a sheet (tab) named "Bench Grading_UC".
2. The approach for estimating bench grading unit costs is as follows:
    - Compile data and assumptions used in the calculations. Data obtained from the CCP or Scope of Work include:
        - Material factors
        - Grade factors
        - Soil weight
        - Production method/blade factors
        - Centroid to centroid push distance
        - Operator factor
        - Work hour
        - Visibility factor
        - Elevation factor
        - Transmission factor
        - Number of passes to finish grade
        - Speed
        - Volume

For example use only. Values may not match the current spreadsheet.

Approach:

- Equipment costs are referenced from the Equipment Sheet
- Estimate the unit cost for bench grading on sides slopes of the stockpiles and tailing ponds. The unit cost for bench grading operations is calculated based on two construction steps: excavate and final grade.
  - Productivity in cy/hr is calculated for excavation using the following equation:

$$\text{Productivity}\ (cy/hr) = \text{Normal Production}\ (cy/hr) * Operator * Material * \frac{\text{Work Hour (min/hr)}}{\text{60 (min/hr)}} * Grade\ Factor * \frac{\text{2300 (lbs/cy)}}{\text{Material Weight (lbs/cy)}} * \text{Prod. } Method * Visibility * Elev. * Drive\ Trans.$$

  - Productivity in hrs/ft is calculated for finish grade by using the following equation:

$$\text{Productivity}\ (hrs/ft) = Operator * Material * Grade\ Factor * \frac{Work\ Hour\ (min/hr)}{60\ (min/hr)} * \frac{2300\ \left(\frac{lbs}{cy}\right)}{Material\ Weight\ \left(\frac{lbs}{cy}\right)} * \text{Prod. } Method * Visibility * Elev. * Drive\ Trans. * Speed\ (mi/hr) * 5280\ (ft/mi) * \frac{1}{\#\ Passes}^{-1}$$

Task: Bench Grading Unit Cost Computed By: Fred Charles Date: 2/27/2019

Checked By: Taryn Tigges Date: 3/14/2019

Results:

1. The results of the bench grading unit cost calculations are shown below (some of the final results may vary from what is shown). These results are used in the overall earthwork RCE.

Bench Grading Unit Cost

Bench Grading - Stockpiles

Task Description	Equipment	Bench Equipment Cost ($/ft)	Bench Fuel Cost ($/ft)	
Excavate	Cat D11T CD	$1.43	$0.35	
Finish Grade	Cat D6T XL, SU Blade	$0.09	$0.02	
		$1.52	$0.37	**$1.89 Total**

Bench Grading -Tailings

Task Description	Equipment	Bench Equipment Cost ($/ft)	Bench Fuel Cost ($/ft)	
Excavate	Cat D11T CD	$1.43	$0.35	
Finish Grade	Cat D6T XL, SU Blade	$0.09	$0.02	
		$1.52	$0.37	**$1.89 Total**

Attachment E.4
Bench Channel Unit Cost

Calculation Documentation

Problem Statement:

Freeport-McMoRan (FMI) utilizes bench channel unit cost information as part of earthwork closure cost estimation associated with the Emma Closure/Closeout Plan (CCP). The unit cost for bench channel construction (including production and placement of riprap and filter material) needs to account for the earthwork process and site-specific conditions, equipment productivity, equipment rental rates, and associated equipment maintenance, fuel costs, and labor rates.

Objectives:

1. Develop a bench channel unit cost ($/ft) for use in estimating earthwork closure costs at FMI's mining operations in Grant County, NM.
2. Note that this calculation set presents the approach, data and assumptions, and calculations and results for developing the unit cost. It is intended to serve as a guide/example even if the actual quantities and/or cost data used in these calculations change due to updates or application to a different Freeport NM Operations mine.

Approach:

1. The data, assumptions, calculations, and results for the bench channel unit cost estimate are presented within the Tyrone earthwork RCE spreadsheet file in sheets (tabs) named "Bench Channel_UC" and "Riprap_Gravel_UC".
2. The approach for the calculations is as follows:
   - Estimate the unit cost for each of the five following bench channel construction steps:
     - Earthwork excavate and waste
     - Load and transfer riprap and filter
     - Haul riprap and filter
     - Place riprap and filter
     - Finish grade channel and riprap
   - Estimate the cost to produce riprap and filter where these materials are obtained.
   - Combine equipment and fuel costs for the bench channel operations and riprap and filter production for a total bench channel unit cost.

Data and Assumptions:

1. Bench channel cross-section data and earthwork quantities are defined in the reclamation design, with additional calculations presented below in Calculations and Results. Basic channel dimensions are shown in Table 1.

Table 1

BENCH CHANNELS		
Dimensions:		
Left Side Slope:	3.00	H:1V
Left Side Slope:	2.50	H:1V
Depth:	2.00	ft
Left Side Slope Length:	3.61	
Right Side Slope Length:	3.20	
Bottom Width:	5.00	ft
Left Anchor	0.00	ft
Right Anchor	0.00	ft
Perimeter:	11.81	ft
Excavation Area:	21.00	sf
Filter Area[1] (cross-sectional)	5.90	sf or cf/ft [2]
Riprap Area (cross-sectional)	11.81	sf or cf/ft

1. Bench cross width* 6" filter thickness
2. Volume (cy) =Area(sf)*Length(ft)/27

2. Equipment and fuel cost information used for bench channel unit cost calculations is developed in the Equipment sheet of the separate Earthwork RCE spreadsheet (summary) calculation set.
3. Equipment rates from Equipment Watch include overhaul labor, parts, and time, and are corrected for a 50-minute work hour.
4. Other equipment parameters used in the calculations are assigned based on previous use at other FMI New Mexico operations.
5. The work day is set at 8 hours/day, 50 minutes/hour.
6. The following assumptions/data inputs apply to riprap and filter production:
   - For riprap and filter production, the primary plant is fed directly by two 769D haul trucks, 300 to 400 yd haul.
   - 400 tons input/hr (per Rusty McCauley, equipment peak production is 900 tons/hr).
   - 30% - 60% waste depending on smallest rip rap size used. (per Rusty McCauley, consistent w/ McCain Springs waste rate of 43% - 1" minus).
   - 3650 lb/cy (Caterpillar Performance Handbook p. 27-4, consistent with 1.8 tons/cy riprap unit weight).

For example use only. Values may not match the current spreadsheet.

Data and Assumptions (continued):

7. Key assumptions/data inputs for riprap and filter production equipment and labor are shown in Table 2.

Table 2

Equipment & Labor	Rate ($/hr)	Comment
One 988H Loader with Operator (bucket = 8.3 cy)	$ 156.46	Used to load stockpiled material to 769D trucks and 777 haul trucks
Three 769D haul trucks with drivers (22 cy, 36 ton payload each)	$ 396.83	Option: Two used to directly feed primary screening plant, one used to move material from end of conveyor
One 1 Deck Portable Screening Plant w/ 5x16 screen & 48"x60' conveyor + 1 Operator	$ 63.68	Primary screening plant, grizzly used to split oversized, 6" - 12" and 6" minus (2 conveyers) One operator required in tower to run screening plant
One 3 Deck Portable Screening Plant w/ 5x16 screen & 42"x60' conveyor + 1 Operator	$ 64.25	One operator required in tower to run screening plant Fed with 6" minus, Produce 6" - 6", 1.5" - 3", 3/8" - 1.5", 3/8 minus One operator required in tower to run screening plant
Two Cat 980H Loaders with Operator (bucket = 7.5 cy)	$ 210.53	Used move material to conveyors or load trucks
Zero Cat 992K Loaders with Operator (bucket = 16 cy)	$ -	Unused loader option
One Cat 966H Loader with Operator (bucket = 5.5 cy)	$ 100.81	Used to move material from end of conveyors & load trucks
One Water Truck with Driver (10,000 gal)	$ 91.96	Dust suppression
One Foreman	$ 23.84	

Calculations and Results:

The unit costs for each of the five following bench channel construction steps are developed:

- Earthwork excavate and waste
- Load and transfer riprap and filter
- Haul riprap and filter
- Place riprap and filter
- Finish grade channel and riprap

1. Excavate and waste (earthwork) operations comprise the first construction step (shown in "Bench Channel_UC" sheet). The unit cost is calculated based on both operations using a Cat D11T CD, U Blade dozer. Table 3 (split into 3 segments due to many columns) shows the progression of the calculations to estimate the cost for these operations. This table is followed by the calculations (or assigned parameters) for the "Excavate" row.

Table 3

	B	C	D	E	F	G	H	I	J
5		Task Description	Equipment	Volume (cy/ft)	Productivity (cy/hr)	Material Factor[2]	Grade Factor[2]	Material Weight[2] (lb/cy)	Production Method/ Blade Factor[2]
6	Bench Channels	Excavate	Cat D11T CD, U Blade	0.78	1123	1.20	1.0	2900	1.00
7	Bench Channels	Waste	Cat D11T CD, U Blade	0.78	1001	1.20	1.0	2900	1.00

	B	C	K	L	M	N	O	P	Q
5		Task Description	Centroid to Centroid Push Distance[2] (feet)	Normal Production (cy/hr)	Operator Factor[2]	Work Hour[2] (min/hr)	Visibility Factor[2]	Elevation Factor[2]	Transmission Factor[2]
6	Bench Channels	Excavate	175	1851	0.75	50	1.00	1.00	1.00
7	Bench Channels	Waste	200	1649	0.75	50	1.00	1.00	1.00

	B	C	R	S	T	U	V	W	X	Y
5		Task Description	Productivity (hrs/ft)	Fuel Cost ($/hr)	Equipment Cost ($/hr)	Operator Cost (IV) ($/hr)	Dozer Cost ($/hr)	Bench Equipment Cost ($/ft)	Bench Fuel Cost ($/ft)	Total $/ft
6	Bench Channels	Excavate	0.0007	69.62	254.44	27.41	281.85	0.20	0.05	
7	Bench Channels	Waste	0.0008	69.62	254.44	27.41	281.85	0.22	0.05	
8								0.41	0.10	$ 0.52

The following parameters used in the calculations are based on previous use at other FMI New Mexico operations – also see Equipment sheet in the separate Earthwork RCE (summary) spreadsheet calculation set: Material Factor (Col. G), Grade Factor (Col. H), Material Weight (Col. I), Production Method/Blade Factor (Col. J), Centroid to Centroid Push Distance (Col. K), Operator Factor (Col. M), Work Hour (Col. N), Visibility Factor (Col. O), Elevation Factor (Col. P), and Transmission Factor (Col. Q).

For example use only. Values may not match the current spreadsheet.

Calculations and Results (continued):

1. Excavate and waste (earthwork) calculations (continued)

$$Volume(Col.E) = \frac{(Excav\ Area, sf\ [Bench\ channel, Table\ 1])}{(27\ cf/cy)} = \frac{21.00\ sf}{27\ cf/cy} = 0.78\ cy/ft$$

$$Productivity\ (Col.F) = Col.L\ x\ M\ x\ G\ x\ \left(\frac{N}{60}\right)\ x\ H\ x\ \left(\frac{2300}{I}\right)\ x\ J\ x\ O\ x\ P\ x\ Q =$$

$$1851\ \frac{cy}{hr}\ x\ 0.75\ x\ 1.20\ x\ \left(\frac{50\ min/hr}{60\ min}\right)\ x\ 1.0\ x\ \frac{2300\ lb/cy}{2900\ lb/cy}\ x\ 1.00\ x\ 1.00\ x\ 1.00\ x\ 1.00 =$$

1123 cy/hr

Normal Production (Col. L): If Centroid to Centroid Push Distance is not 0, then, for the equipment used, look up the production curve fit parameters C and b for equation: C x Average dozing distance [ft] ^{b} = 162,758.76 x 175 ft $^{-0.86691}$ = 1851 cy/hr

$$Productivity\ Col.R = \frac{Volume, \frac{cy}{ft}\ Col.E}{(Productivity, \frac{cy}{hr}\ Col.F)} = (0.78\ cy/ft)/(1123\ cy/hr) =$$

0.00069 hr/ft (or 0.0007 hr/ft)

Fuel Cost Col. S, Equipment Cost Col. T, and Operator Cost Col. U are from Equipment cost calcs presented in the Earthwork RCE spreadsheet calculation set.

$$Dozer\ Cost\ Col.V = \$254.44\ equipment + \$27.41\ operator = \$281.85$$

Bench equipment cost Col. W =

$$Dozer\ cost, \frac{\$}{hr}\ Col.V\ x\ Productivity, \frac{hr}{ft}\ Col.R = (\$281.85/hr)\ x\ (0.00069\ hr/ft) =$$

$0.19/ft

$$Bench\ Fuel\ Cost\ Col.X =$$

$$Fuel\ cost, \frac{\$}{hr}\ Col.S\ x\ Productivity, \frac{hr}{ft}\ Col.R = (\$69.62/hr)\ x\ (0.00069\ hr/ft) =$$

$0.05/ft

Calculations and Results (continued):

2. Load riprap and filter, and transfer for placing, unit cost is calculated based on the following separate operations (see "Riprap_Gravel_UC" sheet): load riprap, load filter, transfer riprap for placing, and transfer filter for placing. A Cat 992K is used for these operations. Table 4 (split into 2 segments due to many columns) shows the progression of the calculations to estimate the cost for these operations. This table is followed by the calculations (or assigned parameters) for the "Load Riprap" row.

Table 4

	B	C	D	E	F	G	H	I	J
4	Earthwork								
5	Loading per cy								
6	Task Description	Equipment		Load, Dump, Maneuver Time (min)	Work Time (min)	Loads/ hr	Net Bucket (cy/load)	Production Rate (cy/hr)	Fuel Use Gal per Hour
7	Load riprap	Cat 992K		0.65	50	76.92	14.00	1076.92	25.63
8	Load filter	Cat 992K		0.65	50	76.92	14.00	1076.92	25.63
9	Transfer riprap for placing	Cat 992K		0.65	50	76.92	14.00	1076.92	25.63
10	Transfer filter for placing	Cat 992K		0.65	50	76.92	14.00	1076.92	25.63

	B	K	L	M	N	O	P	Q
4	Earthwork							
5	Loading per cy							
6	Task Description	Fuel Cost ($/hr)	Equipment Cost ($/hr)	Operator Cost ($/hr)	Loader+Oper Cost ($/hr)	Load+Op Cost ($/cy)	Fuel Cost ($/cy)	Total Cost ($/cy)
7	Load riprap	59.97	216.23	27.70	243.93	0.23	0.06	0.28
8	Load filter	59.97	216.23	27.70	243.93	0.23	0.06	0.28
9	Transfer riprap for placing	59.97	216.23	27.70	243.93	0.23	0.06	0.28
10	Transfer filter for placing	59.97	216.23	27.70	243.93	0.23	0.06	0.28

The following parameters used in the calculations are developed in the Equipment sheet as described for the separate Earthwork RCE (summary) spreadsheet calculation set: Load, Dump, Maneuver Time (min) (Col. E); Net Bucket (cy/load) (Col. H); Fuel Use Gal per Hour (Col. J); Fuel Cost ($/hr) (Col. K); Equipment Cost ($/hr) (Col. L); and Operator Cost ($/hr) (Col. M).

For example use only. Values may not match the current spreadsheet.

Calculations and Results (continued):

2. Load/transfer riprap and filter (continued)

Work Time (Col. F) = 50 min per hour

Loads/hr (Col. G) = (Col. F)/(Col. E) = 50/0.65 = 76.92 loads/hr

Production Rate (cy/hr) (Col. I) = (Col. H) x (Col. G) = 14.00 x 76.92 = 1076.92 cy/hr

Loader + Operator Cost/hr (Col. N) = Equipment Cost (Col. L) + Operator Cost (Col. M)
= $216.23/hr + $27.70/hr = $243.93/hr

Loader + Operator Cost/cy (Col. O) = [Loader Cost, $/hr (Col. N)]/[Production Rate, cy/hr (Col. I)] = ($243.93/hr)/(1076.92 cy/hr) = $0.23/cy

Fuel Cost/cy (Col. P) = [Fuel Cost/hr (Col. K)]/[Production Rate, cy/hr (Col. I)]
= ($59.97/hr)/(1076.92 cy/hr) = $0.06/cy

The total unit cost for the loading and transferring (for placing) riprap and filter = total for equipment + total for fuel = $0.23/ft + $0.06/ft = $0.28/ft (difference due to rounding)

Calculations and Results (continued):

3. Haul riprap and filter unit cost is calculated based on the following separate operations (see "Riprap_Gravel_UC" sheet): haul riprap and haul filter. A Komatsu 730E is used for these operations. Table 5 (split into 3 segments due to many columns) shows the progression of the calculations to estimate the cost for these operations. This table is followed by the calculations (or assigned parameters) for the "Haul Riprap" row.

Table 5

	B	C	E	F	G	H	I	J
12								
13	Hauling							
14	Task Description	Equipment	Exchange Time (min)	Delivery Travel Time[1] (min)	Unload and Maneuver Time (min)	Return Travel Time[1] (min)	Load Time (min)	Total Time (min)
15	Haul riprap from source to site	Komatsu 730E	0.70	8.62	1.10	3.47	6.73	20.62
16	Haul filter from source to site	Komatsu 730E	0.70	8.62	1.10	3.47	6.73	20.62

	B	K	L	M	N	O	P
12							
13	Hauling						
14	Task Description	Work Time (min)	Loads/ hr	Heaped Capacity (cy/load)	Production Rate (cy/hr)	Fuel Use Gal per Hour	Fuel Cost ($/hr)
15	Haul riprap from source to site	50	2.42	145	352	33.48	78.34
16	Haul filter from source to site	50	2.42	145	352	33.48	78.34

	B	Q	R	S	T	U	V
12							
13	Hauling						
14	Task Description	Equipment Cost ($/hr)	Operator Cost ($/hr)	Truck+Op Cost ($/hr)	Truck + Op Cost ($/cy)	Fuel Cost ($/cy)	Total Cost ($/cy)
15	Haul riprap from source to site	221.79	24.27	246.06	0.70	0.22	0.92
16	Haul filter from source to site	221.79	24.27	246.06	0.70	0.22	0.92

The following parameters used in the calculations are developed in the Equipment sheet as described for the separate Earthwork RCE (summary) spreadsheet calculation set: Exchange Time (min) (Col. E); Unload and Maneuver Time (min) (Col. G); Heaped Capacity (cy/load) (Col. M); Fuel Use Gal per Hour (Col. O); Fuel Cost ($/hr) (Col. P); Equipment Cost ($/hr) (Col. Q); and Operator Cost ($/hr) (Col. R).

Delivery Travel Time (Col. F) and Return Travel Time (Col. H) are based on site-wide average borrow haul time.

For example use only. Values may not match the current spreadsheet.

Calculations and Results (continued):

3. Haul riprap and filter (continued)

Load Time (Col. I)
= Dump, Maneuver Time (Col. E in load/transfer riprap)
x [Heaped Capacity, cy/load (Col. M)]/[Net Bucket, cy/load (Col. H in load/transfer riprap)]
= 0.65 min x (145 cy/load)/(14.00 cy/load) = 6.73 min

Total Time (Col. J) = Exchange Time (Col. E) + Delivery Travel Time (Col. F) + Unload and Maneuver Time (Col. G) + Return Travel Time (Col. H) + Load Time (Col. I)
= 0.70 + 8.62 + 1.10 + 3.47 + 6.73 = 20.62 min

Work Time (Col. K) = 50 min per hour

Loads/hr (Col. L) = [Work Time (Col. K)]/[Total Time (Col. J)] = 50/20.62 = 2.42 loads/hr

Production Rate, cy/hr (Col. N) = [Heaped Capacity, cy/load (Col. M)] x [Loads/hr (Col. L)]
= (145 cy/load) x (2.42 loads/hr) = 352 cy/hr

Truck + Operator Cost/hr (Col. S) = Equipment Cost (Col. Q) + Operator Cost (Col. R)
= $221.79/hr + $24.27/hr = $246.06/hr

Truck + Operator Cost/cy (Col. T) = [Truck + Operator Cost, $/hr (Col. S)]/[Production Rate, cy/hr (Col. N)] = ($246.06/hr)/(352 cy/hr) = $0.70/cy

Fuel Cost/cy (Col. U) = [Fuel Cost/hr (Col. P)]/[Production Rate, cy/hr (Col. N)]
= ($78.34/hr)/(352 cy/hr) = $0.22/cy

The total unit cost for the hauling riprap and filter = total for equipment + total for fuel = $0.70/ft + $0.22/ft = $0.92/ft

Calculations and Results (continued):

4. Place riprap and filter unit cost is calculated based on the following separate operations (see "Riprap_Gravel_UC" sheet): place riprap and place filter. A Cat 725 is used for these operations. The sequence of calculations for the place riprap and filter unit cost is the same as for haul riprap and filter (from source to site) calculations, above. Inputs to the calculations for placing riprap and filter are generally the same except that Cat 725 operating parameters and costs are used. Delivery and return travel times are calculated based on the haul distance and the Haul Travel Time polynomial equation (see Equipment sheet) that calculates minutes/meter based on effective grade.

   Table 6 (split into 3 segments due to many columns) shows the progression of the calculations to estimate the cost for these operations.

   Table 6

	B	C	D	E	F	G	H	I
19	Placing							
20	Task Description	Equipment	Distance	Grade	Exchange Time (min)	Delivery Travel Time (min)	Unload and Maneuver Time (min)	Return Travel Time (min)
21	Place riprap	Cat 725	400.00	-30%	0.70	3.25	1.10	0.74
22	Place filter	Cat 725	400.00	-30%	0.70	3.25	1.10	0.74

	B	J	K	L	M	N	O	P
19	Placing							
20	Task Description	Load Time (min)	Total Time (min)	Work Time (min)	Loads/ hr	Heaped Capacity (cy/load)	Production Rate (cy/hr)	Fuel Use Gal per Hour
21	Place riprap	0.87	6.67	50	7.50	19	141.01	6.02
22	Place filter	0.87	6.67	50	7.50	19	141.01	6.02

	B	Q	R	S	T	U	V	W
19	Placing							
20	Task Description	Fuel Cost ($/hr)	Equipment Cost ($/hr)	Operator Cost ($/hr)	Truck + Op Cost ($/hr)	Truck+Op Cost ($/cy)	Fuel Cost ($/cy)	Total Cost ($/cy)
21	Place riprap	14.09	73.11	24.27	97.38	0.69	0.10	0.79
22	Place filter	14.09	73.11	24.27	97.38	0.69	0.10	0.79
23								

Calculations and Results (continued):

5. Finish grade unit cost is calculated based on the following separate operations (see "Riprap_Gravel_UC" sheet): finish grade channel and finish grade riprap. A Cat D6T, SU Blade is used for these operations. The sequence of calculations for the finish grade unit cost is the same as for the first operation for bench channel construction – earthwork (excavate and waste) (see those calculations, above, for details). Inputs to the finish grade channel and finish grade riprap calculations are generally the same with the following exceptions:
   - Cat D6T, SU Blade operating parameters and costs are used.
   - Material Factor (Col. E) and Material Weight (Col. G) for riprap are used, which are different than for the excavate and waste, and channel grading, materials.

Table 7 (split into 3 segments due to many columns) shows the progression of the calculations to estimate the cost for these operations.

Table 7

	B	C	D	E	F	G	H	I
24								
25	Grading							
26	Task Description	Equipment	Productivity (cy/hr)	Material Factor	Grade Factor	Soil Weight (lb/cy)	Production Method/Blade Factor	Centroid to Centroid Push Distance (ft)
27	Finish grade -filter	Cat D6T, SU Blade	304.38	1.0	1.02	3500	1.0	50
28	Finish grade - Riprap	Cat D6T, SU Blade	230.34	0.8	1.02	3700	1.0	50

	B	J	K	L	M	N	O
24							
25	Grading						
26	Task Description	Normal Production (cy/hr)	Operator Factor	Work Time (min)	Visibility Factor[2]	Elevation Factor	Transmission Factor
27	Finish grade -filter	727	1	50	1	1.00	1.00
28	Finish grade - Riprap	727	1	50	1	1.00	1.00

	B	P	Q	R	S	T	U	V
24								
25	Grading							
26	Task Description	Fuel Cost ($/hr)	Equipment Cost ($/hr)	Operator Cost (IV) ($/hr)	Dozer +Op Cost ($/hr)	Dozer + Op Cost ($/cy)	Fuel Cost ($/cy)	Total Cost ($/cy)
27	Finish grade -filter	16.8948	63.65	27.41	91.06	0.30	0.06	0.35
28	Finish grade - Riprap	16.8948	63.65	27.41	91.06	0.40	0.07	0.47

For example use only. Values may not match the current spreadsheet.

Calculations and Results (continued):

6. Riprap and filter production costs (where the material source is located) are estimated according to Table 8, with a summary of the calculations provided after Table 8.

Table 8

	B	C	D	E	F	G	H	I
36	Equipment	Equipment Cost	Fuel Cost	# Equipment	Operator	# Operator	Total Equipment Cost	Total Fuel Cost
37		($/hr)	($/hr)		($/hr)		($/hr)	($/hr)
38	Cat 988H	$ 128.76	$ 35.57	1	$ 27.70	1	$ 156.46	$ 35.57
39	Cat 769D	$ 108.01	$ 22.79	3	$ 24.27	3	$ 396.83	$ 68.37
40	1 Deck Screening Plant (5X16, 48X60)	$ 40.59	$ 11.35	1	$ 23.09	1	$ 63.68	$ 11.35
41	3 Deck Screening Plant (5X16, 42X60)	$ 41.16	$ 11.35	1	$ 23.09	1	$ 64.25	$ 11.35
42	Cat 980H	$ 77.56	$ 25.27	2	$ 27.70	2	$ 210.53	$ 50.54
43	Cat 992K	$ 216.23	$ 59.97	0	$ 27.70	0	$ -	$ -
44	Cat 966H	$ 73.11	$ 19.61	1	$ 27.70	1	$ 100.81	$ 19.61
45	Off-Hwy Water Tanker Truck,6,000-gal.	$ 67.69	$ 26.33	1	$ 24.27	1	$ 91.96	$ 26.33
46	Supervisor	$ -	-	0	$ 23.84	1	$ 23.84	$ -
47								
48					Direct Cost	Equipment	Fuel	
49						$ 1,108	$ 223	$/hr
50						8	8	hr/work day
51						$ 8,867	$ 1,785	$/day
52								
53					Production			
54						400	tons input/hr (total)	
55						0.30	% waste	
56						0.70	% rip rap and gravel/filter	
57						280	tons produced/hr (net)	
58						560,000	lb/hr	
59						3,650	lb/cy	
60						153	cy/hr	
61						8	hr/day (net (60 min/hr))	
62						1,227	cy/day net production	
63								
64					Production	$ 7.22	$ 1.45	$/cy
65					Filter Delivery and placement	$ 2.14	$ 0.49	$/cy
66					Rip Rap Delivery and placement	$ 2.24	$ 0.51	$/cy
67								

Calculations and Results (continued):

6. Riprap and filter production calculations (continued):

For each type of equipment used, the costs calculated (see Earthwork RCE spreadsheet calculation set) are tabulated in Table 8, including Equipment Cost (Col. C), Fuel Cost (Col. D), and Operator Cost (Col. F).

The number of pieces of equipment (Col. E) and number of operators (Col. G) are assigned based on the logistical requirements for production. Pieces of equipment match the number of operators, except for addition of a Supervisor.

Total equipment cost (Col. H) is calculated as follows, with an example calculation shown for the Cat 988H:

$$Total\ Equipment\ Cost, \$/hr =$$
$$Equip\ Cost\ \ Col.C \quad x\ \#Equipment\ \ Col.E \quad +$$
$$Operator\ Cost\ \ Col.F \quad x\ \#Operator\ \ Col.G \quad =$$
$$\$128.76\ x\ 1 \quad + \quad \$27.70\ x\ 1 \quad = \$156.46/hr$$

Total fuel cost (Col. I) is calculated as follows, with an example calculation shown for the Cat 988H:

$$Total\ Fuel\ Cost, \$/hr = \quad Fuel\ Cost \quad Col.D \quad x\ \#Equipment \quad Col.E \quad =$$
$$\$35.57\ x\ 1 \quad = \$35.57/hr$$

The daily cost is calculated for all equipment by summing the total equipment cost (Cell G56) and total fuel cost (Cell H56), as follows:

$$Daily\ Total\ Equipment\ Cost, \frac{\$}{day} = \quad Sum\ for\ all\ equipment, \frac{\$}{hr} \quad x \quad 8\frac{hr}{day} \quad =$$

$$\frac{\$1{,}108}{hr} \quad x \quad 8\frac{hr}{day} \quad = \frac{\$8{,}867}{day}$$

$$Daily\ Total\ Fuel\ Cost, \frac{\$}{day} = \quad Sum\ for\ all\ fuel, \frac{\$}{hr} \quad x \quad 8\frac{hr}{day} \quad =$$

$$\frac{\$223}{hr} \quad x \quad 8\frac{hr}{day} \quad = \frac{\$1{,}785}{day}$$

For example use only. Values may not match the current spreadsheet.

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Calculations and Results (continued):

6. Riprap and filter production calculations (continued):

Next, the production calculations are summarized (see Rows 54-62 in Table 8). Daily net production is calculated via the following sequence:

- 400 tons input/hr (total) – see production assumptions
- 30% waste – see production assumptions
- 70 % riprap and gravel/filter = 100 minus % waste
- 280 tons produced/hr (net) = (400 tons input/hr) x (70%)
- 560,000 lb/hr = (280 tons) x (2,000 lb/ton)
- 3,650 lb/cy – see production assumptions
- 153 cy/hr = (560,000 lb/hr)/(3,650 lb/cy)
- 8 hr/day (net [60 min/hr]) – see production assumptions
- 1,227 cy/day net production = (153 cy/hr) x (8 hr/day)

The total cost for production (see Row 64 in Table 8) is calculated separately for equipment and fuel as follows:

- Equipment portion of the cost = ($8,867/day)/(1,227 cy/day) = $7.22/cy
- Fuel portion of the cost = ($1,785/day)/(1,227 cy/day) = $1.45/cy
- This yields a total cost of $8.67/cy

Summary and Conclusions:

These calculations achieve the objective to develop an estimated bench channel unit cost for the earthwork RCE, as summarized below for production of filter and riprap, and delivery and placement of filter and riprap.

The cost for production of filter and riprap $7.22/cy (equipment + operator) + $1.45/cy (fuel) = $8.68/cy (difference due to rounding).

The cost for filter delivery and placement is the sum of the calculations presented above, for loading, hauling, placing, and final grading, for a total of $2.14/cy (equipment + operator) + $0.49/cy (fuel) = $2.63/cy

Similarly, the cost for riprap delivery and placement is the sum of the calculations above, for a total of $2.24/cy (equipment + operator) + $0.51/cy (fuel) = $2.75/cy

The total cost ($/ft) for bench channel construction, including the initial earthwork (excavate and waste) along with riprap placed at 0.44 cy/ft and filter placed at 0.22 cy/ft, for combined equipment/operator and fuel costs, is:

$0.52/ft (excavate and waste) + $2.47/ft (filter) + $5.00/ft (riprap) = $7.99/ft

Attachment E.5
Down Drain/Dissipater Unit Costs

Calculation Documentation

Problem Statement:

Freeport-McMoRan (FMI) utilizes downdrain/dissipater unit cost information as part of earthwork closure cost estimation associated with the Emma Closure/Closeout Plan (CCP). Downdrains are constructed on regraded side slopes of rock stockpiles to convey runoff. Dissipaters are constructed as needed at the bottom end (downslope) of specific downdrains to dissipate the energy of the downdrain runoff flow. The unit cost needs to account for excavation/preparation of the subgrade, material and placement costs to install articulated concrete blocks (ACBs) in the downdrains and dissipaters, and installation of a concrete cutoff wall at the downslope end of each dissipater.

Objective:

1. Develop unit costs for downdrains ($/ft) and dissipaters ($/each) for use in estimating earthwork closure costs at FMI's mining operations in Grant County, NM.
2. Note that this calculation set presents the approach, data and assumptions, and calculations and results for developing the unit cost. It is intended to serve as a guide/example even if the actual quantities and/or cost data used in these calculations change due to updates or application to a different Freeport NM Operations mine.

Approach:

1. The data, assumptions, calculations, and results for the downdrain/dissipater unit cost estimate are presented within the Tyrone earthwork RCE spreadsheet file.
2. The approach for the calculations is as follows:
   - Identify locations and lengths required for downdrains. Use reclamation design drawings and quantities.
   - Identify excavation equipment and estimate cost to complete the rough grade where the downdrains and dissipaters will be constructed. Use equipment cost information and calculations as also developed for other earthwork operations in the overall earthwork cost estimate.
   - Estimate cost to finish grade and place ACBs in downdrains and dissipaters. Use available unit costs from Contech Engineered Solutions (Contech ES), the manufacturer and installer of ACBs in the area.
   - Estimate cost to install cast-in-place concrete cutoff wall at downslope end of dissipaters. Use online RS Means data.

For example use only. Values may not match the current spreadsheet.

Data and Assumptions (continued):

1. Attachment A presents the following key quantity data used to develop unit costs (note that Attachment A also includes the calculations and results presented in this calculation set):
   - Downdrain base excavation area = 52 square feet/foot of length (sf/ft)
   - Downdrain ACB area coverage = 31 sf/ft
   - Dissipater area (middle [Area 2]) = 320 sf
   - Dissipater area (each side [Area 1 = Area 3]) = 253 sf
   - Cutoff wall concrete volume (each dissipater) = 14 cubic yards
2. Unit cost data from Contech ES (February 2019, see Attachment A) include the following:
   - Material costs for ACBs (includes non-woven geotextile and microgrid/geogrid) are as follows:
     - $7.42/sf (Block Class 40T, for the channel of each downdrain and both side areas of each dissipater)
     - $10.65/sf (Block Class 70T, for the center area of each dissipater)
   - Installation cost is $4.63/sf, which covers the following installation process for both sizes of ACBs: off-load the truck and place delivered ACBs in temporary storage area, fine grade base/subgrade soils, compact soils to 90% Standard Proctor (D698), place and secure filter fabric (non-woven geotextile), place 4- to 6-inch drainage layer overlaid by geogrid, place ACBs in final configuration, grout seams, and backfill ACBs with crushed stone. The installation cost includes crushed stone.
3. Cost data from RS Means for installation of a concrete cutoff wall at the downslope end of each dissipater are presented in Attachment A. The online RS Means cost is $254.97/cubic yard.

Calculations and Results:

1. The estimated cost to excavate the rough grade (where the downdrains will be constructed) is developed in the same manner as excavation costs prepared for bench channel unit costs. Therefore, see the bench channel unit cost calculation set for details. The downdrain rough grade cost = $0.83/ft.
2. The estimated cost to install ACBs in downdrains includes the finish grade and subsequent placement of ACBs. This estimated cost is developed from the Contech ES quotes (as listed above in Data and Assumptions), as follows:
   - Downdrain material cost for 40T ACBs is $7.42/sf
   - Downdrain installation cost for 40T ACBs is $4.63/sf
   - The cost per ft of downdrain ($/ft) = ($7.42/sf + $4.63/sf) x (31 sf/ft) = $12.05/sf x 31 sf/ft = $373.55/ft

$$\boldsymbol{Total\ downdrain\ installation\ cost\ (after\ rough\ grading) = \$373.55/ft}$$

For example use only. Values may not match the current spreadsheet.

Calculations and Results (continued):

3. Similarly, the estimated cost to install ACBs in dissipaters includes the finish grade and subsequent placement of ACBs. This estimated cost is developed from the Contech ES quotes (as listed above in Data and Assumptions), as follows:

   - Dissipater material cost for 40T ACBs is $7.42/sf
   - Dissipater material cost for 70T ACBs is $10.65/sf
   - Dissipater installation cost for 40T and 70T ACBs is $4.63/sf
   - For each dissipater, 40T ACBs cover 506 sf and 70T ACBs cover 320 sf
   - The cost for the 40T part of each downdrain ($/each) =
     ($7.42/sf + $4.63/sf) x (506 sf) = $12.05/sf x 506 sf = $6,097.30/each
   - The cost for the 70T part of each downdrain ($/each) =
     ($10.65/sf + $4.63/sf) x (320 sf) = $15.28/sf x 320 sf = $4,889.60/each
   - The total cost for ACBs in each dissipater = $6,097.30 + $4,889.60 = $10,986.90

4. The estimated cost for installing a cast-in-place concrete cutoff wall at the downslope end of each dissipater is based on on-line cost data from RS Means and the required concrete volume:

   - Cast-in-place concrete cutoff wall (RS Means) cost = $254.97/cubic yard
   - Each dissipater requires cutoff wall concrete volume of 14 cubic yard
   - The total cost for cutoff wall installation at each dissipater =
     ($254.97/cubic yard) x (14 cubic yard) = $3,569.58

   Total dissipater installation cost (after rough grading)= $10,986.90 + $3,569.58 = $14,556.48

Summary and Conclusions:

1. Unit costs for installing downdrains ($/ft) and dissipaters ($/each) were developed for use in estimating earthwork closure costs at FMI's mining operations in Grant County, NM. Note that the estimated unit cost developed in this analysis applies only to FMI operations in the Silver City (Grant County), NM area.
2. Downdrain cost = $0.83/ft (rough grading) + $373.55/ft (after rough grading) = **$374.38/ft**
3. Dissipater cost = $10,986.90/each (rough grading is included in downdrain cost) + $3,569.58/each (cutoff wall) = **$14,556.48/each**

Downdrain Unit Cost

Rough Grade

Task Description	Equipment	Productivity (cy/hr)	Material Factor	Grade Factor	Soil Weight (lb/cy)	Production Method/Blade Factor	Centroid to Centroid Push Distance (ft)	Normal Production (cy/hr)	Operator Factor	Work Hour (min/hr)	Visibility Factor	Elevation Factor	Transmission Factor	Volume (cy/ft)	Productivity (hrs/ft)	Fuel Cost ($/hr)	Equipment Cost ($/hr)	Operator Cost (IV) ($/hr)	Dozer Cost ($/hr)	Equipment w/o Fuel Cost ($/ft)	Fuel Cost ($/ft)	Total Excavation Cost ($/ft)
Excavate	Cat D11T CD	1731	1.2	1.6	2900	1.0	175	1851	0.75	50	1.0	1.0	1.0	1.9	0.0011	$69.62	$254.44	$27.41	$281.85	$0.31	$0.08	$0.39
Waste	Cat D11T CD	1542	1.2	1.6	2900	1.0	200	1649	0.75	50	1.0	1.0	1.0	1.9	0.0012	$69.62	$254.44	$27.41	$281.85	$0.35	$0.09	$0.44
								.												$0.67	$0.16	$0.83

Finish Grade & Place ACB

	Area (sf/ft)	Unit Cost ($/sf)	$/ft
Downdrain ACBs			
40T[1]	31	$7.42	$230.02
Installation[1]	31	$4.63	$143.53
		ACB Cost/ft	**$373.55**

Total Downdrain Cost ($/ft)	**$374.38**

Place ACB

Dissipater ACBs	Area (sf)	Unit Cost ($/sf)	$/sf
70T[1]	320	$10.65	$3,408.00
Installation[1]	320	$4.63	$1,481.60
40T[1]	506	$7.42	$3,754.52
Installation[1]	506	$4.63	$2,342.78
		ACB Cost per Dissipater	**$10,986.90**

Install Cutoff Wall

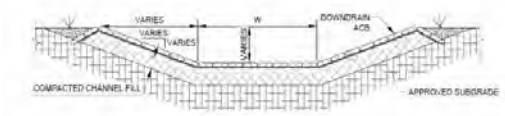
Cutoff Wall (cast in place concrete)	cubic yard	$/cubic yard	**$/dissipater[2]**
RSMeans (2019)	14	$ 254.97	**$3,569.58**

Total Dissipator Cost ($/each)	**$14,556.48**

DOWNDRAIN Dimensions:		
Left Side Slope	3	H:1V
Left Side Slope	3	H:1V
Depth	2	ft
Perimeter	31	ft
Excavation Area	52	sf
ACB Area	31	sf

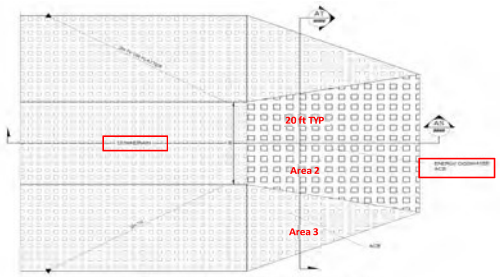
DISSIPATERS	**ACB**				**Cutoff Wall[3]**		
	Surface Area 1	**Surface Area 2**	**Surface Area 3**	**Total**	**Cross-Sectional Area**	**Thickness**	**Volume**
	(sf)	**(sf)**	**(sf)**	**(sf)**	**(sf)**	**(ft)**	**(cy)**
	253	320	253	825	260	1.5	14

1. Quote from Contech ES 2018; Downdrain ACB installation includes fine grade base/subgrade soils (assuming subgrade at + 0.5 ft); equipment is D6 LGP dozer with Power Angle Tilt Blade (PAT) and GPS Blade Control
2. One cutoff wall per dissipator
3. Typical flow depth is 2'; concrete depth is 5' (diagram is not drawn to scale); concrete thickness is 1.5'



N.T.S. AU 022A TYPICAL DOWNDRAIN SECTION

N.T.S. AX 022A TYPICAL CUTTOFF WALL SECTION



TYPICAL TOE ENERGY DISSIPATOR PLAN DETAIL

Fred Charles

From: Fawcett, Clayton <CFawcett@conteches.com>
Sent: Tuesday, February 5, 2019 9:25 AM
To: Fred Charles
Subject: RE: confirm or update costs for ACBs (reply requested by end of day Monday Feb 4, if possible)

Fred,

Hello and good morning. I hope this message finds you doing well. I made it back in to the office this morning and saw your e-mails.

Material and installation costs we discussed in September are still good. Please feel free to use those to complete your estimate.

Regarding your questions:

1. Yes, installation costs are the same for both downchutes and dissipator basins.
2. Yes, installation cost does include crushed stone infill (purchase and install)

Regarding your follow up e-mail with questions pertaining to cut-off walls.

1. Cut-off walls are not always required, however they are a good idea. The use of cut-off walls has increased in the last five years and as such, they are now recommended for inclusion at dissipator basins.
2. Material and installation costs for the installation of a cut-off wall <u>are not</u> included in the costs previously discussed and should be added.

I hope this information helps. Feel free to contact me directly with any additional questions.

Regards,

Clayton Fawcett PE (co)
Armortec Area Manager - West

CONTECH Engineered Solutions
970-290-2971 (cell)
cfawcett@conteches.com

From: Fred Charles [mailto:fcharles@telesto-inc.com]
Sent: Sunday, February 3, 2019 3:28 PM
To: Fawcett, Clayton <CFawcett@conteches.com>
Subject: confirm or update costs for ACBs (reply requested by end of day Monday Feb 4, if possible)

Hi Clayton. This email is a follow up to our email correspondence in September 2018 regarding material and installation costs for articulated concrete blocks (ACBs) used for downdrains at Chino. We've been using the cost info you passed along to me at that time. Now, I need you to confirm those costs or update them. We will use this information in a reclamation cost estimate (financial assurance for closure bonding) which we are currently finalizing for Chino and other mines in that area.

<u>Costs</u>
As we had discussed, the material costs for ACBs (includes non-woven geotextile and microgrid/geogrid) are as follows:

- $7.42/square foot (Block Class 40T, for the channel of each downdrain)

- $10.65/square foot (Block Class 70T, for the dissipation basin at bottom of each downdrain)

Also, you quoted $4.63/square foot for installation costs, which covers the following installation process: off-load the truck and place delivered ACBs in temporary storage area, fine grade base/subgrade soils, compact soils to 90% Standard Proctor (D698), place and secure filter fabric (non-woven geotextile), place 4-6" drainage layer overlaid by geogrid, place ACBs in final configuration, grout seams, and backfill ACBs with crushed stone.

2 questions

In addition to you confirming or updating the material and installation costs, I have two questions: (1) Is the installation cost ($4.63/square foot) the same for both channel downdrains and dissipation basins? (2) Does the installation or material cost include the crushed stone used to backfill the ACBs?

Please create a new email to me with updated unit costs or reply to this email to confirm what I show is still correct. I will present what you provide for documentation in the cost estimate we submit to the state agencies.

Thanks,

Fred Charles, Ph.D., P.E. Senior Engineer
Office: 970-484-7704, Ext 120 Cell: 720-318-5021
3801 Automation Way, Suite 201, Fort Collins, CO 80525
fcharles@telesto-inc.com

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Attachment E.6
Truck and Scraper Optimization

Calculation Documentation

Problem Statement:

Freeport-McMoRan's (FMI's) Chino Mines Company utilizes truck optimization information to develop the most efficient proportions of equipment as part of earthwork closure cost estimation associated with the Emma Closure/Closeout Plan (CCP). Optimization needs to account for the time required and associated costs for truck loading and hauling operations.

Objectives:

1. Develop optimization calculations to determine the most efficient number of trucks (2 to 9 and a calculated maximum) per loader or shovel for loading cover material at borrow stockpiles.
2. Note that this calculation set presents the approach and calculations and results for optimizing equipment for earthwork. It is intended to serve as a guide/example even if the actual quantities and/or cost data used in these calculations change due to updates or application to a different Freeport NM Operations mine.

Approach:

1. The data, calculations, and results for the optimization calculations are presented within the Tyrone earthwork RCE spreadsheet file in sheet (tab) named "18 Truck Optimization".
2. Truck optimization is calculated for each cover material source and destination based on
   - The truck cycle time for 1 roundtrip between a cover material source and destination and the maximum number of trucks per loader/shovel.
   - For X number of trucks (2 to 9 and a calculated maximum), the productivity, task time, cost of using X trucks per loader, the optimum number of trucks per loader/shovel, and the maximum number of trucks per loader/shovel.

Calculations and Results:

1. The truck optimization calculations are set up as shown in Table 1, which is a snapshot of a row of data/calculations in the "18 Truck Optimization" sheet. Table 1 is shown in 6 parts due to the many columns in the spreadsheet. Key calculation steps are listed after Table 1, with referencing to the Column identifier in Table 1 (and the spreadsheet).

Table 1

	E	F	G	H	I	J	K	L
13								
14	ID	Task Description	Source Location 1	Destination Location 2	Equipment	Work Hour (min/hr)	Loader/Shovel Cycles per Truck	Loader/Shovel Cycle Time (min)
299	1200-D-b-Tk4	Haul-Cover	Upper South	West Stockpile	Komatsu 730E	50	5	0.45

	M	N	O	P	Q	R	S	T	U
13									
14	Loader/Shovel Time Per Truck (min)	Truck Cycle Time Per Truck (min)	Trucks Per Loader/ Shovel	Loader/ Shovel Type	Loader/ Shovel Cost ($/hr)	Loader Net Bucket Capacity (cy)	Haul Volume (cy)	Max Trucks Round Up	Max Trucks Round Down
299	2.25	22.7	10.1	Sh1	$ 535.68	27.4	3,031,924	3,317	3,016

	V	W	X	Y	Z	AA	AB	AC
13	Productivity for X Trucks (cy/hr)							
14	9	8	7	6	5	4	3	2
299	2,714	2,412	2,111	1,809	1,508	1,206	905	603

	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM
13	Task Time for X Trucks (hr)									
14	Max Trucks Round Up	Max Trucks Round Down	9	8	7	6	5	4	3	2
299	914.0	1,005.4	1,117.2	1,256.8	1,436.4	1,675.7	2,010.9	2,513.6	3,351.5	5,027.2

	AN	AO	AP	AQ	AR	AS	AT	AU
13			Cost of Using X Trucks per Loader ($					
14	Loader/ Shovel Task Time (hr)	Truck Cost ($/hr)	Max Trucks Round Up	Max Trucks Round Down	9	8	7	6
299	995.9	$ 246.06	$ 3,229,021	$ 3,012,613	$ 3,072,458	$ 3,147,264	$ 3,243,442	$ 3,371,681

	AV	AW	AX	AY	AZ	BA	BB
13	$)						
14	5	4	3	2	Lowest Cost ($)	Optimum Number of Trucks Per Loader/ Shovel	Optimum Number of Trucks Per Loader/ Shovel Within Max
299	$ 3,551,215	$ 3,820,515	$ 4,269,350	$ 5,167,019	$ 3,012,613	10	10

For example use only. Values may not match the current spreadsheet.

Calculations and Results:

1. Truck optimization (continued)

- Calculate the number of loader/shovel (or referred to as loader) cycles to load a truck and the loading time required per truck (Columns K, L, and M) – this calculation uses data from the "9 Trucks" and "10 Shovel" sheets.

Loader Time Per Truck (Col. M) =
[Loader Cycles per Truck (Col. K)] x [Loader Cycle Time, min (Col. L)]
= (5 cycles/truck) x (0.45 min/cycle) = 2.25 min/truck

- Using the truck cycle time for 1 roundtrip between a cover material source and destination (data from the "9 Trucks" sheet), calculate the maximum number of trucks per loader/shovel.

Max Number Trucks Per Loader (Col. O) = [Truck Cycle Time, min (Col. N)]/[Loader Time, min/truck (Col. M)]
= (22.7 min)/(2.25 loader min/truck) = 10.1 trucks/loader

- Calculate the productivity (cy/hr) for X number of trucks (2 to 9 and a calculated maximum).

For X=6 trucks, Productivity, cy/hr (Col. Y) =
(X) x Work Hour, min/hr (Col. J) x Loader Cycles/Truck (Col. K) x [Loader Net Bucket Capacity, cy (Col. R)]/[Truck Cycle Time Per Truck, min (Col. N)]
= [6 x (50 min/hr) x (5 loader cycles/truck) x (27.4 cy/loader cycle)]/(22.7 min/truck cycle) = 1,809 cy/hr

- Using the productivity and total volume of cover material to be hauled, calculate the task time for X trucks (2 to 9).

For X=6 trucks, Task Time, hr (Col. AI) =
[Haul Volume, cy (Col. S)]/[Productivity, cy/hr (Col. Y)]
= (3,031,924 cy)/(1,809 cy/hr) = 1,676 hr

Calculations and Results (continued):

1. Truck optimization (continued):

- Calculate the cost of using X trucks per loader (2 to 9 and a calculated maximum) using data for loader/shovel task time in "9 Trucks" (for each cover material source and destination), loader/shovel cost ($/hr), truck cost ($/hr), and task time for the number of trucks.

For X=6 trucks, Cost of Using X Trucks per Loader, $ (Col. AU) =
[Max of Task Time for Trucks (Col AI) or Loader/Shovel Task Time (Col. AN)] x
{(Loader Cost, $/hr (Col. Q) + [(X) x (Truck Cost, $/hr (Col. AO)]}
= (1,675.7 hr) x {($535.68/hr + [6 x $246.06/hr]} = $3,371,681

- The optimum number of trucks per loader is the lowest cost number of trucks per loader/shovel. This optimum number is compared with the maximum number of trucks per loader/shovel, to ensure the optimum number is within the maximum.

For this row of data, the optimum number of trucks per loader = 10, which is the same within the max.

For example use only. Values may not match the current spreadsheet.

Attachment E.7
Revegetation Unit Cost

Calculation Documentation

Problem Statement:

Freeport-McMoRan (FMI) utilizes revegetation unit cost information as part of earthwork closure cost estimation associated with the Emma Closure/Closeout Plan (CCP). The unit cost for revegetation needs to account for equipment rental rates and associated maintenance, fuel costs, and labor rates.

Objectives:

1. Develop a revegetation unit cost ($/acre) for use in estimating earthwork closure costs at FMI's mining operations in Grant County, NM.
2. Note that this calculation set presents the approach, data and assumptions, and calculations and results for developing the unit cost. It is intended to serve as a guide/example even if the actual quantities and/or cost data used in these calculations change due to updates or application to a different Freeport NM Operations mine.

Approach:

1. The data, assumptions, calculations, and results for the revegetation unit cost estimate are presented within the Tyrone earthwork RCE spreadsheet file.
2. The approach for the calculations is as follows:
   - Identify equipment types for scarifying, discing, drill seeding, mulching, crimping.
   - Obtain equipment information from EquipmentWatch (EQW) and RS Means, labor rates from NMDOL; revegetation material costs (seed, mulch) from FMI and/or their supplier; and the current fuel price from fuel cost calculations.
   - Determine the equipment traveling distance and time to cover 1 acre.
   - For each of the key operations, estimate the operating cost ($/hour).
   - Combine all operations and material costs, calculate the total unit cost.

Data and Assumptions:

1. Rental and operating cost information is accessed online from EQW for tractor (Deere 7340), ripper, and mulcher, and from RS Means for disc harrow (see Attachment A). Monthly rental rates are converted to hourly rates assuming 176 hours/month.
2. Equipment information is not available in EQW nor RS Means for drill seeding and crimping. Therefore, the drill seeder cost is assumed to be an average of the mulcher and disc (complexity is between the two, thus an average is assumed), and the crimper rental cost is assumed to be equal to the disc harrow (similar type of equipment).
3. Costs are included in the ripper and disc harrow (and drill seeder and crimper) to account for the ground engaging component (GEC) of these implements. The GEC cost for the ripper is applied to each of these other implements.
4. Local fuel price is developed from fuel cost calculations also prepared for earthwork closure cost estimates – the estimated 2019 fuel price is $2.34/gallon.
5. Revegetation material costs are from a quote by Rocky Mountain Reclamation, based on typical sources for seed and mulch (see Attachment A). The cost for seed is $210/acre and for mulch is $245/ton which, at 2 tons/acre, is $490/acre.

Data and Assumptions (continued):

6. Labor rates are from NMDOL (see Attachment A).
7. Equipment typical net coverage (width) is set at 12 feet, and equipment travel speed is set at 3 miles/hour (mph) for a 60-minute hour.

Calculations and Results:

1. The Deere 7340 tractor data, along with labor and fuel costs, are tabulated in the following table:

	B	C	D	E
5	**Tractor used for each operation is Deere 7430**	**Cost**	**Unit**	**Information or Calculation**
6	EQW base rate for tractor rental	$ 5,210.05	$ per month	EQW for Deere 7430
7	EQW base rate for tractor rental	$ 29.60	$ per hour	= ($/month)/176
8	EQW field labor rate per hour of operation	$ 2.53	$ per hour	EQW for Deere 7430, which includes mechanic's wage of $23.09 (NMDOL, 2019)
9	EQW lube material cost	$ 2.84	$ per hour	EQW for Deere 7430
10	EQW field parts cost	$ 0.61	$ per hour	EQW for Deere 7430
11	EQW tire material cost	$ 2.42	$ per hour	EQW for Deere 7430
12	EQW fuel burn rate	5.98	gallons per hour	EQW for Deere 7430
13	Local fuel cost	$ 2.34	$ per gallon	Local quote
14	Fuel cost	$ 13.99	$ per hour	= (EQW fuel burn rate) x (local fuel cost)
15	NM Department of labor equipment operator rate	$ 24.27	$ per hour	NM Department of Labor (NMDOL)
16	**Total tractor cost**	**$ 76.27**	**$ per hour**	**Sum of $ per hour costs shown in boxes**

Data in Rows 6 and 8-12 are from EQW, data in Row 8 also incorporates an NMDOL labor rate in the EQW cost, Row 13 is the estimated local fuel cost of $2.34/gallon, and Row 15 shows an NMDOL labor rate. Costs in other rows (7, 14, and 16) are calculated as follows:

$$EQW\ base\ rate\ for\ tractor\ rental = (\$5{,}210.05/\text{month})/(176\ \text{hours/month}) = \$29.60/\text{hour}$$

$$Fuel\ cost = (\text{EQW burn rate}) \text{x (local fuel cost)} = (5.98\ \text{gallons/hour}) \text{ x } (\$2.34/\text{gallon}) = \$13.99/\text{hour}$$

$$Total\ tractor\ cost = \text{sum of rows } 7, 8, 9, 10, 11, 14, 15 =$$
$$29.60 + 2.53 + 2.84 + 0.61 + 2.42 + 13.99 + 24.27 = \$76.27/\text{hour}$$

2. Based on an equipment typical net width of 12 feet, and equipment net travel speed of 2.5 mph (3 mph x 50/60 to adjust for a 50-minute hour), each operation will travel a distance of 3,630 feet to cover 1 acre, and will require 0.275 hour to travel this distance (see calc steps in the table below). The resulting fuel cost is $3.85/acre.

	B	C	D	E
18	**Tractor coverage/rate of operation, fuel cost per acre**			
19	Tractor/equipment net width	12	feet	Assigned as a typical net width of coverage for each pass
20	Tractor/equipment travel speed	2.5	miles per hour	Assigned as approximate average speed of equipment (3 mph for 50 min/hr)
21	For 1 acre, total traveling distance	3630	feet per acre	= (43560 sf/ac)/(net width)
22	Time of travel over 1 acre	0.275	hour per acre	= [(traveling distance feet/acre)/(5280 ft/mile)]/(travel speed)
23	**Fuel cost per acre**	**$ 3.85**	**$ per acre**	**Already included in total tractor cost... Fuel cost/acre = (fuel cost/hour) x (travel time hour/acre)**

For example use only. Values may not match the current spreadsheet.

Calculations and Results (continued):

3. Operating costs for each of the 5 revegetation operations are calculated as shown in the following table. Calculation equations are also noted in the table. Note the total cost for each operation includes fuel.

	B	C	D	E
25	**Operation**			
26	*Scarifying*			
27	Base rate for ripper rental	$ 898.90	per month	EQW Ripper, Miscellaneous MSR-189H, to 260 HP
28	Base rate for ripper rental	$ 5.11	$ per hour	= ($/month)/176
29	Lube labor rate per hour of operation	$ 0.57	$ per hour	EQW for ripper, incl mechanic's wage $23.09 (NMDOL, 2019)
30	Lube material cost	$ 0.15	$ per hour	EQW for ripper
31	Field parts cost	$ 0.16	$ per hour	EQW for ripper
32	Ground Engaging Component cost	$ 0.78	$ per hour	EQW for ripper
33	**Total cost with tractor+operator included**	**$ 83.03**	**per hour**	
35	*Discing*			
36	Disc harrow attachment, for tractor	$ 616.33	per month	RS Means 01 54 33 20 1500
37	Disc harrow attachment, for tractor	$ 3.50	per hour	= ($/month)/176
38	Ground Engaging Component (GEC) cost	$ 0.78	$ per hour	Assume similar to GEC cost for ripper (EQW)
39	**Total cost with tractor+operator included**	**$ 80.55**	**per hour**	
41	*Drill seeding (assume similar to discing)*			
42	Disc harrow attachment, for tractor	$ 616.33	per month	RS Means 01 54 33 20 1500
43	Disc harrow attachment, for tractor	$ 3.50	per hour	= ($/month)/176
44	Ground Engaging Component cost	$ 0.78	$ per hour	Assume similar to GEC cost for ripper (EQW)
45	**Total cost with tractor+operator included**	**$ 80.55**	**per hour**	
47	*Mulching*			
48	Mulcher, diesel powered, trailer mounted	$ 2,167.95	per month	EQW for trailer mounted mulcher (Finn B260)
49	Mulcher, diesel powered, trailer mounted	$ 12.32	per hour	= ($/month)/176
50	Lube labor rate per hour of operation	$ 1.25	$ per hour	EQW for trailer mounted mulcher (Finn B260), incl mechanic's wage $23.09 (NMDOL, 2019)
51	Lube material cost	$ 1.60	$ per hour	EQW for trailer mounted mulcher (Finn B260)
52	Field parts cost	$ 0.15	$ per hour	EQW for trailer mounted mulcher (Finn B260)
53	Tire material cost	$ 0.60	$ per hour	EQW for trailer mounted mulcher (Finn B260)
54	Fuel burn rate	4.13	gallons per hour	EQW for trailer mounted mulcher (Finn B260)
55	Local fuel cost	$ 2.34	$ per gallon	Local quote
56	Fuel cost	$ 9.66	$ per hour	= (EQW fuel burn rate) x (local fuel cost)
57	NM Department of labor equipment operator rate	$ 24.27	$ per hour	NM Department of Labor (NMDOL)
58	**Total cost with tractor+operator included**	**$ 126.12**	**per hour**	
60	*Crimping (assume similar to discing)*			
61	Disc harrow attachment, for tractor	$ 616.33	per month	RS Means 01 54 33 20 1500
62	Disc harrow attachment, for tractor	$ 3.50	per hour	= ($/month)/176
63	Ground Engaging Component cost	$ 0.78	$ per hour	Assume similar to GEC cost for ripper (EQW)
64	**Total cost with tractor+operator included**	**$ 80.55**	**per hour**	
66	*Summary for operations*			

For example use only. Values may not match the current spreadsheet.

Calculations and Results (continued):

5. The hourly operating cost for each operation (includes fuel) is summed for a total cost of $450.79/hour. The cost for each operations is as follows:

   - Scarifying = $83.03/hour
   - Discing = $80.55/hour
   - Drill seeding = $80.55/hour
   - Mulching = $126.12/hour
   - Crimping = $80.55/hour

6. The total combined equipment operating cost with fuel ($/acre) is then calculated based on the operating cost per hour and the time of travel over 1 acre, as follows:

$$Total\ combined\ operating\ cost = \left(\frac{\$450.79}{hour}\right) x \left(0.275\ \frac{hour}{acre}\right) = \$123.97/acre$$

7. Seed and mulch costs are added to the total combined operating cost ($/acre) to calculate the total revegetation unit cost as follows:

   - Total combined operating cost = $123.97/acre
   - Seed = $210/acre
   - Mulch = $490/acre

$Total\ revegetation\ unit\ cost$ = *Total combined operating cost + Seed + Mulch = $123.97/acre + $210/acre + $490/acre = $823.97/acre ($824/acre)*

Summary and Conclusions:

1. A revegetation unit cost was developed for use in estimating earthwork closure costs at FMI's mining operations in Grant County, NM. Note that the estimated unit cost developed in this analysis applies only to FMI operations in the Silver City (Grant County), NM area.
2. The total revegetation unit cost is $824/acre.

For example use only. Values may not match the current spreadsheet.

EquipmentWatch

www.equipmentwatch.com

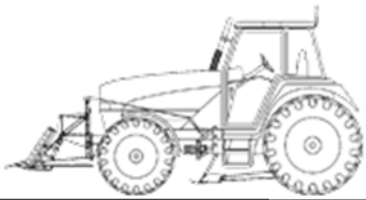
All prices shown in US$

Adjustments for MANDYLILLA27 in All Saved Models

January 17, 2019

Deere 7430 (disc. 2011)
Wheel Tractors

Size Class:
125 to 174 hp
Weight:
N/A



Configuration for 7430 (disc. 2011)

Power Mode **Diesel**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	$12.48/hr	$11.70/hr	-6.3%
Cost of Facilities Capital (CFC)	$3.12/hr	$2.43/hr	-22.1%
Overhead	$4.42/hr	$3.35/hr	-24.2%
Overhaul Labor	$6.46/hr	$1.92/hr	-70.3%
Overhaul Parts	$5.55/hr	$4.20/hr	-24.3%
Total Hourly Ownership Cost:	**$32.03/hr**	**$23.60/hr**	**-26.3%**

User Defined Adjustments: Annual Use Hours (1,030hrs -> 1,359hrs) Sales Tax (5.1% -> 0%)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	$8.51/hr	$2.53/hr	-70.3%
Field Parts	$4.86/hr	$0.61/hr	-87.4%
Ground Engaging Component (GEC)	$0.00/hr	-	-
Tire	$2.42/hr	-	-
Electrical/Fuel	$19.54/hr	$5.98/hr	-69.4%
Lube	$2.84/hr	-	-
Total Operating Ownership Cost:	**$38.17/hr**	**$14.38/hr**	**-62.3%**

User Defined Adjustments: Annual Field Repair Parts Cost ($4,174.20 -> $0.20) Diesel Cost (3.27 -> 1) Mechanics Wage ($58.84 -> $23.09)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	$32.03/hr	$23.60/hr	-26.3%
Hourly Operating Costs	$38.17/hr	$14.38/hr	-62.3%
Total Hourly Cost	**$70.20**	**$37.98/hr**	**-45.9%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	$20.02/hr	$17.48/hr	-12.7%
Idle	$51.57/hr	$29.58/hr	-42.6%

Revised Date: 1st Half 2019

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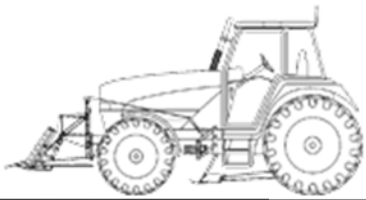
All prices shown in US$

Adjustments for MANDYLILLA27 in All Saved Models

January 17, 2019

Deere 7430 (disc. 2011)
Wheel Tractors

Size Class:
125 to 174 hp
Weight:
N/A



Configuration for 7430 (disc. 2011)

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	$3,891.00	$1,303.00	$463.00
Adjustments			
Region (New Mexico: 134%)	$1,319.05	$441.72	$156.96
User Defined			
Rental Rates (100%)	-	-	-
Total:	**$5,210.05**	**$1,744.72**	**$619.96**

Date Last Updated: Oct 01, 2018

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Custom Cost Evaluator

February 21, 2019

Miscellaneous MSR-189H
Crawler Tractor Multi-Shank Rippers

Size Class:
To 260 HP
Weight:
3,557 lbs.

Model Image

Configuration for MSR-189H

Engine Horsepower	**130 - 189**	Number of Shanks	**3**
Ripper Type	**Parallelogram**		

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	$2.64/hr	$2.50/hr	-5.3%
Cost of Facilities Capital (CFC)	$0.38/hr	$0.31/hr	-18.4%
Overhead	$0.66/hr	$0.52/hr	-21.2%
Overhaul Labor	$1.10/hr	$0.34/hr	-69.1%
Overhaul Parts	$0.95/hr	$0.75/hr	-21.1%
Total Hourly Ownership Cost:	**$5.73/hr**	**$4.42/hr**	**-22.9%**

User Defined Adjustments: Annual Use Hours (1,285hrs -> 1,629hrs) Sales Tax (5.1% -> 0%)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	$1.83/hr	$0.57/hr	-68.9%
Field Parts	$1.18/hr	$0.16/hr	-86.4%
Ground Engaging Component (GEC)	$0.99/hr	$0.78/hr	-21.2%
Tire	$0.00/hr	-	-
Electrical/Fuel	$0.00/hr	-	-
Lube	$0.15/hr	-	-
Total Operating Ownership Cost:	**$4.15/hr**	**$1.66/hr**	**-60%**

User Defined Adjustments: Annual Field Repair Parts Cost ($1,268.18 -> $0.18) Mechanics Wage ($58.84 -> $23.09)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	$5.73/hr	$4.42/hr	-22.9%
Hourly Operating Costs	$4.15/hr	$1.66/hr	-60%
Total Hourly Cost	**$9.88**	**$6.08/hr**	**-38.5%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	$3.68/hr	$3.33/hr	-9.5%
Idle	$5.73/hr	$4.42/hr	-22.9%

Revised Date: 1st Half 2019

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Rental Rate Blue Book®

February 21, 2019

Miscellaneous MSR-189H
Crawler Tractor Multi-Shank Rippers

Size Class:
To 260 HP
Weight:
3,557 lbs.

Model Image

Configuration for MSR-189H

Engine Horsepower	**130 - 189**	Number of Shanks	**3**
Ripper Type	**Parallelogram**		

Blue Book Rates

** FHWA Rate is equal to the monthly ownership cost divided by 176 plus the hourly estimated operating cost.

	Ownership Costs				Estimated Operating Costs	FHWA Rate**
	Monthly	**Weekly**	**Daily**	**Hourly**	**Hourly**	**Hourly**
Published Rates	$1,010.00	$285.00	$71.00	$11.00	$4.15	$9.89
Adjustments						
Region (Las Cruces, New Mexico: 89%)	($111.10)	($31.35)	($7.81)	($1.21)		
Model Year (2019: 100%)	-	-	-	-		
Adjusted Hourly Ownership Cost (100%)	-	-	-	-		
Hourly Operating Cost (100%)					-	
Total:	**$898.90**	**$253.65**	**$63.19**	**$9.79**	**$4.15**	**$9.26**

Non-Active Use Rates

	Hourly
Standby Rate	$3.52
Idling Rate	$5.11

Rate Element Allocation

Element	**Percentage**	**Value**
Depreciation (ownership)	50%	$505.00/mo
Overhaul (ownership)	31%	$313.10/mo
CFC (ownership)	7%	$70.70/mo
Indirect (ownership)	12%	$121.20/mo

Fuel cost data is not available for these rates.

Revised Date: 1st Half 2019

These are the most accurate rates for the selected Revision Date(s). However, due to more frequent online updates, these rates may not match Rental Rate Blue Book Print. Visit the Cost Recovery Product Guide on our Help page for more information.

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EquipmentWatch

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All prices shown in US$

Custom Cost Evaluator

February 21, 2019

Finn B260
Trailer Mounted Mulchers

Size Class:
51 HP & Over
Weight:
4,880 lbs.

Model Image

Configuration for B260

Power Mode **Diesel** Horsepower **115**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	$5.80/hr	$5.45/hr	-6%
Cost of Facilities Capital (CFC)	$0.88/hr	$0.69/hr	-21.6%
Overhead	$1.18/hr	$0.90/hr	-23.7%
Overhaul Labor	$3.36/hr	$1.00/hr	-70.2%
Overhaul Parts	$2.54/hr	$1.92/hr	-24.4%
Total Hourly Ownership Cost:	**$13.76/hr**	**$9.96/hr**	**-27.6%**

User Defined Adjustments: Annual Use Hours (1,050hrs -> 1,388hrs) Sales Tax (5.1% -> 0%)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	$4.20/hr	$1.25/hr	-70.2%
Field Parts	$1.47/hr	$0.15/hr	-89.8%
Ground Engaging Component (GEC)	$0.00/hr	-	-
Tire	$0.60/hr	-	-
Electrical/Fuel	$13.50/hr	$4.13/hr	-69.4%
Lube	$1.60/hr	-	-
Total Operating Ownership Cost:	**$21.37/hr**	**$7.73/hr**	**-63.8%**

User Defined Adjustments: Annual Field Repair Parts Cost ($1,342.66 -> $0.66) Diesel Cost (3.27 -> 1) Mechanics Wage ($58.84 -> $23.09)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	$13.76/hr	$9.96/hr	-27.6%
Hourly Operating Costs	$21.37/hr	$7.73/hr	-63.8%
Total Hourly Cost	**$35.13**	**$17.69/hr**	**-49.6%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	$7.86/hr	$7.04/hr	-10.4%
Idle	$27.26/hr	$14.09/hr	-48.3%

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Rental Rate Blue Book®

February 21, 2019

Finn B260

Trailer Mounted Mulchers

Size Class:
51 HP & Over
Weight:
4,880 lbs.

Model Image

Configuration for B260

Power Mode **Diesel** Horsepower **115**

Blue Book Rates

** FHWA Rate is equal to the monthly ownership cost divided by 176 plus the hourly estimated operating cost.

	Ownership Costs				Estimated Operating Costs	FHWA Rate**
	Monthly	Weekly	Daily	Hourly	Hourly	Hourly
Published Rates	$2,425.00	$680.00	$170.00	$26.00	$21.35	$35.13
Adjustments						
Region (Las Cruces, New Mexico: 89.4%)	($257.05)	($72.08)	($18.02)	($2.76)		
Model Year (2019: 100%)	-	-	-	-		
Adjusted Hourly Ownership Cost (100%)	-	-	-	-		
Hourly Operating Cost (100%)					-	
Total:	**$2,167.95**	**$607.92**	**$151.98**	**$23.24**	**$21.35**	**$33.67**

Non-Active Use Rates

	Hourly
Standby Rate	$6.16
Idling Rate	$25.82

Rate Element Allocation

Element	Percentage	Value
Depreciation (ownership)	37%	$897.25/mo
Overhaul (ownership)	50%	$1,212.50/mo
CFC (ownership)	6%	$145.50/mo
Indirect (ownership)	7%	$169.75/mo
Fuel (operating) @ 3.27	63%	$13.50/hr

Revised Date: 1st Half 2019

These are the most accurate rates for the selected Revision Date(s). However, due to more frequent online updates, these rates may not match Rental Rate Blue Book Print. Visit the Cost Recovery Product Guide on our Help page for more information.

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RS Means Online Data

Accessed February 13, 2019

Revegetation

Line Number	Description	Unit	Material	Labor	Equipment	Total	Data Release	CCI Location
015433201500	Rent disc harrow attchment for tractor, Excl. Hourly Oper. Cost.	Month	$ -	$ -	$ 616.33	$ 616.33	Year 2019	NEW MEXICO / LAS CRUCES (880)

Labor Rates

NMDOL Type A Operator Group	Base rate	Fringe rate	Apprenticeship		Total 2019 Rate ($/hr)
Equipment Operator IV	20.87	5.94	0.6	$	27.41
Equipment Operator V	20.98	5.94	0.6	$	27.52
Equipment Operator VI	21.16	5.94	0.6	$	27.70
Laborer I	16.86	5.63	0.6	$	23.09
Laborer II	17.61	5.63	0.6	$	23.84
Truck Driver III	16.15	7.52	0.60	$	24.27

Labor rates based on NM Department of Labor Type H (Heavy Engineering) 2019 labor rates. Rates include base hourly wage, fringe benefit, and apprenticeship contribution rates.
https://www.dws.state.nm.us/Portals/0/DM/LaborRelations/Prevailing_Wage_Poster_H_2019_final.pdf

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Laramie, WY 82073

FREEPORT MCMORAN – NEW MEXICO MINING OPERATIONS

PRICE ESTIMATES FOR REVEGETATION SERVICES FOR BUDGETING ESTIMATES

Table 1 –Freeport McMoRan, New Mexico Mining Operations – Price Estimates for Revegetation Services for Budgeting Estimates, prepared April, 2018.

	REVEGETATION OPERATION	ESTIMATED QUANTITY	UNITS	COST/UNIT ($)	TOTAL COST
I.	**OPERATIONS:**				
1	**SCARIFYING**	500	Acres	$30.00	$15,000.00
2	**DISCING**	500	Acres	$20.00	$10,000.00
3	**DRILL SEEDING (special Rangeland Drill)**	500	Acres	$80.00	$40,000.00
4	**MULCHING**	500	Acres	$148.00	$74,000.00
5	**CRIMPING**	500	Acres	$55.00	$27,500.00
6	**DAILY PER DIEM, ETC.**	50	Days	$385.00	$19,250.00
7	**MOBILIZATION**	1	Each	$13,500.00	$13,500.00
	Subtotal				**$199,250.00**
II.	**MATERIALS:**				
1	**SEED** at 8.9 PLS/acre	500	Acres	$210.00	$105,000.00
2	**HAY MULCH** - nox. weed free, native	1000	Tons	$245.00	$245,000.00
	Subtotal				**$350,000.00**
	TOTAL ESTIMATED REVEGETATION COST BEFORE TAX				**$549,250.00**
	Add New Mexico Gross Receipts Tax	5.9375	%		**$32,611.72**
	ESTIMATED REVEGETATION COST PER ACRE:			**$1,163.72**	
	TOTAL ESTIMATED REVEGETATION COST				**$581,861.72**

Estimate prepared by Ron Schreibeis, Rocky Mountain Reclamation, for use for Budgeting Estimates.

Attachment E.8
Operation and Maintenance Costs

Calculation Documentation

Problem Statement:

Freeport-McMoRan (FMI) utilizes cost information for operations and maintenance (O&M) as part of earthwork closure cost estimation associated with the Emma Closure/Closeout Plan (CCP). The O&M costs need to account for vegetation maintenance costs for a 12-year period after completion of initial revegetation activities in each area, along with ongoing erosion control, road maintenance, and groundwater monitoring for a 100-year period.

This calculation set presents a summary of the approach and results for estimating O&M costs. Detailed information is presented in the earthwork reclamation cost estimate (RCE) spreadsheet file.

This calculation set is intended to serve as a guide/example even if the assumptions or actual cost data used in these calculations change due to updates or application to a different Freeport NM Operations mine.

Objective:

1. Develop the estimated O&M costs for vegetation maintenance for a 12-year period after completion of initial revegetation activities in each area, along with ongoing erosion control, road maintenance, and groundwater monitoring activities for a 100-year period. Also, develop tailing cover maintenance costs for previously reclaimed areas for the first 7 years of closure reclamation. The O&M costs are used as part of the earthwork RCE for FMI's mining operations in Grant County, NM.

Approach:

1. The data, assumptions, calculations, and results for the O&M cost estimate are presented within the Tyrone earthwork RCE spreadsheet file. Also, a summary of results is presented in the spreadsheet file.
2. The approach for estimating vegetation maintenance O&M costs is as follows:
   - For each facility (stockpile, tailing pond, reservoirs, etc), the total area is listed, along with approximate year of reclamation start, vegetation maintenance start, and vegetation maintenance complete. A 2% loss per year (i.e., 2% of vegetation fails each year) for 12 years is assumed to estimate the acreage requiring vegetation maintenance for each year.
   - Revegetation unit costs (equipment and fuel) are applied to the loss of acreage for each year to calculate the vegetation maintenance cost for each facility.

For example use only. Values may not match the current spreadsheet.

Approach (continued):

3. The approach for estimating erosion control, road maintenance, tailings cover maintenance, and groundwater monitoring ("Other") O&M costs is as follows:
   - For erosion control and road maintenance
     - Determine base costs ($/day) for equipment and fuel base. Also, estimate the number of days/yr for erosion control and road maintenance for three periods: Years 0-19, 20-39, and 40-99.
     - Calculate the annual equipment and fuel costs, based on days/yr, for the same three periods.
   - For tailing cover maintenance
     - Use erosion control equipment with reduced truck requirement and, therefore, reduced base cost. Assume 10 days/yr for Years 0-6, after which tailing cover maintenance is not required.
   - For groundwater monitoring
     - Determine base costs ($/day) for equipment and aqueous chemistry (lab analytical), and days/yr for groundwater monitoring for three periods: Years 0-19, 20-39, and 40-99.
     - Calculate the annual equipment and annual aqueous chemistry costs, based on days/yr, for the same three periods.
   - For these "Other" O&M activities
     - While reclamation is ongoing, adjust the O&M costs accordingly based on the proportion of reclamation completed as of each year. The full annual cost applies when reclamation is complete.
     - For years after reclamation is complete, assign the O&M costs for each year based on the annual costs calculated for Years 0-19, 20-39, and 40-99.

Results:

1. The vegetation maintenance and "Other" O&M costs are summed for all years, as shown in the summary table below (some of the final results may vary from what is shown). These results are used in the overall earthwork RCE.
2. The indirect costs are set at 17.5% of direct costs, based on an agreement between FMI and the agencies in January 2019. Indirect costs include but are not limited to mobilization and demobilization, contingencies, engineering redesign fees, contractor profit and overhead, project management, administrative expenses, etc.

DRAFT Operations and Maintenance Summary			
			Current Value
DIRECT COSTS	Facility and Structure Removal		$0
	Earthmoving		$0
	Vegetation		$1,328,888
	Other		$6,202,825
	Subtotal, Direct Costs		**$7,531,713**
INDIRECT COSTS[1]	**Subtotal, Indirect Costs**	17.5%	**$1,318,050**
TOTAL COST			**$8,849,763**

For example use only. Values may not match the current spreadsheet.