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16. Abstract

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# DEVELOPMENT OF AN AUTOMATED FLEET-LEVEL EQUIPMENT REPLACEMENT METHODOLOGY

Angela Jannini Weissmann
José Weissmann

Research Report 0-4941-2

Research Project 0-4941

"Equipment Replacement Criteria Based On Life Cycle Cost Benefit Analysis (LCCBA) TERM: Transportation Equipment Replacement Methodology"

Conducted for the
**TEXAS DEPARTMENT OF TRANSPORTATION**

By the
**THE UNIVERSITY OF TEXAS AT SAN ANTONIO**

July 2003

## ABSTRACT

The Texas Department of Transportation (TxDOT) owns and maintains an active fleet inventory of over 17,100 units, replacing about ten percent of the fleet annually. Any methodology that can expand upon the replacement procedures currently used at TxDOT has the potential of savings millions of dollars. This report describes a replacement methodology developed to assist equipment replacement at TxDOT that includes life cycle cost history as one of the replacement criteria. This new method takes full advantage of the comprehensive TxDOT's Equipment Operating System (EOS) database. It automatically outputs prioritized replacement lists based on ranking the condition of each unit with respect to the condition of all other units within its class.

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This report, the second of the 4941 series, describes the development of this methodology and the framework of the computer program for its implementation. The third report of this series is the software manual.

## DISCLAIMERS



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Lenert Kurtz, Dawn Doyle, Caren Cowfer, and Joe Graff, and coordinator Kahli Persad. Their advice was paramount to the successful conclusion of this research. We received invaluable data files from Glenn Hagler, Dee Dee Evans, Karen Dennis, and Hope Kruise, as well as key research information every time we needed expert advice on details of equipment characteristics and replacement strategies. Several others also helped along the way, including, but not restricted to, David Umscheid, Sandy Nichols, Hope Kruse, Raul Hoxie, Cathy Long, Dana Snokhous, Noemi Rios and Rachelle Koczman.

This research effort was a model of productive teamwork in a cooperative environment headed by a team leader as capable and experienced as Mr. Hagler.

## IMPLEMENTATION RECOMMENDATIONS

This report should be used together with the other reports of this series, as a guidance to install and maintain TERM (Texas Equipment Replacement Methodology) software at TxDOT's General Services Division–Purchase and Equipment Sections.

The researchers recommend that fleet managers use the software capabilities to prepare replacement priority lists based on different combinations of criteria, and compare replacement costs for each list. This would give managers a good feel for the new method, and would also enable them to devise ways to upgrade and improve the software's practical features.

TERM should not be regarded as a one-time-only effort. Rather, it should be viewed as an ongoing programming effort, like all other computer softwares in the market (constantly being upgraded by their companies). TxDOT should assign TERM to a staff member who is proficient in the SAS programming language, including the AF and SCL environments, and the IML subroutines. This person should be responsible for two tasks: periodic update of the historical data sets used by the program, and ongoing programming of the software upgrades requested by the users.

Prepared in cooperation with the Texas Department of Transportation and the U.S. Department of Transportation, Federal Highway Administration.

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# CHAPTER 1
# INTRODUCTION, OBJECTIVES, AND RESEARCH APPROACH

## BACKGROUND

The primary function of equipment managers is to provide the proper equipment, at the right time and at the lowest overall cost. A major task in accomplishing this function is fleet planning, which involves identifying the requirements of equipment users, developing optimal strategies to meet those needs, and putting the plan into action. Equipment replacement is a complex portion of this process. It requires a methodology to assure that each unit is replaced or remanufactured at its optimal economic life point, as well as assisting in the development of effective specifications and procurement procedures. This is the main thrust of this research project.

Currently, TxDOT uses Texas Equipment Replacement Methodology (TERM) to identify candidates for replacement one year in advance. TERM uses threshold values for age and usage of an equipment unit as criteria for replacement. For example, current threshold values for dump trucks with tandem rear axles (class code 540020) for age and usage, are respectively 10 years and 150,000 miles.

In addition to targeting life and usage, units with exceptionally high repair cost are also targeted, by establishing an exception threshold, so that units that exceed the class average repair costs can be identified. For example, TxDOT's TERM identifies units that exceeded a certain predetermined threshold of the repair costs represented as a percentage of the original purchase cost. Using the dump trucks with tandem rear axles again as an example, the current threshold in TxDOT's TERM system for the repair cost is 100 percent.

## STUDY OVERVIEW

The current TERM provides TxDOT with a very good tool to make equipment replacement decisions. However, the equipment life-cycle costs are taken into account in a simplified manner, and the data reports are not fully automated. Moreover, the criteria look at equipment units individually; there is methodology to prioritize units for replacement. A comprehensive equipment replacement method should ideally include the following steps:

(1) Identify units targeted for replacement,
(2) Obtain replacement requests from users,
(3) Apply an economic analysis model,
(4) Prioritize replacement units,
(5) Allocate the available budget and make purchasing decisions,
(6) Acquire new equipment, and
(7) Dispose of old equipment.

In addition, replacement decisions should ideally consider some form of economic analysis such as life cycle cost analysis, which requires the accumulation of accurate cost historical data. TxDOT's Equipment Operations Systems (EOS) database is very comprehensive, containing a wealth of information relevant to life cycle cost analysis and replacement decisions.

Research project 7-4941 originated from TxDOT's General Services Division–Purchase and Equipment Sections as a response to the need for developing equipment replacement analysis procedures based on engineering economics principles. The project staff assigned to this research project developed a new, computerized Transportation Equipment Replacement Methodology (TERM) system for the State of Texas. TERM is a menu-driven software broken down into modules that allow the user to maintain an updated replacement database, retrieve information on specific equipment units or classes of equipment, and obtain replacement priorities based on user-selected criteria that can include life-cycle cost trends, downtimes, mileage, and repairs. Agencies such as TxDOT, whose capital replacement budgets are fixed or subject to approval by legislative bodies, may not always have funds for all needed replacements. A prioritized replacement list will assist the manager in making purchase decisions. It will also make the effects of inadequate funding more visible.

## STUDY OBJECTIVES AND APPROACH

### *Study Objectives*

TxDOT owns and maintains an active fleet inventory of over 17,100 units and replaces ten percent of the fleet annually. Any methodology that can expand upon the replacement procedures currently used at TxDOT has the potential of saving millions of dollars. This research project developed an economically sound methodology to assist equipment replacement at TxDOT. This new method takes full advantage of the comprehensive EOS database, and is based on criteria that prioritize the units based on comparisons among all units within any desired class.

The project objectives are to develop, test and implement a computerized TERM system capable of updating the analysis data sets, processing the life cycle cost profiles for the different pieces of equipment in the TxDOT inventory, applying the replacement criteria developed by this project to support equipment replacement decisions, and generating reports in tabular and graphical formats in order to simplify the analysis of the results by TxDOT decision makers.

### *Study Approach*

This project is organized into three phases. Phase I is the development of an equipment replacement model based on life cycle cost analysis procedures. Phase II is the statistical analysis of equipment historical data available at TxDOT, and Phase III is the development of a computerized procedure for supporting equipment replacement decisions at TxDOT.

These phases are interrelated, rather than sequential. For example, the equipment replacement models (phase I) and computerized procedures (Phase III) necessitate an analysis of equipment historical data available from EOS database (Phase II), and statistical data analyses (Phase II) need to be programmed (Phase III). Several computer programs developed during phase II are part of the final deliverable (Phase III). The final product is a SAS®-based software to assist TxDOT in equipment replacement decisions.

## REPORT OBJECTIVES AND ORGANIZATION

### *Report Objectives*

The nature of this project implies the need for two types of deliverables: the research documentation and the implementable research result, i.e., the software. The objectives of this report are to document the following:

(1) The literature and background research necessary to develop life-cycle cost functions and replacement criteria, to be programmed into the final deliverable, the software;
(2) The data validation process;
(3) The data analyses and the development of the life-cycle cost functions from the available data;
(4) The development of a way of allowing a computer program to mimic human decisions based on visual inspection of life-cycle cost graphs;
(5) The development of the software framework; and
(6) The development of a programmable multi-criteria decision-aid system to prioritize equipment units for replacement.

The next and final report of this series concerns itself with project implementation. It is a TERM software user's manual, explaining how to install, use and maintain the software this project developed.

### *Report Organization*

This report is organized into six chapters and one appendix. Chapter 1, *Introduction, Objectives, and Research Approach* (this chapter), presents a background and introduction, and discusses the project objectives, the research approach, and the report objectives and organization.

Chapter 2, *Development of the Analysis Data Sets*, discusses the EOS database information that is relevant to this project, and explains how these data are treated by the new TERM system. Chapter 3, *Literature Review and Research Approach*, presents a summary of the literature review performed during this project, focusing on equipment replacement methodologies in use by several agencies. It summarizes the most significant findings that led to the type of approach proposed in this project, describing it briefly.

Chapter 4, *Replacement Methodology Based on Life Cycle Costs*, explains how the life-cycle cost concept, and how the research team applied to the case at hand. Next, it explains the trendscore; a new concept developed by the team to allow the program to mimic human decisions based on inspecting a life-cycle cost chart.

Chapter 5, *Proposed Replacement System*, explains the proposed multi-criteria approach for replacement priorities, the incorporation of an option for replacement qualification based on thresholds, and the system architecture to program it into a menu-driven software. It also discusses the relative importance of the multi-criteria attributes, referring to the table in the appendix.

The last Chapter is number 6, *Summary, Conclusions and Recommendations*. This chapter contains important recommendations for implementing and improving this newly developed system.

The Appendix, titled *Statistical Analysis of Attributes' Contribution to Replacement Priority*, contains the complete list of classcodes, and the summary statistics of each attribute's contribution to the priority rank. This analysis was requested by the advisory committee to use as initial guidance in selecting weights for the ranking module; it is not intended as a substitute for managerial experience with the relative importance of each attribute.

# CHAPTER 2
# DEVELOPMENT OF THE ANALYSIS DATA SETS

## INTRODUCTION AND OBJECTIVE

TxDOT's Equipment Operations Systems (EOS) database is very comprehensive, containing a wealth of information relevant to life cycle cost analysis and replacement decisions. As such, the first task of this project was to select variables relevant for a replacement database, and validate the records available for them. Next, the project team developed the analysis data sets, and the data update module.

At the time of the data validation analysis, the study team had EOS files from fiscal year 1995 to fiscal year 2000. The historical data set extracted from TxDOT's EOS database contained 118,158 records, and included minor equipment as well as both retired and active equipment. The data sets used can be updated whenever another EOS file becomes available.

It is relevant to note that the data validation checks resulted in a remarkable overall level of accuracy over 99.5%. Nevertheless, the replacement system contains code to flag data inconsistencies that may be present. The levels of tolerance used for flagging each variable were selected in concert with the project Advisory Committee.

This chapter discusses the variables selected for the TERM system, the data validation criteria developed in conjunction with the project Advisory Committee, and the four data flags that indicate whether or not these validation criteria were being met for each particular observation. It also documents the development of the two analysis data sets: one for retired, and the other for active equipment.

## VARIABLES SELECTED FOR ANALYSIS

TxDOT's Equipment Operations Systems (EOS) database is very comprehensive, containing a wealth of information relevant to life cycle cost analysis and replacement decisions. The variables selected from EOS for use in the new TERM system are listed below. The other main source of information, besides the EOS files, is TxDOT's file number 29, ADY.DIC.0204 (Ref. 28), termed "data dictionary" in this report.

### *Date Variables*

Date of last database update (dbdt)
Date equipment was received (recdt)
Date retired (retdt)
Fiscal year of EOS file (flyr)

### *Life-Cycle Cost Variables*

Purchase cost (purcost)
Resale value, only if retirement code is 2,7,8 or 9 (resale)
Repair expenses during database update year (repair)

Gasoline expenses during database update year (gas)
Gallons of gasoline consumed during database update year (gasq)
Diesel expenses during database update year (diesel)
Gallons of diesel consumed during database update year (dieselq)
Oil expenses during database update year (oil)
Quarts of oil consumed during database update year (oilq)
Other fuel expenses during database update year (otherfuel)
Gallons of other fuel consumed during database update year (otherfuelq)
Hydraulic fluid expenses during database update year (hydfl)
Quarts of hydraulic and other fluids consumed during database update year (hydflq)
Indirect expenses during database update year (indirect)
Miles or hours of usage during database update year (usage)
Code for usage, miles or hours (usecd)
Hours of downtime during database update year (down)
Net cost (netc)
Rental (rental)
Cost adjustment (cost_adj)

### *Equipment Identification and Status*

Equipment unit identification (ID)
Special ID code (SIC)
Equipment class code (classcod)
Equipment class description (clname)
Equipment makes code (make)
Equipment makes name (maken)
Year manufactured (ymade)
Model name (model)
TxDOT District (district)
TxDOT Section (section)
Equipment status (status), P through Z, (EOS data dictionary page 2, ref. 28)
Retirement code (retcd), 1 through 9, (EOS data dictionary page 13, ref. 28).

## DATA VALIDATION RESULTS

### *Date Variables*

A remarkable 100% accuracy was found for these types of variables. For example, the retirement date was always greater than the receipt date, the receipt date was always less than the corresponding database update.

The only instances of equipment units in use without a receipt date refer to recently received units whose receipt date has not yet been logged. This is of no concern for replacement methodology, since new equipment units are not candidates for replacement. The receipt date will be available in later EOS files, for future use when the equipment unit gets older and closer to replacement.

The only inconsistency found was between the year made and the receipt date. The research team searched for records logged as received two or more years BEFORE the recorded year made. Most cases corresponded to devices being mounted on trucks. Apparently, the EOS initially recorded the year the truck was made; when the device was mounted, the data base recorded a later manufacturing date, which probably corresponds to the device. There were also some typos in the year made. For example, unit 00469C, an automobile in classcode 20030, had year manufactured as 1994 throughout its history, except in the EOS file year 1995, where it appears as 1995. These are of no concern to TERM, since the TERM calculates the equipment age based on receipt date and data base date.

What is important to TERM are units that don't have a uniform receipt data throughout their history; the equipment age calculation will be wrong, and its life-cycle cost history will be peculiar. Table 2.1 shows one example; by looking at the entire history of variables receipt date, year made, and EOS file year, the correct receipt date becomes obvious: it appears corrected in later EOS versions. The correct value of receipt date must appear in TERM. Table 2.2 shows the 23 units that had this type of problem with the receipt data. The corrected values appears in the version of the active equipment data set delivered with TERM in February 2003.

***Table 2.1 EOS Corrections in Receipt Date***

| | File | Last EOS | Year | Receipt Date | |
|---|---|---|---|---|---|
| **ID** | **Year** | **Update** | **Made** | **EOS** | **TERM** |
| 06001A | 1992 | 8/28/92 | 1991 | *9/4/71* | 9/4/91 |
| 06001A | 1993 | 8/26/93 | 1991 | *9/4/71* | 9/4/91 |
| 06001A | 1994 | 8/26/94 | 1991 | *9/4/71* | 9/4/91 |
| 06001A | 1995 | 8/30/95 | 1991 | *9/4/71* | 9/4/91 |
| 06001A | 1996 | 8/29/96 | 1991 | 9/4/91 | 9/4/91 |
| 06001A | 1997 | 8/26/97 | 1991 | 9/4/91 | 9/4/91 |
| 06001A | 1998 | 8/26/98 | 1991 | 9/4/91 | 9/4/91 |
| 06001A | 1999 | 8/26/99 | 1991 | 9/4/91 | 9/4/91 |
| 06001A | 2000 | 8/30/00 | 1991 | 9/4/91 | 9/4/91 |
| 06001A | 2001 | 8/29/01 | 1991 | 9/4/91 | 9/4/91 |
| 09811G | 2000 | 8/30/00 | 2000 | *6/26/60* | 6/26/00 |
| 09811G | 2001 | 8/29/01 | 2000 | 6/26/00 | 6/26/00 |

There is one asphalt maintenance unit, trailer mounted (ID=08585D, classcode 12020), whose history is unclear. Up to 1997, this ID appears with manufacturing year 1948 and receipt date 11/21/48. From 1998 and on, it appears with t manufacturing year 1981 and receipt date 11/21/81. In 2001, this unit appears as received in 1982. This is difficult to interpret. In order to have a coherent life-cycle cost history for this unit, the active data set version delivered with TERM records the receipt date as 1981 for the entire history of this unit (ID=08585D).

Because of cases like this, the TERM version we delivered does not include automatic corrections for the receipt date. The data update module contains code to output a table similar to table 2.1. The system administrator will be able to harmonize most if not all of receipt dates in the equipment history in a few lines of very simple SAS code. Given the remarkable accuracy of the EOS files, this output file will probably have less than 10 units. S/he can discuss the dubious cases (if any) with the fleet managers, and later implement the corrections they suggested.

It is important to note that the updated data set can be used with TERM even before the system administrator and the fleet managers harmonize all receipt dates. In the 11 years of data history examined by the research team, the receipt dates were uniform for over 99.95 percent of the units.

***Table 2.2 Corrections in Receipt Date for TERM Data Set***

| ID | First Obs* | Year Made | Receipt Date EOS | Receipt Date EOS and TERM |
|---|---|---|---|---|
| 01550 | 1990 | 1982 | 10/23/98 | 4/5/83 |
| 01566A | 1994 | 1994 | 9/4/97 | 4/1/94 |
| 01785B | 1990 | 1981 | 6/9/80 | 4/1/81 |
| 03229F | 1995 | 1995 | 2/25/99 | 3/16/95 |
| 03463G | 1997 | 1997 | 1/3/96 | 1/3/97 |
| 04248F | 1994 | 1994 | 6/22/93 | 6/22/94 |
| 04299F | 1995 | 1995 | 1/20/98 | 1/25/95 |
| 04300F | 1995 | 1995 | 1/20/98 | 1/25/95 |
| 04733E | 1991 | 1990 | 2/4/89 | 2/4/91 |
| 04741E | 1991 | 1990 | 1/31/90 | 1/31/91 |
| 05474E | 1993 | 1993 | 11/13/90 | 11/13/92 |
| 05702D | 1990 | 1989 | 3/13/87 | 3/13/89 |
| 05902D | 1990 | 1989 | 10/5/93 | 3/21/89 |
| 06101B | 1993 | 1993 | 3/19/92 | 3/19/93 |
| 06108B | 1993 | 1993 | 2/23/92 | 2/23/93 |
| 06241 | 1990 | 1990 | 2/20/89 | 2/20/90 |
| 06410A | 1994 | 1993 | 1/7/93 | 1/7/94 |
| 06862 | 1990 | 1989 | 1/6/88 | 1/6/89 |
| 07730 | 1990 | 1988 | 9/8/77 | 9/8/88 |
| 09806E | 1993 | 1992 | 6/21/00 | 12/15/92 |

* This is the earliest available data record for this equipment unit. The research team worked with EOS files from 1990 to 2001.

***Cost Variables***

*Purchase cost and resale values are consistent*. This was 100 percent accurate. There were no negative numbers for purchase costs or resale values. There were no instances where purchase cost was less than the resale value. There were no instances of resale values attributed to the wrong equipment status or retirement code.

*Negative numbers for prices or fuel quantities.* There were 109 negative repair costs. Equipment units containing these corrections are flagged by the system, although these are not data errors. Zero and negative values represent accounting correction for overcharges in the previous fiscal year; as such, they can and should enter into the cost calculations. The occurrences are summarized in table 2.3 (from 1995 through 2000).

***Table 2.3 Records Containing Negative Cost Data***

| Item | Expense<0 and Quantity <0 | Expense<0 and Quantity >0 | Expense>0 and Quantity <0 |
|---|---|---|---|
| Gas | 88 | 2 | 2 |
| Diesel | 49 | 0 | 0 |
| Other fuels | 7 | 2 | 4 |
| Hydraulic and other fluids | 21 | 5 | 2 |
| Oil | 8 | 3 | 0 |
| Purchase cost* | 0 | N/A | N/A |
| Resale price* | 0 | N/A | N/A |
| Repair expenses* | 109 | N/A | N/A |

* Quantities not applicable

*Consistency between fuel quantities and their price.* Price ranges were estimated dividing the recorded fuel expenses by the recorded fuel quantities. Results should be within a reasonable unit price for all categories except "other fuels". For the latter type, the recorded value includes the fuel price and the tax sticker, so the quotient between expenses and quantity is meaningless. Table 2.4 shows the tolerances established by the Advisory Committee, and the number of records containing unit prices

***Table 2.4 Tolerance and Consistency of Fuel and Fluids Prices (expenses/quantity)***

| Item | Tolerance ($/gallon or quart) | Records outside tolerance range | Accuracy |
|---|---|---|---|
| Gas | $0.50—$2.00 | 379 | 99.7% |
| Diesel | $0.40—$2.00 | 274 | 99.8% |
| Hydraulic and other fluids | $1.00—$5.00 | 12,112 | 89.8% |
| Oil | $1.00—$4.00 | 31,571 | 73.8% |

above the tolerance. Gasoline and diesel records are almost 100 percent within range, while generic items, such as "other fluids" and "oil", have more records outside range. The system flags these records.

### *Downtime and Usage*

Downtimes. Downtime values ranged from 1 to 4,879 hours at a mean of 112 hours. The 90% percentile was at 288 hours (12 days). The Advisory Committee recommends a tolerance for downtimes equal to the maximum working hours in a year, which is 2,080 hours. Table 2.5 shows a summary of downtimes equal to or greater than 2,080. There were only 18 points outside the range—eleven of them for minor equipment, which is not part of the replacement methodology. This means an accuracy level of 100.000% if rounded to the third decimal place. The system flags these occurrences, in spite of their negligible frequency.

***Table 2.5 Downtimes Greater Than 2,080 hours/ year***

| Downtimes | Number of Data Points |
|---|---|
| 2080<=down<3000 | 11 |
| 3000<=down<4000 | 3 |
| 4000<=down<5000 | 4 |
| >=5000 | 0 |
| Total | 18 |

Usage in hours ranges from 1 to 13,023, at a mean of 273. The maximum number of hours in a working year of 52 weeks and 8-hour working day is 2,080. Table 2.6 shows a summary of the hours of usage greater than 2,080. There were 272 records with usage values greater than 2,080, resulting in an accuracy level of 99.8%.

Values below 3,000 could represent full-time or full-time plus weekend overtime, as long as downtime values are zero. There were 180 data points with usage between 2,080 and 3,000 hours and downtime greater than zero. Since there are 8,760 hours in a year, values greater than this number are impossible. There were only 6 records with impossible values, as shown in table 2.6. In spite of their negligible frequency, these records are flagged by the system.

***Table 2.6 Usage Greater Than 2,080 hours/ year***

| Hours of usage | Number of Data Points |
|---|---|
| 2080<=usage<3000 | 223 |
| 3000<=usage<4000 | 23 |
| 4000<=usage<5000 | 12 |
| 5000<=usage<6000 | 3 |
| 7000<=usage<8760 | 5 |
| usage>=8760 | 6 |
| Total | 272 |

Mileage ranged from 1 to 120,684. The maximum number of hours in a working year of 52 weeks and 8-hour days is 2,080. Assuming an average speed of 40 mph, and full-time, 5-days-a-week, yearround usage, the maximum mileage per year should be 83,000. There were only 24 instances of mileage≥80,000 in the combined 6-year database, a negligible frequency of occurrence. One instance was an automobile and the others were trucks. Mileage data below 80,000 miles/year will be considered accurate, while values greater than 80,000 will be flagged.

### *Variables to Identify Equipment Units and their Status*

Equipment ID is not always unique. There was no duplication of ID numbers within each fiscal year, but the same equipment ID may refer to a different unit in a previous and/or in a subsequent fiscal year. From 1995 to 2000, there were 232 instances of equipment IDs that appear as repetitions in the 6-year history (therefore, 464 records in all). They can be classified as follows:

1. Equipment units that changed classcodes when the voucher was processed, i.e., the classcodes are different in the voucher (status V) and the purchase order (status P). This inconsistency is not flagged by the system, whose datasets include only active equipment.
2. Equipment units that changed to a different size/power category. Example: Unit 01246, received on 09/16/87, appears as classcode 90030 (grader, motor, class III, 125 to 149 H.P.) in the 08/25/97 database update, and as classcode 90040 (same equipment, 150 H.P. and greater) in the 08/30/95 database update. **Recommendation: use the latest classcode.**
3. Truck or trailer mounted devices previously classified as trucks or trailers, and vice-versa. For example, units 03555F and 033556F changed from classcode 530010 (truck, all body styles except conv. dump/wrecker, 25500-28900gvwr) to 1010 (aerial personnel device, truck mounted). Cost history and life-cycle cost curve for these IDs are not reliable, as they combine truck-only costs and costs of a truck-mounted device. **Recommendation: flag these units.**
4. IDs from retired equipment being assigned to newer equipment. For example, ID=02031E was assigned to a classcode 174020 pneumatic roller that was retired in 1994, and then reassigned to a classcode 170010 roller received in 1996. This conflict does not affect the analysis data sets, since they separate active and retired equipment. The project Advisory Committee states that this practice has been abandoned. **Their recommendation: Flag these records for user examination and decision.**

### *Multiple-Variable Consistency Checks*

*Do retired units remain in databases subsequent to retirement?*

Yes. The results indicated that retired units might remain in the data base for 2 years. The 1999 data base, for example, contained 411 units retired in 1997 and 1249 units retired in 1998. The system will contain code to ensure that retired units appear in the retired equipment data set only once. The last records showing usage greater than zero will be the last ones appearing in the retired equipment data set.

*Can retired equipment IDs be absent from previous databases (instead of appearing as not retired)?*

Yes. For example, there were 408 equipment units that appeared as "retired in 1997" in the 1998 database, but were absent from previous databases.

*Equipment status, retirement code, and fuel consumption*

Equipment status, retirement code (if retired), usage and fuel consumption must be consistent. For example, equipment status "Q" (requisitioned) must have zero usage and fuel consumption; and so must retired equipment after retirement date.

This was 100 percent accurate. For every record, the results indicate that the equipment status variable is consistent with the retirement code (when appropriate) and with the maintenance and usage values.

*Are the resale prices and the equipment status consistent?*

Yes. All equipment pieces that had a recorded resale price also had status of either X (retired, payment pending) or Z (retired).

#### *Summary and Conclusions*

The data validation checks resulted in a remarkable overall level of accuracy of 99.5%. Nevertheless, the following findings are flagged by the system. Not all of them are errors.

1. Negative costs and prices, which represent accounting correction for overcharges in the previous fiscal year, are flagged be the system. This is not a data error, but the equipment manager may have interest in examining these data.
2. Retired units that appear as retired in one year but do not appear on previous years were deleted from the retired equipment data base, due to lack of data.
3. The last year a retired unit appears in the retired equipment data set is the retirement year.
4. Repeated equipment ID's will be flagged.
5. Fuel and fluids expenses: flagged whenever the recorded expenses and recorded quantities do not obey the tolerances set by the Advisory Committee.
6. Hourly usage values greater than 8,760 hours/year, as well as mileage values greater than 80,000 miles/year, are flagged whenever the recorded values are outside the tolerances set forth by the Advisory Committee.
7. Downtime values greater than 2,080 hours/year are flagged. Values greater than 8,760 will be flagged and set to missing.

## DEVELOPMENT OF THE ANALYSIS DATA SETS

#### *Active Equipment Data Set*

The active equipment data set is the data set used for replacement decisions. It is a subset of the EOS data files that includes only the variables selected as relevant for replacement decisions. It does not include records for retired equipment, or equipment that has been ordered but is not in use yet.

Exhibit 2.1 shows the contents of the active equipment data set. When the analysis data set was developed, it contained records from fiscal year 1990 to fiscal year 2000. It can be updated when another EOS file becomes available, using the data update module. This module also flags records as recommended by the Advisory Committee, and writes them to a text file for inspection. This is the only file that is not coded in menu-driven format. It will be used only once a year by the person responsible for the system maintenance, to write the updated data set used by the rest of the program.

Exhibit 2.2 shows a printout of the first six observations (or records) in the active data set. They correspond to the history of equipment unit with ID=00001D. Each data set record, or observation, comes from one EOS file, and contains the variables for that particular fiscal year.

***Exhibit 2.1 Contents of the Active Equipment Data Set***

Observations: 116610 Variables: 51

| Variable Name | Type | Details |
|---|---|---|
| cum_diesel | Numeric | Cumulative diesel expenses from receipt to dbdt |
| cum_dieselq | Numeric | Cumulative diesel gallons from receipt to dbdt |
| cum_down | Numeric | Cumulative downtimes from receipt to dbdt |
| cum_gas | Numeric | Cumulative gas expenses from receipt to dbdt |
| cum_gasq | Numeric | Cumulative gas gallons from receipt to dbdt |
| cum_hydfl | Numeric | Cumulative hyd.fuids expenses from receipt to dbdt |
| cum_hydflq | Numeric | Cumulative hyd.fuids gallons from receipt to dbdt |
| cum_indirect | Numeric | Cumulative indirect expenses from receipt to dbdt |
| cum_oil | Numeric | Cumulative oil expenses from receipt to dbdt |
| cum_oilq | Numeric | Cumulative oil gallons from receipt to dbdt |
| cum_otherfuel | Numeric | Cumulative other fuel expenses from receipt to dbdt |
| cum_otherfuelq | Numeric | Cumulative other fuel gallons from receipt to dbdt |
| cum_repair | Numeric | Cumulative repair expenses from receipt to dbdt |
| cum_use | Numeric | Cumulative usage from receipt to dbdt |
| Classcod | Numeric | |
| clname | Text | Classcode description |
| cost_adj | Numeric | Cost adjustment |
| count | Numeric | Number of classcodes in equipment history |
| dbdt | Numeric | Last*Database*Update |
| diesel | Numeric | Diesel expenses in FY |
| dieselq | Numeric | Diesel gallons in FY |
| District | Numeric | |
| down | Numeric | Downtimes in FY |
| flag1 | Text | See table 2.7 |
| flag2 | Numeric | See table 2.7 |
| flag3 | Text | See table 2.7 |
| flag4 | Numeric | See table 2.7 |
| flyr | Numeric | Fiscal year of EOS file |
| gas | Numeric | Gasoline expenses in FY |
| gasq | Numeric | Gasoline gallons in FY |
| hydfl | Numeric | Hydraulic fluids expenses in FY |
| hydflq | Numeric | Hydraulic fluids gallons in FY |
| ID | Text | Equipment ID |
| indirect | Numeric | Indirect expenses in FY |
| Make | Numeric | |
| Model | Text | |
| netc | Numeric | Net cost |
| oil | Numeric | Oil expenses in FY |
| oilq | Numeric | Oil gallons in FY |
| otherfuel | Numeric | Other Fuel expenses in FY |
| otherfuelq | Numeric | Other Fuel gallons in FY |
| purcost | Numeric | Purchase cost |
| recdt | Numeric | Date*Equipment*Received, mm/dd/yy |
| rental | Numeric | Rental rates |
| repair | Numeric | Repair costs in FY |
| Section | Numeric | TxDOT section |
| SIC | Text | Special ID codes |
| Status | Text | R, S, V, W, or Y only. |
| Usage | Numeric | (miles or hours) |
| usecd | Text | Usage code, 'hr'or 'mi' |
| ymade | Numeric | Year manufactured |

**_Exhibit 2.2 Active Equipment Data Set: Printout of the First ID_**

| Obs | ID | COUNT | FY | Classcod | Make | Model | dbdt | Status | District | Section |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 00001D | 1 | 1995 | 20030 | 160 | CAPRICE | 08/30/95 | V | 1 | 54 |
| 2 | 00001D | 1 | 1996 | 20030 | 160 | CAPRICE | 08/29/96 | V | 1 | 54 |
| 3 | 00001D | 1 | 1997 | 20030 | 160 | CAPRICE | 08/26/97 | V | 1 | 74 |
| 4 | 00001D | 1 | 1998 | 20030 | 160 | CAPRICE | 08/26/98 | V | 1 | 74 |
| 5 | 00001D | 1 | 1999 | 20030 | 160 | CAPRICE | 08/26/99 | V | 1 | 74 |
| 6 | 00001D | 1 | 2000 | 20030 | 160 | CAPRICE | 08/28/00 | V | 1 | 74 |

| Obs | ymade | recdt | purcost | cost_adj | netc | SIC | repair | gas | gasq | diesel | dieselq |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1995 | 09/01/94 | 11574 | 0.00 | 11574 | Y | 549.36 | 300.04 | 361 | 0 | 0 |
| 2 | 1995 | 09/01/94 | 11574 | 2291.44 | 11574 | Y | 229.12 | 382.10 | 450 | 0 | 0 |
| 3 | 1995 | 09/01/94 | 11574 | 2291.44 | 11574 | Y | 1106.72 | 142.62 | 152 | 0 | 0 |
| 4 | 1995 | 09/01/94 | 11574 | 2291.44 | 11574 | Y | 1223.73 | 280.23 | 343 | 0 | 0 |
| 5 | 1995 | 09/01/94 | 11574 | 2291.44 | 11574 | Y | 1767.04 | 117.74 | 165 | 0 | 0 |
| 6 | 1995 | 09/01/94 | 11574 | 2291.44 | 11574 | Y | 1456.21 | 84.17 | 91 | 0 | 0 |

| Obs | oil | oilq | otherfuel | otherfuelq | hydfl | hydflq | rental | indirect | Usage | down |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 12.30 | 11 | 0.00 | 0 | 0 | 0 | 3560.87 | 486.33 | 8811 | 70 |
| 2 | 17.30 | 15 | 279.52 | 171 | 0 | 0 | 5235.59 | 484.34 | 11365 | 219 |
| 3 | 11.40 | 10 | 256.62 | 234 | 0 | 0 | 3166.11 | 528.14 | 7440 | 237 |
| 4 | 24.21 | 22 | 579.77 | 643 | 0 | 0 | 8715.34 | 387.55 | 20315 | 77 |
| 5 | 27.25 | 25 | 547.49 | 657 | 0 | 0 | 5946.44 | 352.30 | 15389 | 99 |
| 6 | 26.12 | 24 | 560.86 | 656 | 0 | 0 | 3213.29 | 398.35 | 11125 | 90 |

| Obs | usecd | clname | FLAG1 | flag3 | flag2 |
|---|---|---|---|---|---|
| 1 | mi | AUTOMOBILES, SEDAN, 113 IN. WHEELBASE AND GREATER | | OK | 0 |
| 2 | mi | AUTOMOBILES, SEDAN, 113 IN. WHEELBASE AND GREATER | | OK | 0 |
| 3 | mi | AUTOMOBILES, SEDAN, 113 IN. WHEELBASE AND GREATER | | OK | 0 |
| 4 | mi | AUTOMOBILES, SEDAN, 113 IN. WHEELBASE AND GREATER | | OK | 0 |
| 5 | mi | AUTOMOBILES, SEDAN, 113 IN. WHEELBASE AND GREATER | | OK | 0 |
| 6 | mi | AUTOMOBILES, SEDAN, 113 IN. WHEELBASE AND GREATER | | OK | 0 |

| Obs | flag4 | cum_repair | cum_gas | cum_gasq | cum_diesel | cum_dieselq | cum_oil | cum_oilq | cum_otherfuel |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 549.36 | 300.04 | 361 | 0 | 0 | 12.30 | 11 | 0.00 |
| 2 | 0 | 778.48 | 682.14 | 811 | 0 | 0 | 29.60 | 26 | 279.52 |
| 3 | 0 | 1885.20 | 824.76 | 963 | 0 | 0 | 41.00 | 36 | 536.14 |
| 4 | 0 | 3108.93 | 1104.99 | 1306 | 0 | 0 | 65.21 | 58 | 1115.91 |
| 5 | 0 | 4875.97 | 1222.73 | 1471 | 0 | 0 | 92.46 | 83 | 1663.40 |
| 6 | 0 | 6332.18 | 1306.90 | 1562 | 0 | 0 | 118.58 | 107 | 2224.26 |

| Obs | cum_otherfuelq | cum_hydfl | cum_hydflq | cum_indirect | cum_use | cum_down |
|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 486.33 | 8811 | 70 |
| 2 | 171 | 0 | 0 | 970.67 | 20176 | 289 |
| 3 | 405 | 0 | 0 | 1498.81 | 27616 | 526 |
| 4 | 1048 | 0 | 0 | 1886.36 | 47931 | 603 |
| 5 | 1705 | 0 | 0 | 2238.66 | 63320 | 702 |
| 6 | 2361 | 0 | 0 | 2637.01 | 74445 | 792 |

After development, the active equipment data set was validated according to the criteria discussed in the previous section. Table 2.7 presents a summary of reasons to flag a record, and explains the values of the four flag variables in the data set.

***Table 2.7 Special Flags for Active Equipment***

| FLAG Name | FLAG Values | MEANING OF FLAG VALUES | No. of Records |
|---|---|---|---|
| Flag1 (ID) | RECY_ID | Equipment ID previously used in already retired equipment | 675 |
| | Blank | Equipment ID is unique | 115,935 |
| Flag2 (costs and quantities) | 0 | No negative costs | 115,697 |
| | 1 | Repair or indirect costs are negative | 124 |
| | 2 | Fuel costs and respective quantities are negative | 776 |
| | 3 | Fuel costs are negative but respective quantities are positive | 6 |
| | 4 | Fuel quantities are negative but respective costs are positive | 7 |
| | 5 | Fuel (cost and/or quantity) and repair or indirect are negative | 0 |
| Flag3 (class-code change) | OK | Classcode is constant throughout the equipment (ID) history | 115,073 |
| | SIZE | Classcode changes to a different size of equipment | 437 |
| | DESCR | Classcode changes to a different equipment description | 355 |
| | OTHER | Other reasons, especially mounting/ dismounting devices | 745 |
| | NOT_OK | Classcode change is awaiting inspection by fleet manager | 0* |
| Flag4 (usage, down-times, unit fuel costs) | 0 | No values out of range | 107,149 |
| | 1 | Mileage>80,000 mi/year or (mileage/40mph)+downtime>8,760 hours | 23 |
| | 2 | Downtime>2,080 hours | 5 |
| | 3 | Gas: unit price outside the $0.5 to $2.00 range | 303 |
| | 4 | Diesel: unit price outside the $0.5 to $2.00 range | 220 |
| | 5 | Hydraulic fluids: unit price outside the $0.5 to $2.00 range | 6,078 |
| | 6 | Oil: unit price outside the $0.5 to $2.00 range | 1,643 |
| | 7 | More than one of the flag4 criteria | 364 |
| | 8 | Negative value for mileage, downtime, or fuel price/fuel quantity | 825 |

* The research team implemented changes requested by Advisory Committee up to fiscal year 2000.

***Retired Equipment Data Set***

The retired equipment data set is a subset of the EOS data files analogous to the active data set. It contains the histories of already retired equipment, starting with those in EOS file 1990, up to 2000. When a new EOS file becomes available, the data update module checks for newly retired equipment, removes the entire history of the unit from the active data set, and places it in the retired data set. The TERM system, of course, does not use information from the retired data set, since it concerns itself with replacement priorities for active equipment.

## SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter documented the process of data validation and examination, and the development of the analysis data set for the TERM system. TxDOT's EOS files are more comprehensive than needed for replacement decisions. For example, they contain thorough descriptions of the equipment technical specifications, as well as information needed for administrative purposes other than replacement. As such, the initial step in developing the TERM system consisted of developing a SAS data set containing only the variables needed for replacement decisions. Next, this data set was split into two: active and retired equipment. The active data set records were validated, and records containing values that may negatively impact accuracy were flagged in four different manners. It is important to emphasize that the overall accuracy of the data is impressive: over 99.5 percent of the records are perfectly consistent.

The active data set is the basis for the TERM system. It is recommended to use the data update module at least once every year, and maintain the active data set up-to-date. Information from the retired data set is not necessary for the TERM system. It was used in this study to establish default values for some life-cycle cost variables such as depreciation and inflation rates, as explained later in chapter 4. The researchers recommend maintaining and yearly updating this database of retired equipment for future

# CHAPTER 3
# LITERATURE REVIEW AND RESEARCH APPROACH

In 1993, Loren Wiseman of Pacific Electric Co. surveyed the utility industry to find the "perfect" replacement program. After analyzing over 100 responses, he found almost as many variations in replacement programs and criteria as there were responses (Ref. 6). This underscores the importance of surveying of replacement strategies, programs and models in order to efficiently conduct this study.

## OBJECTIVES

As a part of the research activities, this project conducted a two-level overview of replacement criteria: a survey of existing practices, and a literature review of theoretical model, engineering economics principles, and critical reviews of both practical and theoretical replacement methodologies. The results assisted the researchers as well as the project Advisory Committee in selecting the approaches underlying the new TERM system.

The objectives of this literature search were threefold:

- Obtain the state-of-the-art in replacement methodologies,
- Ensure that the methodology developed by this project was based on sound economic and mathematical principles, and
- Identify advantages and disadvantages inherent to various replacement methodologies, to develop a final product that minimizes the disadvantages as much as possible.

## BASIC CONCEPTS IN EQUIPMENT REPLACEMENT

Equipment replacement decisions are a very complex aspect of equipment management. They involve criteria for removing a unit from active service (equipment retirement), in addition to decisions on obtaining another similar equipment to substitute the retired one. Whether they are based on physical deterioration or equipment obsolescence, reasons for retirement always reflect "economic mortality". For example, a decision to retire equipment may be due to:

- End of physical life,
- Lack of support by supplier,
- High operational cost,
- Need for higher quality product than the present system,
- Need for higher productivity and/or efficiency,
- Move to less labor-intensive system,
- The present system no longer satisfies safety standards or regulations, and
- New environmental regulations are imposed that the system cannot satisfy.

All reasons above amount to one basic reason: the need for the functions performed by the equipment still exists, but the net present worth for the rest of its life is less than that of a new equipment. Replacement strategies determine the choice between maintaining the present system for the foreseeable future (planning horizon), and replacing it. Such strategies vary widely, but conceptually they are always based on some perception of what is the optimal life of the equipment.

### *Replacement Models*

One way to attempt to define and foresee the end of the equipment optimal life is by fitting a mathematical model. There are several types of replacement models in the literature (4, 6, 13, 15, 17, 18, 20, 22, 23, 27, 29, 30). They can be summarized as follows:

- **Cost/benefit ratio models**. These models divide the unit cost of production over n years of service (a function of the cumulative operating expenses, the discount rate, and the depreciation), by the monetary value of the benefit, i.e., the service provided by the equipment. Replacement criteria attempt to maximize the value of the cost/benefit ratio. The major drawback of a cost/benefit analysis lies in how to define a monetary value for the benefits, as well as for some of the costs, such as downtime and obsolescence.
- **Cost functions**. After defining a cost function that includes items such as operational costs, depreciation, capital costs, downtime costs, etc., the method defines the time to replace as the time when the cost function reaches its minimum. This method avoids having to define a monetary value for the benefits, but still relies too heavily on uncertain cost estimates, such as downtime and obsolescence.
- **Probability models**. In this approach, an existing database of equipment data is used to define equipment failure criteria, and then estimate the probability of failure as a function of explanatory variables such as operational costs, downtimes, etc. These models require a quantifiable, clearly defined failure threshold. Conceptually, they are a mathematical sophistication of the threshold method currently in use by TxDOT. It is difficult to perform a critical analysis of the probability models found in the literature due to widespread use of least squares regression to model equipment failure. Least squares regression is inappropriate to model failure data for many reasons. The most important is the method's mathematical inability to discriminate between failed equipment (life variables EQUAL TO the values in the database) and equipment that has not yet reached failure (life variables GREATER THAN the values in the database). The latter data are termed "censored". Least squares regression automatically considers all data points as uncensored, so the life variables are always counted as EQUAL TO the values in the modeling data set. Failure time probabilities must be modeled using survival analysis' censored regression techniques (Refs. 9, 14, 21). Not one instance of censored regression was found in the literature.
- **Rate of return**. This method computes a rate of return for two alternatives: replace the existing equipment now or defer replacement for one more year and retain the existing equipment. The magnitude of this rate of return, relative to an investment rate of return acceptable to the agency, will determine the replacement decision. This method has basically the same drawbacks as the cost/benefit, as the rate of return necessitates monetary estimates of equipment costs and benefits.

### *Replacement Strategies Currently in Use by State Highway Departments*

This section presents the results of a nation-wide survey of State Transportation Departments. All states were contacted, and the response rate was 36 percent. Some information comes from phone interviews, some from letters, and some from ref. 27). The survey results assisted the researchers as well as TxDOT's advisory panel to decide the best overall approach for the new TERM software.

*Alabama* uses thresholds for mileage or age. Examples: full size pick-ups are replaced at 3 years or 55,000 miles, dump trucks at 10 years or 100,000 miles, hydraulic excavators and loaders at 8 years.

*Arkansas* uses thresholds for mileage or age. Examples: full size pick-ups are replaced at 4 years or 100,000 miles, dump trucks at 8 years or 300,000 miles, hydraulic excavators at 12,000 hours or 10 years, and loaders at 10 years or 12,000 hours.

*Florida* uses thresholds for mileage or age. Examples: full size pick-ups are replaced at 8 years or 95,000 miles, dump trucks at 10 years or either 150 or 250 thousand miles (depending on the capacity), hydraulic excavators at 8,000 hours or 12 years, and loaders at 10 years or 6,000 hours.

*Georgia* Districts submit lists of priority, within their budget, based on criteria that include scores for age, operational cost, condition of equipment parts, and others. A score is given for each attribute, and then an overall score is calculated for the unit, which are replaced based on these scores values.

*Kentucky* A 10-member Equipment Committee sends to the Districts their budget allocation and a list of estimated costs for each equipment item. KY-DOT recommends that employees in each county crew talk about equipment needs to their foreman and maintenance engineer. No information was provided regarding specific criteria for replacement. Apparently, KY-DOT relies heavily on user input for replacement decisions.

*Louisiana* Districts submit lists of priority, within their budget.

*Mississippi* Mississippi uses thresholds for age. Examples: full size pick-ups are replaced at 7 years, dump trucks at 8 years, hydraulic excavators and loaders at 10 years.

*Montana* Montana developed an Equipment Management System (EMS) in the early 70's. It is based on a combination of threshold values and operational costs. Threshold values for age (20 years) are used for loaders (excluding sand house loaders). Threshold values for vehicles are as follows: 110,000 miles for midsize sedans, 45,000 miles for vans, 190,000 miles for diesel-powered medium trucks (15,000-31,500 GVW), 140,000 miles for gasoline-powered medium trucks, 145,000 miles for light trucks (less than 15,000 GVW), and 385,000 miles for heavy trucks (31,600–80,000 GVW). MT-DOT also has priority core equipment. The available funding is applied first to core equipment that matches replacement criteria; remaining funds go to the non-core equipment slated for replacement. Core equipment consists of snow removal equipment and the light duty fleet, which includes passenger cars, pickups, vans and utilities. MT-DOT EMS system has a program that runs reports of the various classes of vehicles and equipment meeting the replacement criteria as well as a cost analysis of operational costs. If a unit's operating costs are too high, the system will add it to the replacement list even though it may not meet the mileage or age criteria. Every two years, a committee consisting of Maintenance Chiefs, District Administrators and Shop Superintendents reviews the replacement lists and makes replacement decisions.

*Nevada* Each year, NV-DOT's Equipment Division prepares, by class code, a list of equipment recommended for replacement during a given budget period. Among other information, the list includes equipment description, an estimate of replacement costs, and replacement criteria based upon number of miles or hours, age, downtime, excessive repair or recapitalization cost, and parts availability. For example, sedans are candidates for replacement at either 100,000 miles or 96 months of age, pickups and light trucks at 150,000 miles or 96 months (whichever happens first).

*New Mexico* New Mexico uses thresholds for mileage or age. Light duty vehicles are replaced at 7 years or 125,000 miles, and medium trucks at 7 years or 150,000 miles.

New York New York used an in-house Dbase program that calculates replacements based on age, optimum life, cumulative costs, and usage. The team could not obtain clear information on the criteria to define "optimal life". This program became Y2K non-compliant and was being replaced while this literature search was in progress.

*N. Carolina* Divisions submit lists of priority, based on life expectancy and depreciation schedules. According to Mr. Delbert Roddenberry, NC-DOT Facilities Mechanical Engineer, the entire fleet inventory is close to 800 million dollars, but budget constraints for equipment replacement usually limit the replacements to approximately 40 percent of what the plans call for.

*S. Carolina* According to Mr. Jim Brooks, from SC-DOT Supply and Equipment Office, SC-DOT has replacement guidelines only for vehicles. Historically, equipment replacement is limited by funding, and only the equipment in the worst overall condition can be replaced.

*Tennessee* Tennessee uses thresholds for age and usage. Examples: loaders are replaced at 8,000 hours or 12 years, full size pick-ups at 8 years or 115,000 miles, and dump trucks at 8 years or either 140 or 150 thousand miles (depending on capacity).

*Texas* Texas currently uses an in-house database and thresholds for age and usage. Examples: full size pick-ups are replaced at 7 years or 90,000 miles, dump trucks at 10 years or either 140 or 150 thousand miles (depending on capacity), hydraulic excavators at 8 years or 6,000 hours. The system developed in this project will replace this strategy.

*Virginia* Virginia uses an Equipment Replacement Model based on threshold values for age, usage, and ratio between maintenance plus repair costs and cost of a new unit. For example, dump trucks are replaced when the ratio between maintenance plus repair costs and replacement cost is 75 percent, or at 10 years, or at 110,000 miles.

For automobiles, VA-DOT developed a model to estimate the threshold values of attributes such as age, maintenance cost, and resale value, as a function of purchase cost and other factors. While the concept is valuable, the results relied on regression models whose $r^2$ values can be as low as 18.5 percent (Ref. 18). A model with $r^2$ value of 0.185 can be interpreted as follows: the model explains 18.5 percent of the response, while the remaining 82.5 percent is due to random error and other factors. Prominent statisticians recommend any statistical results with less than 90 percent confidence should be used with serious reservations, if at all (1, 9, 14, 21, 26). In addition, these models were apparently developed using least squares regression, when they should have been fitted using survival analysis techniques with censored regression, as discussed in the previous section of this chapter.

*W. Virginia* West Virginia has criteria based on thresholds for usage, life-to-date expenses, estimated life expectancy, and repair costs.

***Replacement Strategies in Use by Other Public Agencies***

(1) **Sun Metro** (Transit Company in Pennsylvania).
Contact Person: Wesley Swenson, at (915) 534 –5874

The Federal Transit Administration (FTA) sets standards (thresholds) based on breakdown tests done at El Tuna, Pennsylvania.

(2) **United States Air Force** (USAF).

http://www.af.mil
Document consulted: http://farsite.hill.af.mil/archive/doe/1997/908.HTM
FMR document site: http://www.policyworks.gov

Replacement criteria are based on threshold values for age and usage.

(3) **General Services Administration** (GSA).

Contact: Guillermo Cajigas, Fleet Service Representative.
GSA, FSS, FMC, 7FF-10
Fort Bliss, TX 79916
(915) 565 5534

Replacement criteria are based on threshold values for age and usage, as well as repair costs. There are computer programs to store repair costs, usage, and other information relevant to replacement decisions.

(3) **City of Philadelphia**

Source: Policy Memorandum # 3-95A, 2/22/95.

Replacement criteria are based on threshold values for age and usage. There are criteria to extend the thresholds if the equipment underwent rehabilitation.

***Replacement Strategies in Use by Private Companies***

(1) **Bechtel Equipment Operations** (Formerly BLSI)

13157 Middletown Industrial Building # C
Louisville, KY 40223
TEL (502) 244-2574 -- FAX: (502) 244-2211
California headquarters: (415) 768 1234
www.bechtel.com
No precise methodology. As a rule of thumb, Bechtel keeps pick-ups for 2 years, and cars for 3 years, longer if found serviceable.

(2) **Phillips Petroleum Company**

4th and Keeler Avenue.

Bartlesville, OK 74004

Tel: (918) 661-6000

Contact Ken Dietz

TEL: (918) 661 –6066

In a 1983 technical paper, Wadell described a dynamic programming algorithm to optimize the discounted cash flow for the equipment (Ref. 30). The paper stated that the program had been in use for six years, and had resulted in substantial savings. A follow up phone call to Phillips, however, indicated that recently they moved away from this program and returned to the threshold criteria. Automobiles are now replaced after 80,000 miles, light duty trucks after 100,000 to 125,000 miles. The amount in their budget is the deciding factor at this point. No life cycle cost analysis (LCCA) is used due to budget constraints to keep maintenance logs.

(3) **Knight Transportation** (truckload carrier), Phoenix, AZ.

Source: Ref. 22.

Replacement criteria are based on stringent threshold values for age: it replaces tractors every three years and trailers every five. Experience indicates high operational and downtime costs after that.

(4) **Stevens Transport** (refrigerated load carrier), Dallas, TX.

Source: Ref. 22.

Power equipment is replaced every three years. Experience indicates obsolescence after this time.

(5) **Dennis Cook, Inc.** (truckload carrier), Boone, NC.

Source: Ref. 22.

Replacement criteria are based on stringent threshold values for age: the entire fleet is turned over every 30 months. Experience indicates that downtime costs are too high to absorb.

(6) **ABF Freight Systems**.

Source: Ref. 22.

ABF uses the age threshold criterion, but it charts the cost per mile from the time of purchase to the time of replacement. The company changes the replacement threshold based on the observed cost per mile of new units compared to old ones.

## SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

### *Summary*

Deciding when it is the proper time to replace an operating system with a new system depends on how age, usage and obsolescence affected the productivity and costs of the defender. External conditions such as depreciation and tax also enter into the decision making process. There are other considerations in the areas of safety, environment and even prestige that enter into the replacement decision. A replacement decision based on sound reasoning and experience can save time and effort; the wrong decision will waste money.

The survey of replacement methodologies indicated that, for the most part, agencies rely on ad-hoc threshold values and managers' experience for their replacement decisions. Virginia DOT developed a more sophisticated system. Other agencies took the opposite route. Philips Petroleum Company has recently abandoned a complex model they had been using in favor of decisions based on threshold values and managers' experience.

It is next to impossible to log all factors affecting the replacement decisions into a database, and program a computer to analyze all their interactions. For example, sometimes frequency of failure is more important to a replacement decision than its duration; sometimes it is the opposite.

The overview of mathematical models for replacement indicates that, in real life, the factors affecting replacement decisions are too complex to be reduced to a mathematical equation, and qualitative opinions from experienced managers must be considered for optimal decisions. Apparently, this is why strategies based solely on mathematical or economical models have not received wide acceptance.

### *Conclusions*

The overall results of the survey and the literature search indicated that:

- The prevalent mentality in the private sector is that replacement decisions should be based on experience, and a sophisticated replacement program is not cost-effective to maintain. However, the few private agencies that did develop sophisticated replacement strategies reported savings.
- Public agencies are required to justify replacement decisions and, unless the replacement budget is historically greatly deficient, they have strategies in place. These strategies, for the most part, are based on threshold values for variables relevant to describe the equipment cost and/or lifetime.
- Managers' experience is extremely important for sound replacement decisions, and should always be an integral part of any system. Efficient replacement decisions depend on some factors that cannot be easily quantified or automated (such as technical obsolescence).
- Cost models must be developed using existing historical data. These data always reflect management's efforts to remove equipment with high operational costs. As such, any adjusted function or curve of cost versus time cannot accurately predict what would have happened if the equipment remained in use.
- Life-cycle costs are a useful attribute for replacement decisions, but are not widely utilized as a sole basis for replacement decisions. The main reasons are: controversies in inflation and discount rates; equipment usage (mileage or hours) cannot explicitly appear in the life-cycle cost function; real life-cycle curves are not as smooth as theory indicates; and difficulties in discriminating between high repair costs (which should indicate high replacement priority) and cost of a major equipment upgrade (which should indicate the opposite).
- Managers' efforts always result in lists of replacement candidates.
- Of all DOT's responding to the survey, only TxDOT, which is currently finalizing this project, and NY-DOT, are in the process of updating their replacement methodology.
- One of the most useful tools for managers is a way to easily rank replacement priorities within a desired group.

- TxDOT seems to have one of the best-organized methodologies, and one of the most comprehensive databases, allowing replacement priorities to be automatically calculated.

Some companies indicated lack of a comprehensive equipment database as one of the hurdles that preclude a more sophisticated replacement strategy. TxDOT already has a very comprehensive database, as well as a working replacement methodology. Any improvement over the existing methodology must take full advantage of the EOS database, adding new criteria without disregarding a wealth of experience with the current method.

***Significant Findings***

Replacement strategies are very important for fleet managers, and as such have been and still are the subject of many studies. The literature review, along with the survey of replacement strategies and approaches currently in use, indicated that replacement programs can be classified into the following six groups:

(1) **Threshold criteria**. Equipment units become candidates for replacement when they reach predetermined threshold values of indicators such as age, mileage, repair cost, and downtimes. This is the method currently in use by TxDOT.

(2) **Historical costs as percent of new costs**. Equipment units become candidates for replacement when their lifetime maintenance costs reach a predetermined percentage of the cost of a new unit.

(3) **Probability of failure**. Probability models are used to predict when a unit is approaching failure. This requires developing a subjective definition of "equipment failure". Units are replaced when their estimated probability of failure reaches a predetermined threshold.

(4) **Unit cost (e.g., cost per mile)**. Equipment units become candidates for replacement when their cost per mile reach a predetermined percentage of the cost per mile for a given class of equipment.

(5) **Life-cycle cost analysis**. Equipment units become candidates for replacement when their estimated total cost of ownership and operation reaches its minimum. A variation of this method uses incremental costs rather than costs over the entire life.

(6) **Weighted factor method**. Relevant parameters (such as age, usage, downtimes, etc.) are divided by base figures, and the resulting ratios are weighted and added up. Equipment units become candidates for replacement when their sums exceed a predetermined threshold value.

The most important conclusion of this literature review is that, conceptually, all strategies above are the same. They compare the condition of a challenged unit to some pre-determined threshold, which can be age, usage, downtimes, etc. (groups 1 and 6), cost ratios (groups 2, 4 and 5), or a probability of failure (group 3). None of these strategies provide a way to directly compare each unit with the rest of the fleet—in other words, a way to look at the entire fleet (or a desired subgroup) and see where the challenged unit stands in comparison with the rest of the fleet, rather than pre-determined values, thresholds, or cost ratios.

***Proposed Strategy***

This project proposed and developed a **new** equipment replacement approach, the **multi-attribute priority ranking**. It balances elements of several of the approaches above, and allows the manager to rank replacement priorities based on comparisons with the rest of the fleet instead of one-on-one comparisons to threshold values or minimum values of any kind. The proposed method is a new fleet-level approach that allows the manager compare the challenged unit to all other active units within a desired class or group. Ideally, this approach requires a comprehensive historical database of equipment attributes to be available. However, the concept can also be applied to limited databases. The priority ranking is calculated for the combination of attributes and relative weighs selected by the manager. The replacement budget can be matched to the units on top of the replacement priority list.

The development of this proposed approach and the architecture of the computer program developed to allow its application are thoroughly discussed in the subsequent chapters of this report. The replacement methodology was based on a new concept developed specifically for this project, combined with the ranking approach developed by Weissmann in 1990 for TxDOT's Bridge Division (Ref. 31). Weissmann's approach for bridge maintenance and replacement has been successfully in use for over 10 years at TxDOT, giving the researchers confidence that a similar approach would also be useful for equipment management. This replacement strategy was programmed into an automated menu-driven system, and is in the process of being implemented at TxDOT's General Services Division–Purchase and Equipment Sections for immediate use.

# CHAPTER 4
# REPLACEMENT METHODOLOGY BASED ON LIFE CYCLE COSTS

## CONCEPT OF LIFE-CYCLE COST

Life Cycle Cost (LCC) of an equipment unit is the sum of all costs incurred during the entire equipment life (Refs. 8, 12, 16, 31). It includes the purchase cost, resale cost, repair costs, operational costs, and indirect costs. Ideally, it should also include the monetary value of intangibles such downtimes, and equipment depreciation and obsolescence. Without considering the time value of money (to be discussed later), the total LCC of an equipment unit is, over its entire lifetime, given by equation 4.1.

$$LCC = PC + \sum_{i=1}^{n}\left[R_i + OP_i + IC_i + DT_i\right] + RS \quad (4.1)$$

Where:

| | | |
|---|---|---|
| LCC | = | Life-cycle cost over the entire equipment lifetime |
| PC | = | Purchase cost |
| N | = | Number of years in the equipment lifetime |
| $R_I$ | = | Repair costs in year 'i' |
| $OP_I$ | = | Operational costs in year 'i' |
| $IC_I$ | = | Indirect costs in year 'i' |
| $DT_I$ | = | Costs of downtime in year 'i' |
| RS | = | Resale value at retirement. It can be zero (no resale and no disposal cost), positive (no resale and disposal cost), or negative (resale). |

The retired equipment database contains information on all parameters in equation 4.1, except cost of downtime. Equation 4.1 can be viewed as the sum of capital costs (purchase minus resale if resold), and periodic expenditures needed to operate and maintain the unit during its entire life.

In order to make the LCC concept applicable to active equipment, as well as comparable to another active unit at a different point in its cost history, it is necessary to estimate a resale value, and annualize the LCC costs.

## CONCEPT OF EQUIVALENT UNIFORM ANNUAL COST

The concept of annualized cost is extensively covered in engineering economics literature (Refs. 8, 12, 16). It consists of converting lump sums into equivalent annual installments, using time value of money. These installments are termed Equivalent Uniform Annual Costs (EUAC).

The factors to convert the costs depicted in equation 4.1 into EUAC installments can be found in any engineering economics book. They are a function of the number of years, or equipment age ("n") and the annual discount rate ("i"), assumed constant over the analysis period. The beginning of the analysis period is the reference date for the present worth values. The present worth of a future amount is obtained multiplying it by the P/F (present to future) factor shown in equation 4.2.

$$P/F = \frac{1}{(1+i)^n} \tag{4.2}$$

- **Equivalent uniform annualized purchase cost**. Purchase cost is a lump sum spent at the beginning of the equipment life. In order to convert it to EUAC over "n" years, it should be multiplied by the factor in equation 4.3.

$$\frac{i(1+i)^n}{(1+i)^n - 1} \tag{4.3}$$

- **Equivalent uniform annualized resale cost**. Resale cost is a lump sum gained at the end of the equipment life. In order to convert it to EUAC over "n" years, it must first be translated into its present worth at the beginning of the equipment life, then annualized. In order to do both, resale values should multiplied by the factor in equation 4.4.

$$\frac{i}{(1+i)^n - 1} \tag{4.4}$$

- **Equivalent uniform annualized operational and repair costs**. These costs are spent as needed, throughout the equipment life. Each year's total operational costs are reported in the database. If time value of money was negligible, then the annualized operational and repair costs for year "n" would simply be the average over "n" years. Since there is a time value of money, in order to convert a series of "n" annual expenditures into EUACs, it is necessary to first translate each one of them into its present worth, add those, then annualize this sum over the desired period of ""n" years. In order to do this, first we multiply each reported expenditure by the present worth factor (equation 4.2, where "n" is the equipment age at the year of the expenditure). Present worth values are then added and annualized using equation 4.3, where "n" is the equipment age at each desired year.

***Estimated Depreciation for LCC Calculations***

The financial costs of owning an equipment unit include the initial purchase less the resale value, if positive. TxDOT routinely records two costs: purchase cost, and resale value at the end of the service life. In order to estimate annualized LCCs for an active equipment, it is necessary to estimate what its resale value would be at the end of each year. This section discusses the methodology used to estimate depreciation factors as a function of equipment age. These factors are programmed into the system. For the purposes of the program, the depreciation factor was defined as the ratio between the present worth of the resale value ("present" is the date of the purchase), and the purchase cost, as shown in equation 4.5.

$$DF = \frac{PW(RS)}{PC} = \frac{RS}{PC(1+i)^{age}} \quad (4.5)$$

Where:

DF = Depreciation factor

RS = Resale value at age "age"

PW(RS) = Present worth of the resale value

PC = Purchase cost

i = Discount rate

Figure 4.1 shows the median and mean depreciation factors (equation 4.5) for each age, calculated for all retired units, using a discount rate of 3 percent, which is the average inflation rate observed in the past 11 years. Between the ages of 5 and 20 (88 percent of the data), there is a general downward trend that appears to fit either an exponential or a power function of age. Retirement ages below 5 and above 20 display a rather erratic variation in resale values, indicating that the database does not provide good general indicators of the resale value of an equipment unit within these ages. This is to be expected, since equipment in good condition will not be sold early at high resale prices.

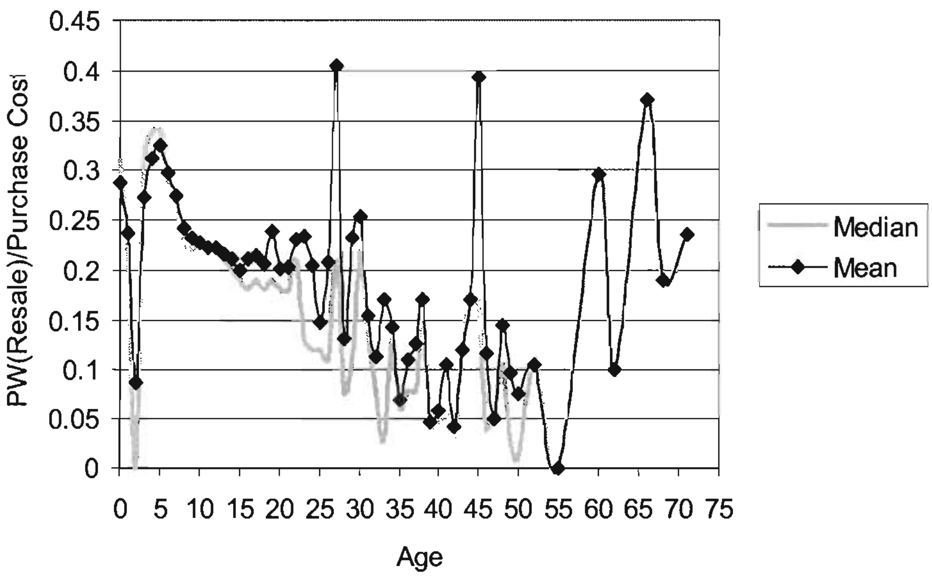


***Figure 4.1 Observed Mean and Median Depreciation Factor by Age***

Figure 4.2 shows the median depreciation factors for ages between 5 and 20 years (88 percent of the data), calculated with 3 percent discount rate for the present worth of the resale value. It also shows the function fitted to the data to estimate the depreciation factors.

It is well known that, in the beginning of the equipment life, the resale value is higher, then drops rather quickly. As the equipment ages, the resale value is considerably less than the purchase cost, but decreases less sharply with age. The retired equipment data set has 33 units retired and resold at early ages (1 and 2 years). The ratio between resale value and purchase cost varied from 3 to over 60 percent; in the majority of cases, the resale values were less than 25 percent of the initial purchase cost. Low resale prices at early ages do not represent an accurate salvage value of equipment in good condition. More likely, they are typical of equipment sold early due to problems. For ages between 1 and 4 years, the program uses a default ratio of 80 percent of the purchase cost for the first year, decreasing at a steady rate of 10 percent a year, regardless of discount rate.

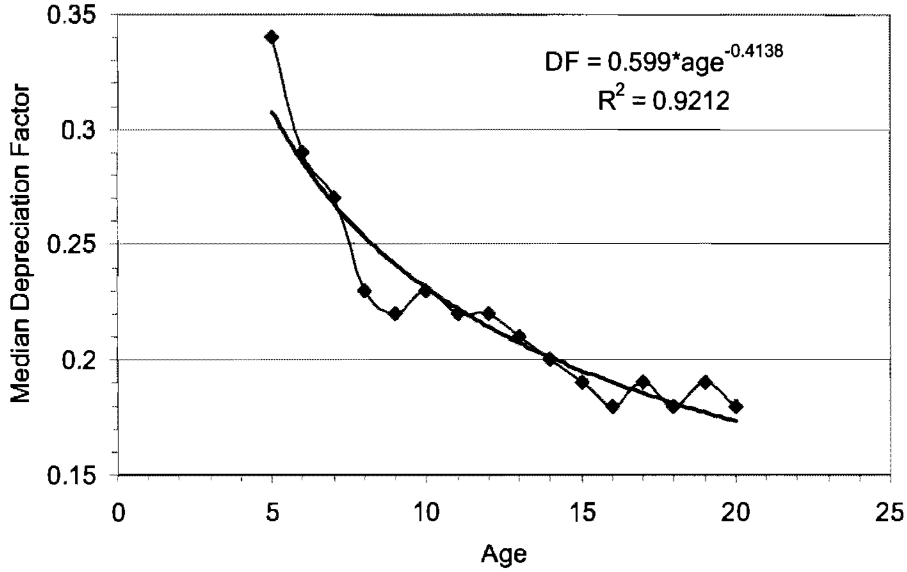


***Figure 4.2 Observed Median Depreciation Factor, Ages Between 5 and 20***

In order to obtain the present worth of the resale value at each age, the program multiplies the purchase cost by the depreciation factors shown in equations 4.6 and 4.7. It is important to understand that taking median values has significantly smoothed the variation or "noise" in the depreciation data. The error in equation 4.7 includes the error in the regression and the error in the median estimates. The only way to verify the practical accuracy of these depreciation factors is after implementation of system for use by experienced fleet managers.

*Ages between 1 and 4 years:* $$DF = 0.8 - 0.1 * [age] \qquad (4.6)$$

*Ages between 5 and 20 years:* $$DF = 0.599 * [age]^{-0.42} \qquad (4.7)$$

Other researchers also found depreciation costs unstable and difficult to model, leading to recommendations of simplified approaches to estimate equipment depreciation. Most approaches recognize that depreciation drops quickly in the early ages, and slower as the equipment gets older (Refs. 3, 4, 5, 10, 19, 25). Ref. 4 discusses a double-declining method for estimating automobile depreciation (which is conceptually similar to the two equations proposed above), and Ref. 10 discusses models with shapes similar to equation 4.7.

***Estimated Downtime Costs for LCC Calculations***

In order to be part of a life-cycle cost function, a variable must have a monetary value. An important parameter in equipment life-cycle is the number of hours of downtime. Costs of downtime are very difficult to estimate, even with a costly and very detailed data collection. Based on the literature (11, 25, 29), an approximate figure would be $20.00 per hour. The manager has the ability to override this default value if desired. The sensitivity analysis section discusses the influence of downtime costs on the EUALCC estimates.

## INTERPRETATION AND USE OF THE EQUIVALENT UNIFORM ANNUAL LIFE-CYCLE COST CONCEPT

If the equivalent uniform annual life-cycle costs (EUALCC) are calculated for each year a unit is in operation, and plotted against time (equipment age), one should obtain the trends depicted in Figure 4.3. In the beginning of the equipment life, the cost of acquiring the unit is spread into a small number of installments and weighs heavily on the annual cost, while the maintenance costs are low. As time passes, the initial investment offsets over the years, while repair costs increase. Adding these two costs results in the equivalent uniform annualized LCC curve, which decreases as the initial investment offsets over the years, and increases as the operating costs become greater than the capital cost installments. Theoretically, the total EUALCC reaches a unique point of minimum (optimal age in figure 4.3). There is a region of low EUALCC before and after this minimum, where the first derivative of the EUALCC with respect to age (slope of the curve) is very small, and the EUALCC changes little with time. Then, the slope increases faster, until the EUALCC is equal to the acquisition cost of new equipment.

Ideally, an equipment should be replaced right before the point where the EUALCC equals the purchase cost of a new unit. If one wants to avoid decisions based on single-point forecasting, the equipment should be replaced after the region of optimality and before the EUALCC reaches the purchase value. The region of the graph where the EUALCC is still declining should have the lowest replacement priority; the region of optimality is the second lowest replacement priority; and the region where the EUALCC increases with time is the highest priority. The longer the equipment has been in the upward region, the higher the priority. Predicting exactly when to replace within this period is a delicate exercise. Real cost data are affected by randomness, intangible factors such as equipment obsolescence or vendor warranties must be taken into account, and expenditures are not as smooth as assumed in the literature, as clearly shown in figures 4.4 through 4.6.

Figures 4.4 and 4.5 show two actual examples of equivalent uniform annualized life cycle costs calculated over the entire lifetime of two retired units. The assumed discount rate was 3 percent, and the cost of downtime was $20.00 per hour. Figure 4.4 refers to unit 00161C, retired on 5/18/96 after 6 years of service. This unit is an automobile, sedan, 100 through 112.9 inches wheelbase (classcode=20020).

Figure 4.5 example was selected among units that have the longest complete cost histories (10 years). The figure refers to 04113E, retired on 3/1/2000, after 10 years of service. This unit is a 6-yd dump truck (classcode=540010).

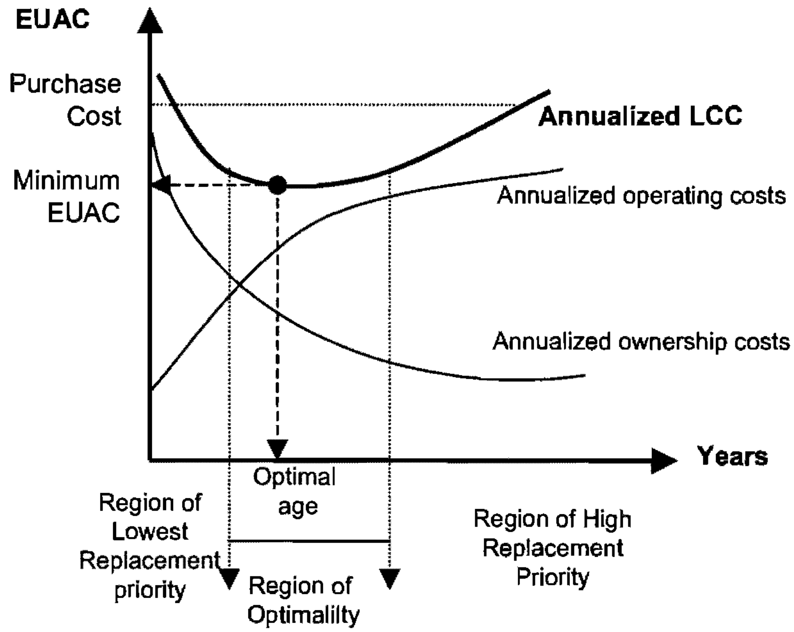


***Figure 4.3 Theoretical EUACs of Owning and Operating an Equipment Unit***

Both units were retired when their EUALCC curve started to plateau. Would it have been more cost-effective to maintain these units in service until the EUALCC started to increase? There may be no clear-cut answer. For instance, factors such as equipment obsolescence and quality of technical support of a particular vendor may have encouraged replacement. Moreover, the assumed cost of downtime may be too low. Higher costs of downtime may put this unit's EUALCC curve in the upward region, as discussed later in the sensitivity analysis section.

Figure 4.6 shows an example of a unit received in 1989, and still in service in the year 2000. It refers to ID 00137C, a classcode 20020 sedan automobile. This figure shows the operational costs significantly increasing after the $5^{th}$ year in service, while the capital costs still weigh heavily on the EUALCC, keeping it in the optimal region.

Figures 4.4 through 4.6 also show that annualized life cycle costs are not as smooth as theory indicates. Actual operational costs contain atypical surges and drops in equipment use, downtimes, and operational costs. This is to be expected. Unforeseen repairs do occur, and usage is not uniform every year. Figure 4.6 was selected as a good illustrative example of this fact. It clearly indicates that automobile 00137C is in the optimal EUALCC region (see figure 4.3), since the general trend of its EUALCC is neither increasing nor decreasing. However, there are two atypical peaks in the operational costs, at age 5 and a higher one at age 7. A closer inspection of the data base indicates that highest sum of repair cost and downtime of the entire history was, indeed, at age 7 (year 1996), totaling $4,342.89.

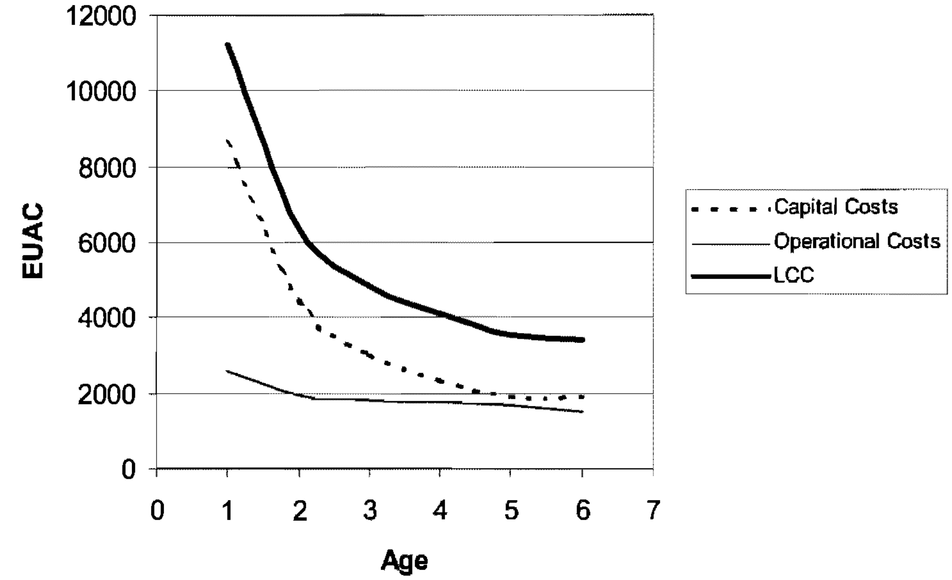


***Figure 4.4 EUALCC of Equipment ID=00161C (Automobile)***

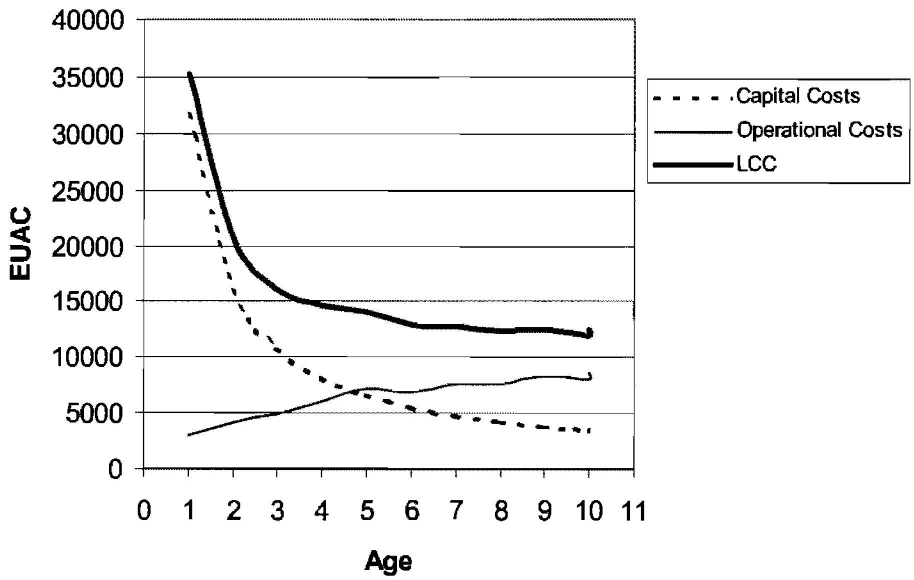


***Figure 4.5 EUALCC of Equipment ID= 04113E (Dump Truck)***

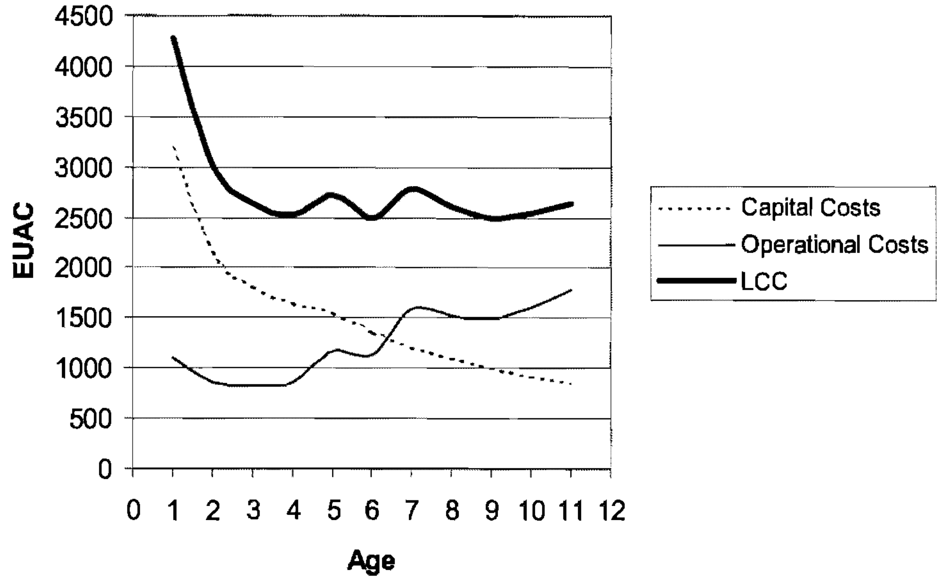


***Figure 4.6 EUALCC of Equipment ID= 00137C (Automobile)***

The variations in operational costs depicted in figure 4.6 are the norm for most units. This situation creates the need for a programmable method to identify when the overall trend in EUALCC is exiting the optimal region and entering the upward cost slope. This method must enable the computer to distinguish between localized cost "surges" and drops, and overall increasing or decreasing trends.

***Time Series Trend Analysis***

The graph of EUALCC versus age meets the mathematical definition of a time series: a series of autocorrelated values with a general trend in time that is a function of external factors. Autocorrelated means that the values in each year depend not only on the external factors, but on the previously observed values as well.

Among the many techniques for analyzing time series, the research team selected the Bayesian trend modeling. This statistical method decomposes a time series $Y_t$ into three components, as follows:

$$Y_t = T_t + S_t + \varepsilon_t \tag{4.8}$$

Where:

$Y_t$ = Variable under study (in this case, EUALCC in each year or age "t");

$T_t$ = Trend component, the part of the variable that explains the general trend;

$S_t$ = Seasonal component, applicable in cases where the time series is affected by a seasonal factor whose effects repeat at regularly spaced intervals (this component is zero for equipment costs);

$\varepsilon_t$ = Random, or irregular component.

The method filters the random (irregular) factors and the seasonal factors out of the time series, leaving only the general trend. The trend can increase with time, decrease with time, remain stable, or combine one or more trends. Figures 4.7 through 4.10 show examples of actual EUALCC with these four types of trends. In this study, the trend calculations start at the third year of equipment age, since the initial depreciation always causes a sharp downward slope that is not relevant for the replacement analysis, and may bias the estimate of the relevant part of the trend.

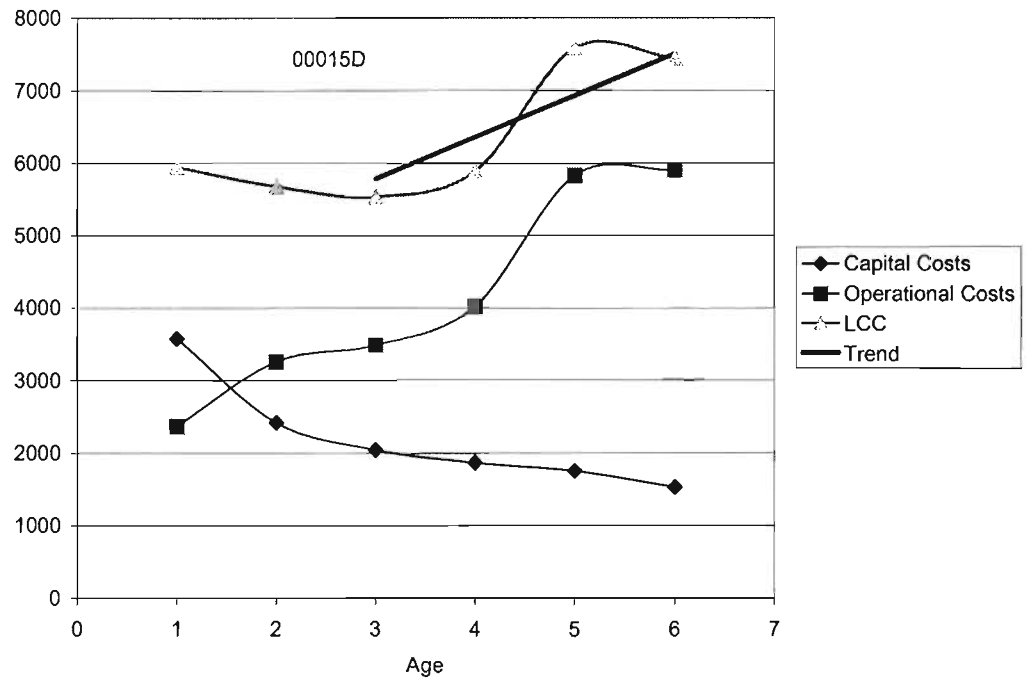


***Figure 4.7 EUALCC with Increasing Trend***

**PROPOSED REPLACEMENT CRITERION BASED ON EUALCC**

As discussed previously in this chapter, equipment should not be replaced while its EUALCC is decreasing, because the acquisition (or capital) cost has not yet been amortized by utilization (example: figure 4.8). It should not be replaced while the EUALCC is stable (example: figure 4.9), since it is on the optimal region where amortization is occurring without increase in operational costs.

When to replace? Ideally, when the EUALCC reaches the value of acquiring a new unit. Given all the uncertainties and intangible factors affecting replacement decisions as well as the EUALCC calculations, any approach that attempts to predict when this optimal point would occur would inevitably disregard many important criteria, and introduce additional errors in the replacement process.

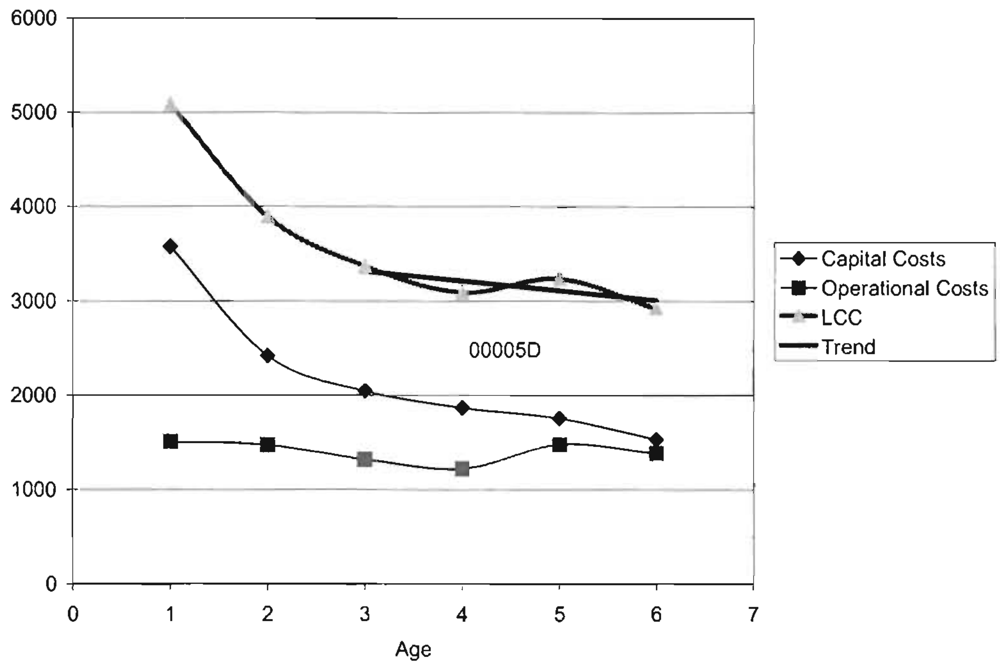


***Figure 4.8 EUALCC with Decreasing Trend.***

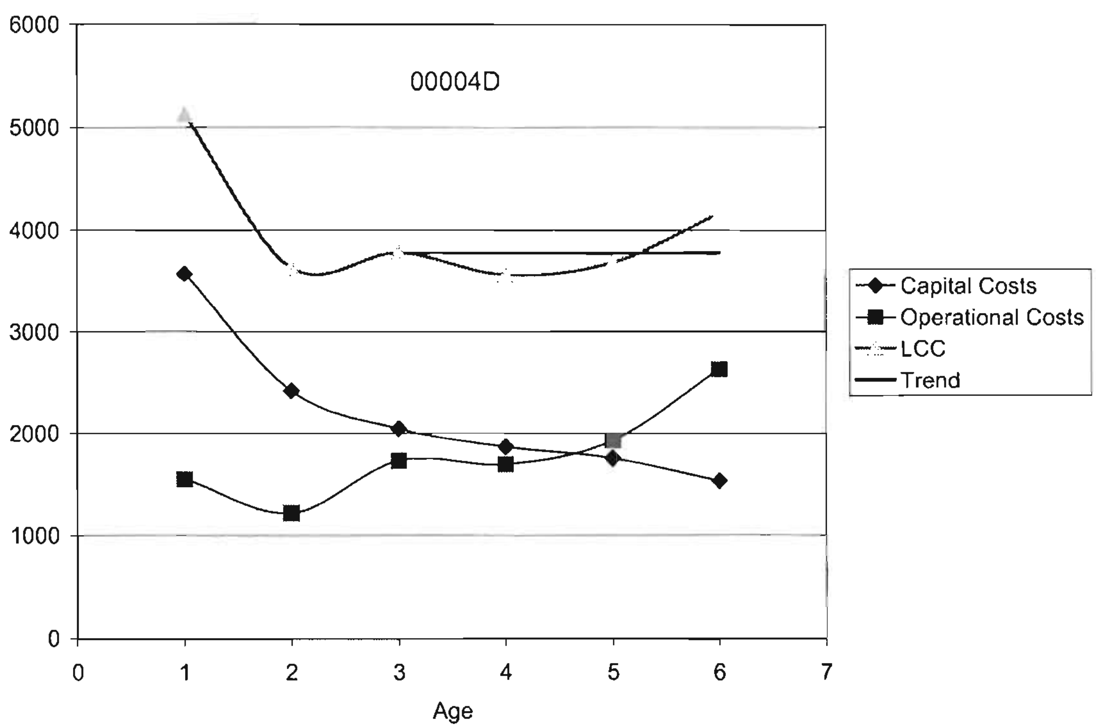


***Figure 4.9 EUALCC with Stable Trend.***

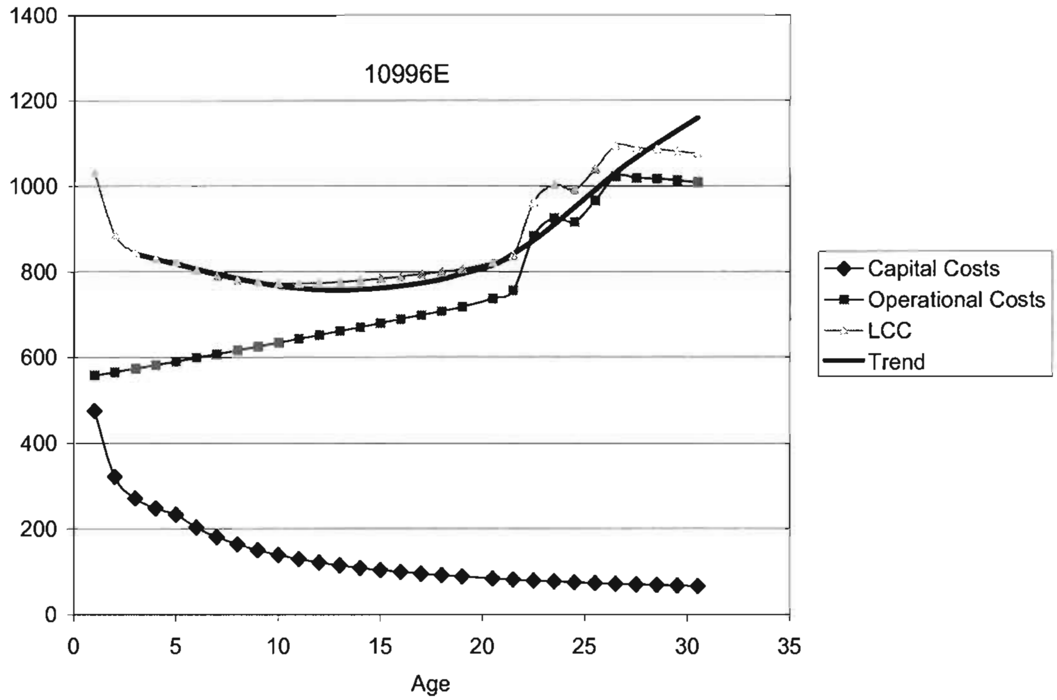


***Figure 4.10 EUALCC with Combination Trend***

The most practical way to use the information provided by the EUALCC would be to look at the graphs (such as those in figures 4.7 through 4.10) and prioritize the units according to how long they have been in the upward EUALCC trend, and how steep this upward trend has been. For example, among figures 4.7 through 4.10, the replacement priorities according to life cycle costs would be, from lowest to highest:

- Lowest replacement priority (4) to unit 0005D (figure 4.8), still in the downward region;
- Second lowest priority (3) to unit 0004D (figure 4.9), which is in the optimal region;
- Second to-top priority (2) to unit 00015D (figure 4.7), in the upward region for three years, which is less critical than
- Unit 10996E (figure 4.10), in the upward region for a much longer time than unit 00015D; should have the first replacement priority (1).

In summary, a fleet-level replacement methodology based on EUALCC would "look" at the graphs, assigning the highest priorities to equipment units that have been in the upward region for the longest time, followed by those that have been in the same region for shorter times. It would assign the lowest priorities to equipment units that have not yet been amortized (downward trend), and those still in the optimal region.

In order to use the EUALCC as described above, it was necessary to develop an automatic, programmable method to enable a computer to "look" at the graphs in a way that mimics the human judgement. This required converting the trends into numbers that can be examined by a computer.

***The EUALCC Trend Score***

The project team developed the EUALCC trendscore, a number that combines three attributes relevant to equipment replacement: (1) which region of the EUALCC curve the equipment is, (2) how long it has been there, and (3) how steep is the upward slope. The trendscore is a numerical method to enable a computer to "look" at each EUALCC graph, and mimic decisions made by a person looking at the graphs.

The EUALCC trend score is defined as:

$$Trendscore = 100\sum_{t=3}^{n}\frac{T_{t+1}-T_t}{T_t} \tag{4.9}$$

Where:
- T = EUALCC trend component
- n = equipment age (number of years in service)
- t = time (in years of service, the same as equipment age).

The greater the trendscore, the highest the replacement priority. Units with trendscore less than or equal to zero have the lowest priority. The trendscore is greater than zero only for the part of the EUALCC history that has an upward trend. For these cases:

- The steeper the upward trend slope, the higher the trendscore; and
- The longer the unit has presented an upward trend, the higher the trendscore.

The equipment units in figures 4.7 through 4.10 would have the trendscores (sorted in descending order) and replacement priorities shown in table 4.1. This example shows that the trendscore concept actually mimics decisions based on a person's examination of the EUALCC trends. It is important that the units shown in these examples were selected from different classcodes, using one criterion only: an EUALCC graph that is most suitable for the discussion at hand. Obviously, the actual replacement ranking is done for each classcode.

When managing a large fleet, the manager would want to simplify the analysis by assigning zero priority to any unit that is either still amortizing the initial investment, or in the optimal EUALCC region. Therefore, the program contains instructions to zero any trendscore in the optimal region on before it:

**SENSITIVITY ANALYSIS OF EUALCC ESTIMATED PARAMETERS**

All parameters required for the calculation of the equivalent uniform annualized life-cycle cost (EUALCC) are recorded in the data base, with two exceptions: the discount rate and the cost of downtimes. These must be assumed. The first can be found in the financial literature and is easier to assume than the cost of downtime. This latter cost depends on intangibles, and is difficult to quantify. This section discusses a sensitivity analysis of these two parameters on the EUALCC values.

***Table 4.1 Trendscore and EUALCC Replacement Criteria***

| | | Replacement Priority Based on | |
|---|---|---|---|
| Unit | Trendscore | Trendscore | Actual Graph Examination |
| 10996E | 43 | 1 | 1 |
| 00015D | 27 | 2 | 2 |
| 00004D | 0 | 3 | 3 |
| 00015D | -9.5 | 4 | 4 |

***Discount Rate***

The sensitivity analysis was run for discount rates varying from 3 to 6 percent a year. Figure 4.11 shows the summary of EUALCC deviations between the maximum and the minimum discounts rates in the sensitivity analysis. The EUALCC changed 10 percent or less for nearly 78 percent of the entire data base. More than half of the remaining 22 percent of the data points, had EUALCC sensitivity to the discount rate of less than 20 percent.

Units that had EUALCC variations of 20 percent or more were at least 12 years old, with the exception of three units. Unless one is dealing with equipment ages 12 or older, the EUALCC values will not be very sensitive to the range of discount rates observed in the US for the past 20 years. Moreover, the slope of the EUALCC curve had very little sensitivity to the 3 to 6 percent range in discount rate, which means that the trendscore--and therefore the replacement priorities based on EUALCC--are not greatly affected by variations in discount rate estimates.

***Cost of Downtime***

In this part of the analysis, the discount rate was kept 3 percent a year, while the downtime costs increased from $20 to $80. Table 4.2 summarizes the results of these calculations for the entire equipment data base. For a downtime cost increase of $20, EUALCC values changed less than 20 percent for almost 70 percent of all equipment units. The percent of equipment units within 20 percent EUALCC change decreases to about 39 percent for downtime cost variation of $40, and to less than 30 percent when downtime costs increases by $40 an hour. Therefore, it can be concluded that downtime cost variations within a range of plus or minus $20 an hour have potential to significantly affect only 20 percent or less of the data points.

A more important effect of increases in the downtime hourly values is the change in the EUALCC curve shape, as such potentially affecting the unit's replacement priority. Figure 4.12 shows an example of change in EUALCC shape (unit 00016D, an automobile). For downtime hourly costs up to $40.00, the automobile would have zero priority, since its EUALCC trend is either flat or downward. For downtime costs of $40.00 and greater, the EUALCC trend turns upward, taking the unit out of the "ineligible for replacement" part of the prioritized list. The higher the downtime hours, the more noticeable this effect will be, as expected.

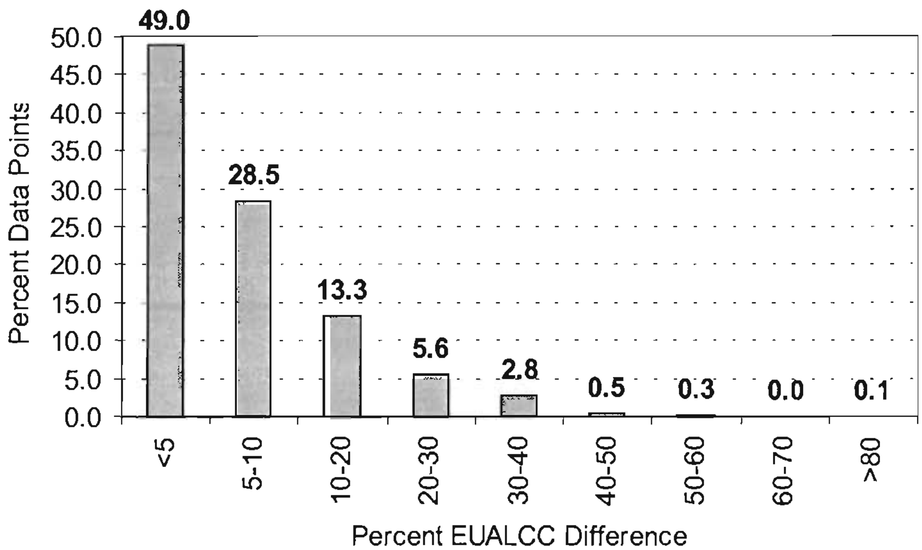


*Figure 4.11 EUALCC Variation for Discount Rates Between 2% and 6%*

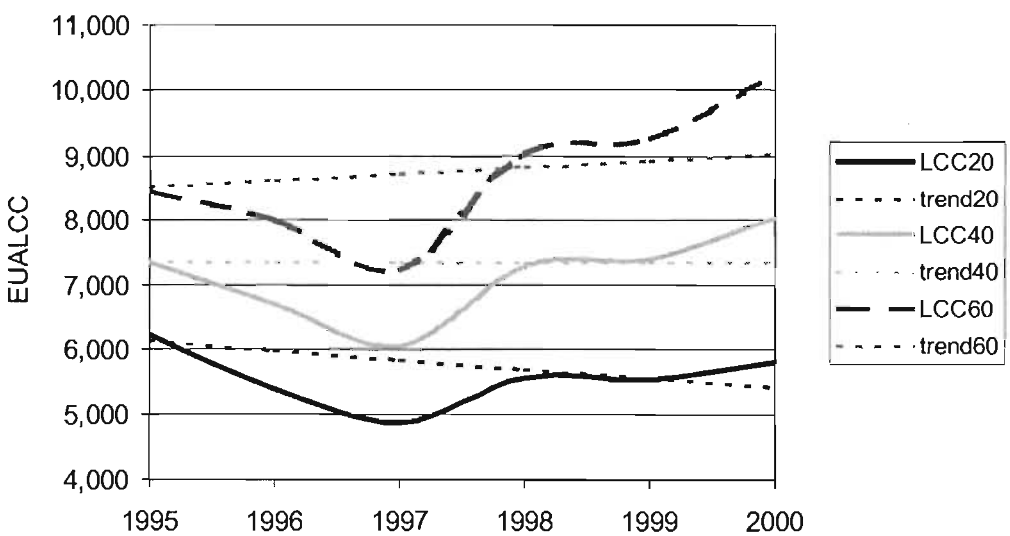


*Figure 4.12 Sensitivity of Trendscore to Downtime Cost Variations.*

*Table 4.2 EUALCC Sensitivity to Hourly Cost of Downtime*

| Percent EUALCC Difference | Percent Data Points With EUALCC Difference Within Range | | |
|---|---|---|---|
| | $20 to $40 | $20 to $60 | $20 to $80 |
| 0 | 19.7% | 12.6% | 10.0% |
| 10 | 44.8% | 26.2% | 19.7% |
| 20 | 68.1% | 38.5% | 28.3% |
| 30 | 84.2% | 51.0% | 36.5% |
| 40 | 93.6% | 62.8% | 44.8% |
| 50 | 97.6% | 73.0% | 53.0% |
| 60 | 99.2% | 81.0% | 60.9% |
| 70 | 99.8% | 87.1% | 68.1% |
| 80 | 100.0% | 91.8% | 74.5% |
| 90 | | 94.9% | 79.7% |
| 100 | | 96.9% | 84.2% |
| 110 | | 98.1% | 88.0% |
| 120 | | 98.9% | 91.1% |
| 130 | | 99.4% | 93.6% |
| 140 | | 99.7% | 95.3% |
| 150 | | 99.9% | 96.6% |
| 160 | | 100.0% | 97.6% |
| 170 | | | 98.3% |
| 180 | | | 98.8% |
| 190 | | | 99.2% |
| 200 | | | 99.4% |
| 210 | | | 99.7% |
| 220 | | | 99.8% |
| 230 | | | 99.9% |
| 240 | | | 100.0% |

## SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter discussed the EUALCC concept and the proposed methodology for equipment replacement based on life-cycle costs. This methodology is based on ranking replacement priorities based on their EUALCC trendscore. The trendscore is a number that captures two characteristics of a life-cycle cost graph that are relevant to replacement decisions: how long the unit has been beyond the optimal range, and how steep the upward LCC trend is. The trendscore was developed to make a computer mimic replacement priorities assigned by a person looking at EUALCC graphs.

The trendscore is a powerful tool to effectively utilize the information provided by EUALCC estimates. As such, it reflects all advantages and disadvantages of the life-cycle cost concept. The major disadvantage is its high sensitivity to variations in downtime cost beyond $20.00 an hour. Several researchers reported difficulties in accurately estimating downtime costs.

The research team recommends that the trendscore (equivalent uniform annual life cycle cost trends) should not be used as the only or the dominant criterion for equipment replacement, especially during the first few times the new methodology is in use. As fleet managers develop experience with the new method, they can fine-tune these assumptions. The next chapter discusses the proposed replacement methodology, based on a multi-attribute decision making process with input from the fleet manager.

# CHAPTER 5
# PROPOSED EQUIPMENT REPLACEMENT SYSTEM

## BACKGROUND

The replacement methodology currently in use by TxDOT is based on threshold values for variables that capture the equipment usage and condition, such as mileage, downtimes, and repair costs. The objective of this project is to build upon this experience, developing a new replacement methodology capable of taking into account the life-cycle cost history of equipment units, which was discussed in chapter 4.

The trendscore allows the computer to generate fleet-level priority lists based on life-cycle cost histories. This fulfills the objective of developing a replacement methodology based on engineering economics principles, taking full advantage of information in TxDOT's EOS database. This methodology, however, needs to be complemented by another that can be accurately used with units that do not have a complete cost history. In spite of its comprehensiveness, the currently available historical database has complete life-cycle histories only for equipment units received on fiscal year 1990 (09/01/1989) or later. These units comprise about 45 percent of the database. The other 55 percent were received before the oldest available data records, and as such have a truncated life-cycle history. Moreover, the older the unit, the more important it is to verify its need to be retired. There is a pressing need to develop a replacement methodology for immediate use with the older units, which are more likely to be in need of replacement.

## SYSTEM OBJECTIVES

Given these facts, there are two sets of objectives that the proposed TERM system must fulfill: conceptual and practical. Conceptual concern require a replacement strategy that:

- Includes life-cycle costs, but does not rely solely on this attribute for every replacement decision;
- Allows the manager to include his/her experience on the relative impact of different attributes (such as downtime, repair costs, etc.) in the replacement decision;
- Allows the user to include thresholds for automatic qualification, for gradual transition between the old system and the new one; and
- Allows the user to compare challenged units to the rest of the fleet, in addition to pre-determined thresholds.

There are also practical concerns, which relate to a balance between powerful software and its ease of use. Those require system capable of:

- Immediate implementation with the data already available.
- Immediate use without cumbersome training in software use (a menu-driven system).

- Generating replacement priority lists for each equipment class, allowing the manager to easily compare the condition of the challenged unit to the condition of all other units within a desired subgroup.
- Generating automatic data reports, tables and graphs for each individual unit.
- Periodic update every time new EOS files are issued.

In order to fulfill all these objectives, the researchers developed the replacement methodology and system framework discussed in this chapter.

## MULTI-ATTRIBUTE PRIORITY RANKING

The most important finding of this study's literature review is that, conceptually, all replacement strategies are the same in one important way. They all compare the condition of a challenged unit to some pre-determined threshold, which can be age, usage, downtimes, cost ratios, or a probability of failure. None of these strategies provide a way to compare each unit with the rest of the fleet—in other words, a way to look at the entire fleet (or a desired subgroup) and see where the challenged unit stands in comparison with the FLEET, rather than pre-determined values, thresholds, or ratios.

### *Approach Development and Definition*

This project proposed and developed a new equipment replacement approach, the multi-attribute priority ranking. It allows the manager to compare the challenged unit to all other active units within a desired class. This approach was based on the conceptual approached developed by Weissmann in 1990 for TxDOT's Bridge Division (Ref. 31). Weissmann's method for bridge maintenance and replacement has been successfully used for over 10 years at TxDOT, giving the researchers confidence that a similar approach will also be useful for equipment management.

The attributes selected for comparison are trendscore (life-cycle costs), repair costs, cumulative usage, and cumulative downtime. Each unit's replacement priority rank is calculated for the combination of attributes and relative weighs selected by the manager. A unit has replacement priority over all units that have a better combination of attributes, in terms of cumulative percentiles. The percentiles ("P") are calculated from the historical data set, and represent the percent of equipment units that have attribute values equal to or less than those of the specific unit being ranked (within a classcode).

The ranking formula scores units for replacement based on a weighted average of the percentiles of different attributes selected by the user: downtime, repair costs, usage, and trendscore. The ranking is made based on equation 5.1.

$$R = \sum_{i=1}^{n} w_i P_i \qquad (5.1)$$

Where:

R = Ranking

i = attribute (such as age, downtime, etc.)

n = number of attributes

w = weight of attribute "*i*", a number between zero and 1.

P = cumulative percentile of attribute, i.e., percent of units that have an attribute "*i*" value equal to or less than that of the unit being ranked.

Equation 5.1 calculates the rank score in equation 5.1 as a number between 0 and 100, with 100 being the highest replacement priority, and zero the lowest. The weights ("w") are input by the user. They represent the relative importance placed on each attribute. For example, if the user feels that downtime and repair costs should be twice as important as the trendscore and the mileage, the weights of these attributes could be respectively 0.335, 0.335, 0.165 and 0.165.

***Practical Example***

Let's assume the manager selects downtime as the only attribute for classcode 1030 (aerial personnel device, truck mounted, 41' to 59', with truck). There are 29 units in this classcode.

The first step in generating a prioritized replacement list is calculate the cumulative percentiles for the downtimes. This is shown in Figure 5.1. A unit with 2,000 hours of downtime would be in the 70% percentile. This means that 70 percent of the aerial devices in this classcode had less downtime than this unit, and 30 percent had more. The rank score (equation 5.1) would be the same as the percentile, since there is only one attribute. Analogous reasoning can be applied to a second attribute, such as usage. These attributes can be combined in different ways. Three examples: with equal importance (weights equal to 0.5), with emphasis on downtimes (weights respectively 0.7 for downtimes and 0.3 for usage), and reversed weights (0.3 for downtimes and 0.7 for usage).

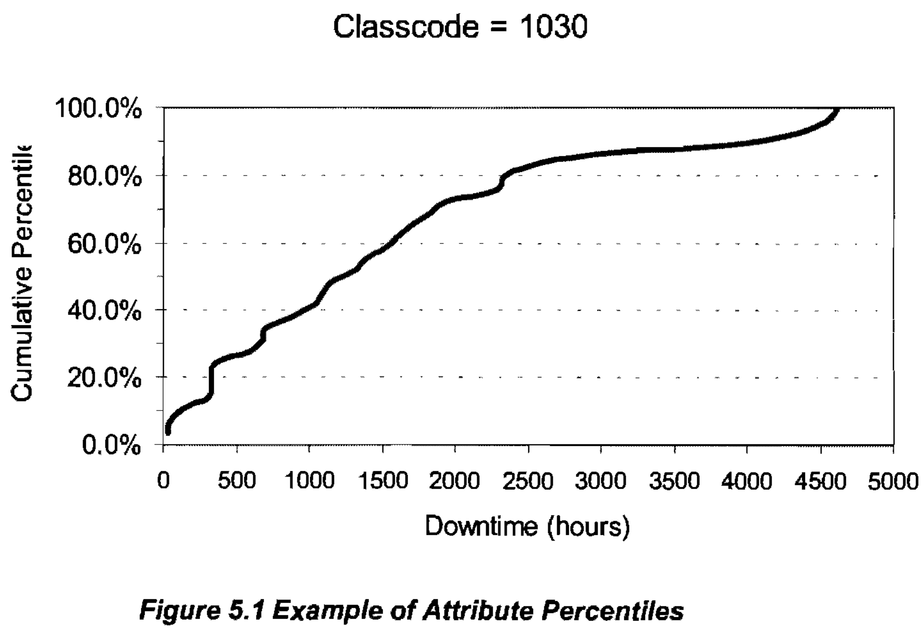


***Figure 5.1 Example of Attribute Percentiles***

Table 5.1 shows the resulting replacement priority lists. The units are ranked from the top priority to the last priority. The priorities change depending on the relative importance of the attributes, numerically

***Table 5.1 Example of Replacement Priority***

| Priority | Downtime Only | | Usage Only | | Two-Attribute, Weights 0.5-0.5 | | Two-Attribute, Weights 0.7-0.3 | | Two-Attribute, Weights 0.3--0.7 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Equip. ID | Rank Score | Equip. ID | Rank Score | Equip. ID | Rank Score | Equip. ID | Rank Score | Equip. ID | Rank Score |
| 1 | **06158A** | 100.0 | 06179A | 100.0 | 06179A | 98.3 | 06179A | 97.6 | 06179A | 99.0 |
| 2 | 06179A | 96.6 | 06110B | 96.6 | **06158A** | 93.1 | **06158A** | 95.9 | 06110B | 93.4 |
| 3 | 06183A | 93.1 | 06141 | 93.1 | 06110B | 91.4 | 06164A | 89.7 | **06158A** | 90.3 |
| 4 | 06164A | 89.7 | 06164A | 89.7 | 06164A | 89.7 | 06110B | 89.3 | 06164A | 89.7 |
| 5 | 06110B | 86.2 | **06158A** | 86.2 | 06183A | 84.5 | 06183A | 87.9 | 06141 | 82.8 |
| 6 | 06157A | 82.8 | 06179B | 82.8 | 06179B | 79.3 | 06179B | 77.9 | 06183A | 81.0 |
| 7 | 03617G | 79.3 | 06129B | 79.3 | 06141 | 75.9 | 06157A | 74.5 | 06179B | 80.7 |
| 8 | 06179B | 75.9 | 06183A | 75.9 | 06157A | 69.0 | 06141 | 69.0 | 06129B | 70.0 |
| 9 | 06180A | 72.4 | 06128B | 72.4 | 06103B | 63.8 | 03617G | 65.9 | 06128B | 67.2 |
| 10 | 06185 | 69.0 | 06152C | 69.0 | 06128B | 63.8 | 06122B | 63.4 | 06103B | 64.5 |
| 11 | 06122B | 65.5 | 06103B | 65.5 | 06129B | 63.8 | 06103B | 63.1 | 06152C | 63.8 |
| 12 | 06103B | 62.1 | 06132 | 62.1 | 06122B | 62.1 | 06185 | 62.8 | 06157A | 63.4 |
| 13 | 06141 | 58.6 | 06122B | 58.6 | 06152C | 60.3 | 06180A | 62.1 | 06122B | 60.7 |
| 14 | 06128B | 55.2 | 06157A | 55.2 | 06185 | 58.6 | 06128B | 60.3 | 06132 | 55.9 |
| 15 | 06152C | 51.7 | 06166 | 51.7 | 03617G | 56.9 | 06129B | 57.6 | 06185 | 54.5 |
| 16 | 06129B | 48.3 | 06185 | 48.3 | 06180A | 55.2 | 06152C | 56.9 | 06180A | 48.3 |
| 17 | 06192B | 44.8 | 03948G | 44.8 | 06132 | 51.7 | 06132 | 47.6 | 03617G | 47.9 |
| 18 | 06132 | 41.4 | 06126C | 41.4 | 06166 | 43.1 | 06192B | 40.7 | 06166 | 46.6 |
| 19 | 06116D | 37.9 | 06180A | 37.9 | 06192B | 37.9 | 06166 | 39.7 | 03948G | 39.7 |
| 20 | 06166 | 34.5 | 03617G | 34.5 | 03948G | 36.2 | 06126C | 34.1 | 06126C | 38.3 |
| 21 | 06126C | 31.0 | 06192B | 31.0 | 06126C | 36.2 | 03948G | 32.8 | 06192B | 35.2 |
| 22 | 03948G | 27.6 | 06114D | 27.6 | 06116D | 25.9 | 06116D | 30.7 | 06114D | 23.4 |
| 23 | 06174C | 24.1 | 06183C | 24.1 | 06183C | 22.4 | 06183C | 21.7 | 06183C | 23.1 |
| 24 | 06183C | 20.7 | 06115D | 20.7 | 06114D | 20.7 | 06174C | 20.0 | 06116D | 21.0 |
| 25 | 04446G | 17.2 | 04446G | 17.2 | 04446G | 17.2 | 06114D | 17.9 | 06115D | 17.6 |
| 26 | 06114D | 13.8 | 06116D | 13.8 | 06174C | 17.2 | 04446G | 17.2 | 04446G | 17.2 |
| 27 | 06115D | 10.3 | 06174C | 10.3 | 06115D | 15.5 | 06115D | 13.4 | 06174C | 14.5 |
| 28 | 06146D | 6.9 | 06146D | 6.9 | 06146D | 6.9 | 06146D | 6.9 | 06146D | 6.9 |
| 29 | 06149D | 3.4 | 06149D | 3.4 | 06149D | 3.4 | 06149D | 3.4 | 06149D | 3.4 |

expressed by the weights. Unit 06158A (highlighted on table 5.1), has accumulated more hours of downtime than any other unit, so it has top replacement priority based on downtime. Based on usage alone, it goes down to 5th priority. When one combines both attributes either with equal weights, or with emphasis on downtime, it goes up to 2nd priority. If more emphasis (heavier weight) is put on usage than downtime, it goes down to 3rd priority.

### *Conclusions*

The multi-attribute based ranking method has the following major advantages:

- The methodology relies on current status rather than on a complete history, and is therefore immediately applicable to the entire fleet.
- The methodology uses attributes that are easy to visualize, such as mileage, downtimes, repair expenses, etc.
- The fleet manager can select attributes that s/he knows by experience are the most relevant for a specific classcode.
- By choosing appropriate weights for the ranking formula, the ranking can reflect relative importance of attributes, and the user has flexibility to change such priorities. The user may also compare two or more different replacement schedules based on different attribute priorities.

## STATISTICAL ANALYSIS OF ATTRIBUTES' CONTRIBUTION TO REPLACEMENT PRIORITY

As discussed in chapter 3, managers' experience is extremely important for sound replacement decisions, and should always be an integral part of any system. Efficient replacement decisions depend on some factors (such as technical obsolescence) that cannot be directly quantified. Relative importance of factors is another important factor in replacement decisions; each class of equipment has a different set of priorities. For example, technical obsolescence is hardly a factor in replacing a water tank, while sophisticated equipment such as falling weight deflectometer can become obsolete whenever technology improves or changes.

### *Analysis Objectives*

The weighted average discussed above provides a tool to incorporate the fleet manager's experience and TxDOT's policies into the automated TERM system. The ranking module allows the fleet manager to assign weights to the following attributes: cumulative downtime, trendscore, cumulative usage, and cumulative repair costs. The weights represent the relative importance each attribute will have on the replacement priorities, and experienced fleet managers know about this relative importance. However, it takes some experience with the new method for managers to become comfortable with quantifying the relative importance of these attributes in terms of a number from zero to one. The project Advisory Committee requested an analysis of the relative impacts of the four attributes that would serve as a starting point to develop such experience. The objective of the analysis discussed in this section is therefore to assist in selecting weights during initial program runs. Experience with the system and with fleet management is invaluable in refining these choices, and in no way can be substituted by any statistical analysis of the values in the database.

### *Analysis Methodology*

The analysis methodology consists of the following steps:

(1) Calculate the replacement priorities of each unit using equation 5.1, assigning equal importance to all four attributes (all weights equal to one quarter).

(2) Calculate the percentage of each attribute's contribution to the rank "R", for each equipment unit. The attribute contribution is one quarter of the quotient between the attribute and the rank, expressed in percentage.

(3) Calculate the summary statistics of each attribute's percent contribution to the rank, in two ways: for all data points, and for each classcode separately.

### *Results Presentation*

The complete table with summary statistics by classcode is in the Appendix, given its size. This table displays the following summary statistics:

(1) First quartile, median, and third quartile.

(2) Mean, standard deviation, and 95 percent confidence interval for the mean.

(3) Maximum and minimum contributions.

This chapter contains a summarized discussion of the aggregated results, and a thorough discussion of five classcodes, to serve as a model for other classcodes. These classcodes are:

(1) 12030: asphalt maintenance unit, truck mounted, with 151 data points;

(2) 212000: storage tank, portable, with 11 data points;

(3) 214000: water tank, truck mounted, includes truck, with 14 data points;

(4) 20020: automobiles, sedan, 100 through 112.9 in wheelbase, with 314 data points; and

(5) 20030: automobiles, sedan, 113 in and greater wheelbase, with 198 data points.

The summary statistics are also presented in the format of box-and-whisker plots, for these five classcodes and for the aggregated classcodes. Box-and-whisker plot is a technique for displaying range and summary statistics of one-dimensional data. In box-and-whisker plot, the line inside the box represents the median. The edges of the box represent the $3^{rd}$ quartile ($75^{th}$ percentile) and the $1^{st}$ quartile ($25^{th}$ percentile), respectively, and the size of the box is the interquartile range (difference between $3^{rd}$ and $1^{st}$ quartiles). Half the data are inside the interquartile range, represented by the area inside the box. One quarter of the data is less than the first quartile and the other quarter is greater than the $3^{rd}$ quartile. The narrower the interquartile range (the box), the less scattered the values are around the median. Whiskers are drawn from the edges of the box to either the minimum and maximum observations, or to the lower and upper outliers, whichever is less. The whiskers give a clear visual indication of how far beyond the interquartile range the first and last quarter of the data spread.

### *Results and Conclusions*

Table 5.2 shows the summary statistics for all classcodes; there are 15,899 data points aggregated in this summary table. For all classcodes, the trendscore contributes, on the average 39.4±0.3 percent to the priority rank, while the other factors tended to contribute about 20 percent each. The median trendscore contribution is around 34.3 percent, while the other factors' contribution increase to over 21 percent each. This is clearly shown in figure 5.2, the boxplot of each attribute. In this plot, the whiskers go up to the outliers; there are several points above the upper outlier, as indicated by the dotted line, but none below the lower outlier. For the trendscore, the maximum value is almost 100%.

***Table 5.2 Overall Attribute Contributions to Replacement Priority Rank***

| Attribute | Minimum | 1st Quartile | Median | 3rd Quartile | Mean | St. Dev. | Conf.Int. | Maximum |
|---|---|---|---|---|---|---|---|---|
| Downtime | 0.1% | 14.1% | 21.4% | 26.3% | 20.4% | 8.9% | 0.1% | 62.4% |
| Trendscore | 1.1% | 27.7% | 34.3% | 46.9% | 39.4% | 16.1% | 0.3% | 99.2% |
| Usage | 0.1% | 14.4% | 21.4% | 26.3% | 20.3% | 8.7% | 0.1% | 70.3% |
| Repair | 0.1% | 14.8% | 21.5% | 25.7% | 19.9% | 7.8% | 0.1% | 54.2% |
| Total | | | 98.6% | | 100% | | | |

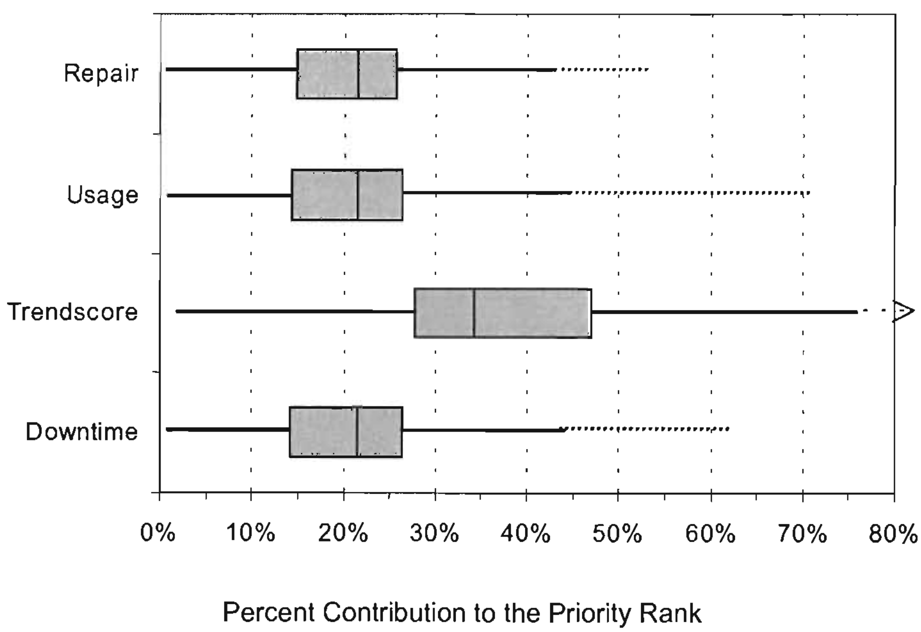


***Figure 5.2 Attribute Contributions to Replacement Priority: All Classcodes***

For the entire set of classcodes shown in the Appendix, the greatest and smallest median contributions were as follows:

| | |
|---|---|
| Trendscore | greatest median contribution: 41 percent, for classcode 75030, excavator, telescoping boom, carrier mounted, class 3.<br>smallest median contribution: 22.2 percent, for classcode 917000, 4-in pump. |
| Downtime | greatest median contribution: 28.2 percent, for classcode 921000, snow plow, v-type.<br>smallest: 18.1 percent, for classcode 470020, light duty, crew cab truck, 7901 to 8999gvwr. |
| Usage | greatest median contribution: 33.33 percent, for classcodes 132030 (mower, lift or trail type, rotary swing arm), and 530020 (conventional dump truck, 25500 to 28900 gvwr).<br>Smallest: 18 percent, for classcode 190040, snow blower for mounting on pneumatic loader. |
| Repair cost | greatest median contribution: 29.4 percent, for classcode 250010, trailer, bunkhouse or dining.<br>Smallest: 18.4 percent, for classcode 500010, 15000 to 18900 gvwr truck. |

Table 5.3 (extracted from the Appendix) shows five examples of summary statistics by classcode. These classcodes are a representative sample of the overall results for all classcodes. Usually, the heavier or more complex equipment is, the higher the trendscore contribution. Classcodes 212000 and 214000 are good examples. For a storage tank, the median trendscore contribution is 25 percent, and the mean is 28 percent. In the case of a truck-mounted tank (classcode 214000), the trendscore median contribution increases to 36.4 percent, and its mean contribution to over 39 percent.

Classcode 12030, a truck mounted asphalt maintenance unit, had median trendscore contribution of over 38 percent, at a mean of over 43 percent. Sedan automobiles have smaller trendscore impact: the median was between 32.8 and 33.9, and the mean between 38.8 and 39.87 percent (depending on whether they are small or large sedans).

The contribution of each attribute can be easily seen in figures 5.3 through 5.6, boxplots of each attribute, for the five classcodes in table 5.3. The data for sedan automobiles were aggregated to prepare the boxplot, given the result similarities between the two. In these figures, the trendscore boxplot lies clearly higher than the others, underscoring its higher contribution to the overall replacement priority rank. The only exception is figure 5.4, the storage tank, where the trendscore contribution is not very different from the others. The boxes for the trendscore are also consistently bigger, and their upper whiskers are longer than the others, indicating that the percent trendscore contributions are subject to more variation than the others are. Moreover, these variations tend to be skewed towards larger values than the other attributes, as indicated by the longer upper whiskers.

***Table 5.3 Examples of Attribute Contributions to Replacement Priority Rank***

| Classcode | Attribute | Minimum | 1st Quartile | Median | 3rd Quartile | Mean | St. Dev. | Conf.Int. | Maximum |
|---|---|---|---|---|---|---|---|---|---|
| 12030 | Downtime | 0.7% | 13.1% | 20.9% | 24.8% | 19.0% | 7.5% | 1.2% | 34.6% |
| asphalt | Trendscore | 23.9% | 29.5% | 38.3% | 52.7% | 43.2% | 17.4% | 2.8% | 96.5% |
| maintenance | Usage | 0.6% | 14.0% | 21.1% | 25.1% | 19.0% | 7.6% | 1.2% | 32.3% |
| unit, truck | Repair | 0.6% | 14.3% | 20.4% | 24.7% | 18.8% | 7.2% | 1.2% | 29.8% |
| mounted | Total | | | 100.8% | | | | | |
| 212000 | Downtime | 9.1% | 13.0% | 23.5% | 33.3% | 24.2% | 12.2% | 7.2% | 45.0% |
| portable | Trendscore | 5.0% | 11.1% | 25.0% | 43.5% | 28.3% | 20.8% | 12.3% | 72.7% |
| storage | Usage | 9.1% | 14.3% | 23.5% | 30.6% | 23.5% | 10.0% | 5.9% | 41.7% |
| tank | Repair | 8.3% | 16.7% | 21.7% | 34.6% | 24.0% | 11.1% | 6.5% | 40.7% |
| | Total | | | 93.8% | | | | | |
| 214000 | Downtime | 3.6% | 15.8% | 22.2% | 25.0% | 20.3% | 6.9% | 3.6% | 28.9% |
| water tank | Trendscore | 22.6% | 26.7% | 36.4% | 42.9% | 39.4% | 14.4% | 7.6% | 66.7% |
| truck mounted | Usage | 5.6% | 15.0% | 21.8% | 25.0% | 19.9% | 6.9% | 3.6% | 28.0% |
| includes | Repair | 5.0% | 15.0% | 22.0% | 24.0% | 20.3% | 8.4% | 4.4% | 39.3% |
| truck | Total | | | 102.4% | | | | | |
| 20020 | Downtime | 0.8% | 12.6% | 20.5% | 28.6% | 20.6% | 10.2% | 1.1% | 42.4% |
| automobiles | Trendscore | 22.1% | 28.3% | 33.9% | 43.6% | 39.7% | 16.2% | 1.8% | 98.4% |
| sedan | Usage | 0.4% | 13.3% | 21.1% | 27.0% | 20.1% | 8.9% | 1.0% | 39.3% |
| 100 - 112.9 in | Repair | 0.4% | 13.7% | 20.6% | 26.2% | 19.7% | 8.1% | 0.9% | 38.1% |
| wheelbase | Total | | | 96.1% | | | | | |
| 20030 | Downtime | 0.6% | 13.5% | 20.7% | 27.7% | 20.9% | 10.2% | 1.4% | 44.4% |
| automobiles | Trendscore | 22.0% | 27.7% | 32.8% | 46.0% | 38.8% | 15.2% | 2.1% | 92.0% |
| sedan | Usage | 0.5% | 14.5% | 21.1% | 26.9% | 20.3% | 8.7% | 1.2% | 38.0% |
| >=113 in | Repair | 0.5% | 15.4% | 21.4% | 26.3% | 20.0% | 7.9% | 1.1% | 33.4% |
| wheelbase | Total | | | 96.0% | | | | | |

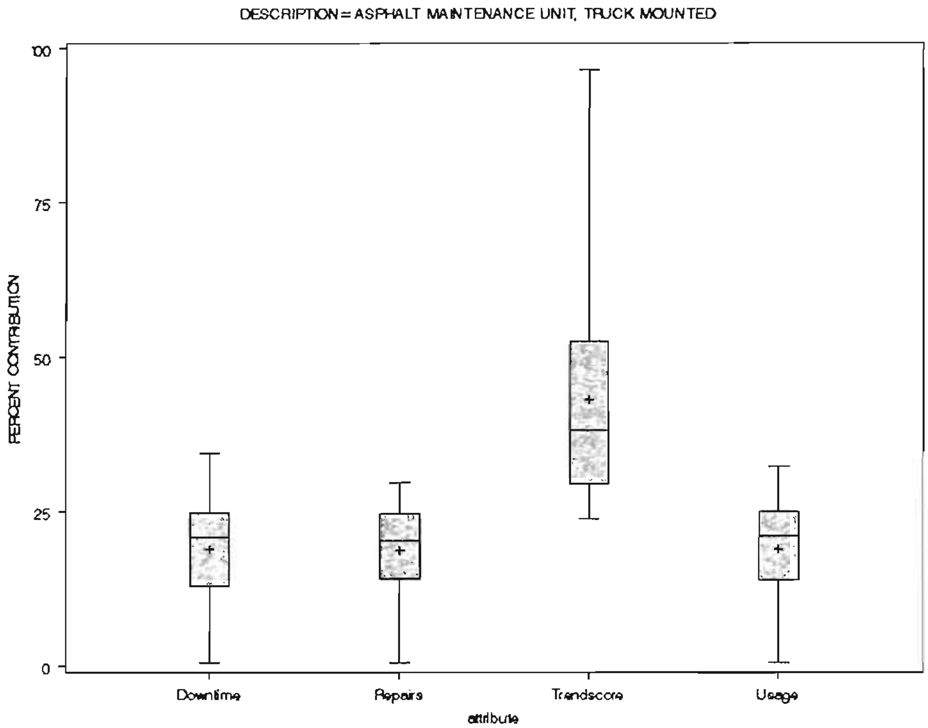


***Figure 5.3 Attribute Contributions to Replacement Priority: Classcode 12030***

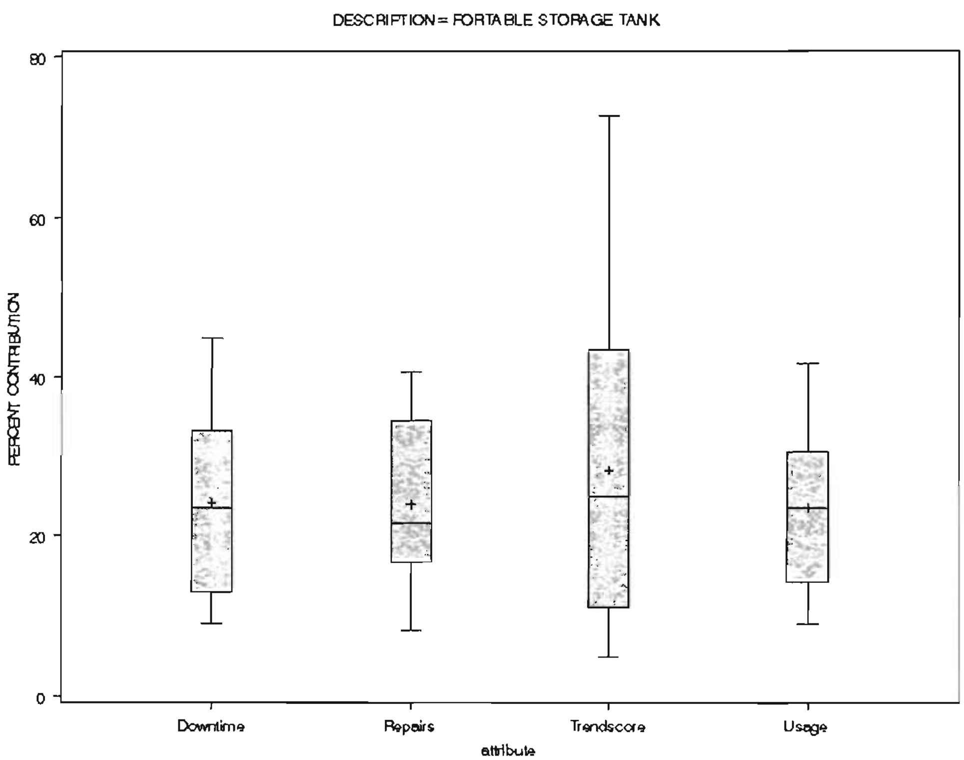


***Figure 5.4 Attribute Contributions to Replacement Priority: Classcode 212000***

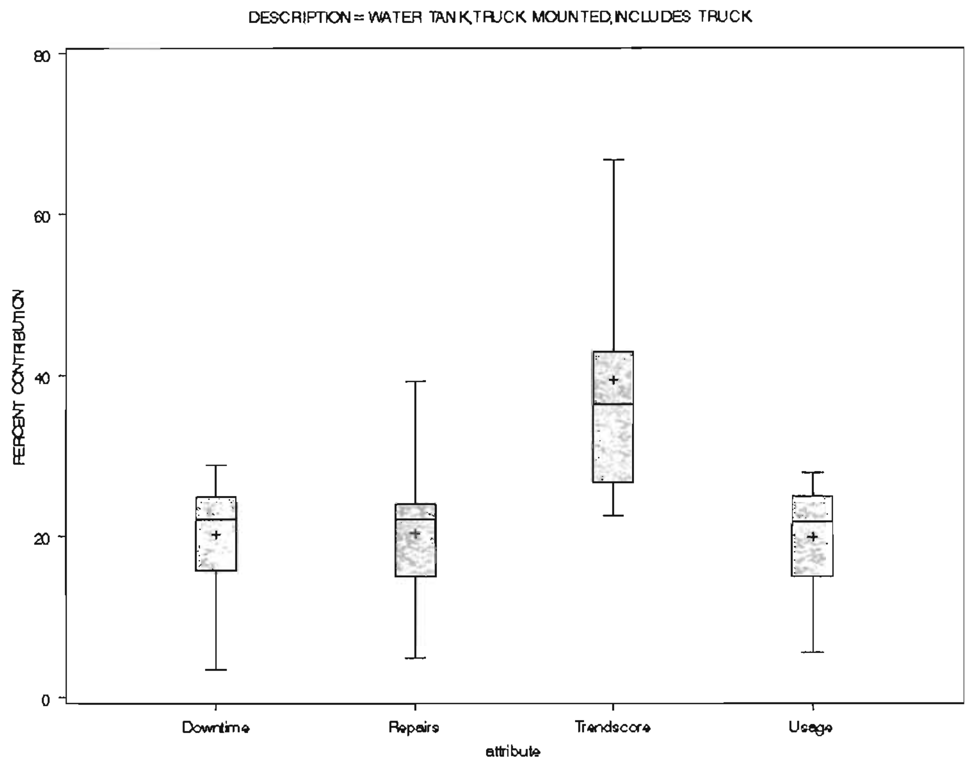


***Figure 5.5 Attribute Contributions to Replacement Priority: Classcode 214000***

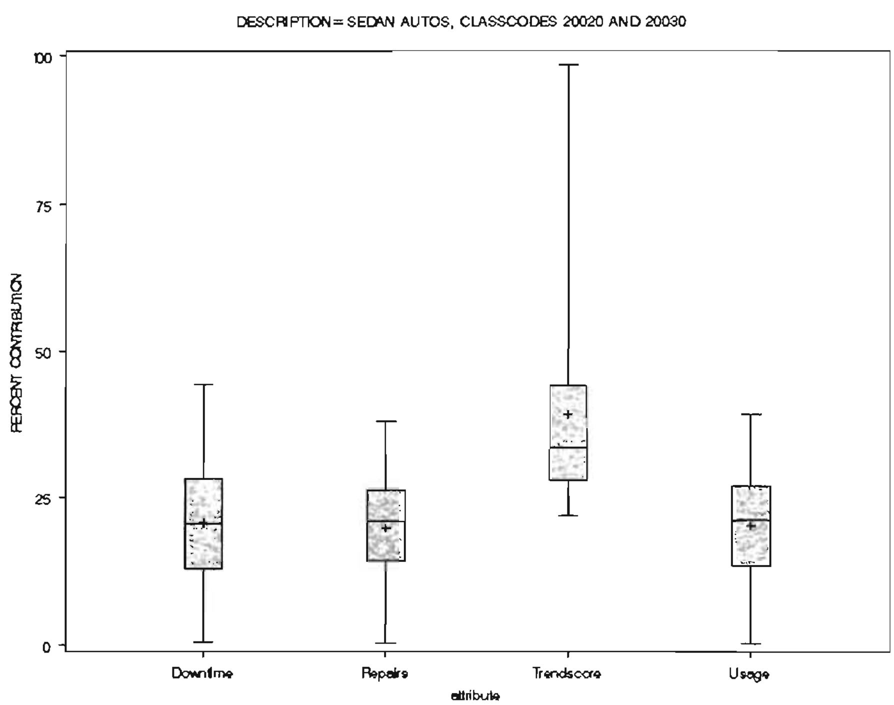


***Figure 5.6 Attribute Contributions to Replacement Priority: Classcodes 20020 and 20030 (Aggregated)***

**SYSTEM FRAMEWORK**

TERM is an automated computerized system for equipment replacement analysis. TERM's menu-driven interface provides TxDOT personnel with a user-friendly environment to support equipment replacement decisions. The SAS® programming language is used for the calculation modules of the TERM system and for the user interface. The components of SAS used for user interface development were SAS/AF frames, SCL (Screen Control Language) and SAS Macros.

The conceptual system framework is shown in figure 5.7. It consists of 7 menu-driven modules that link to the historical data set and have graphical capabilities, and one set of programs to update the historical data set as needed. This is the only module that is not menu-driven; it is meant to be run periodically by the system manager, who must be proficient in the SAS programming language.

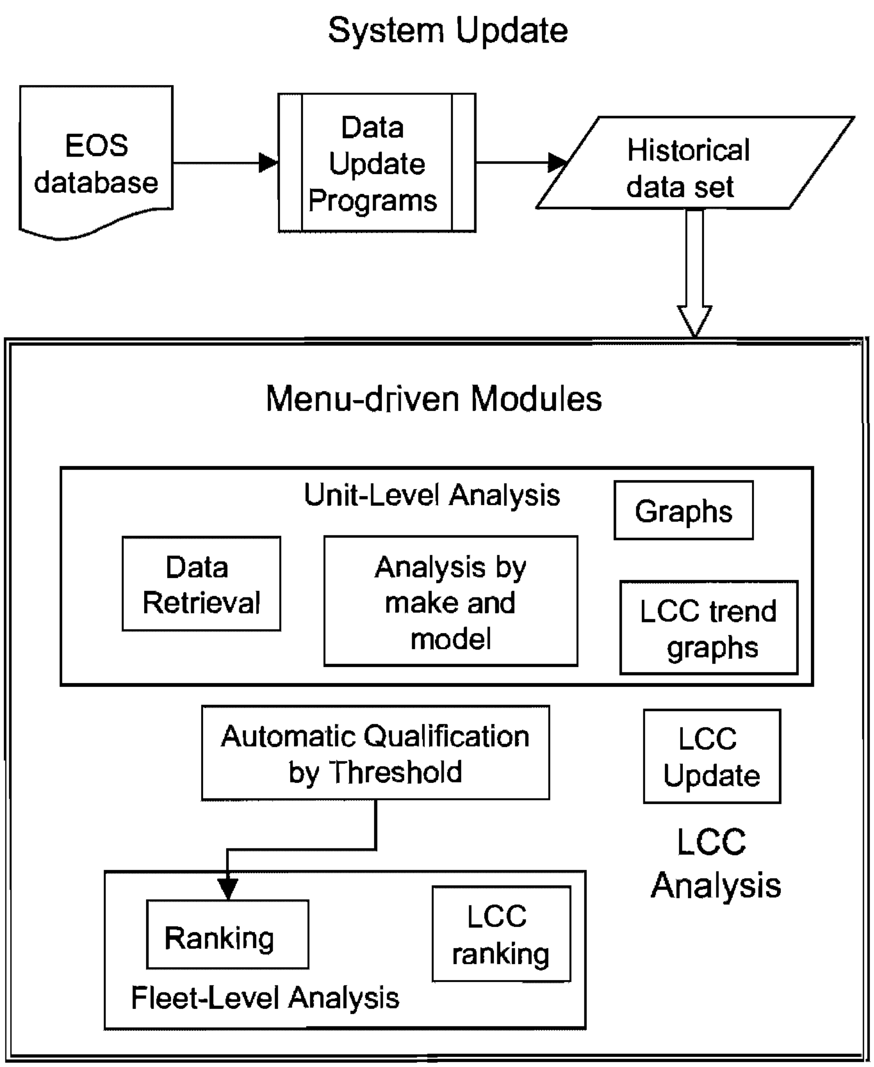


***Figure 5.7 System Framework***

***System Modules***

Figure 5.8 depicts the main menu screen for the system. It has several buttons to access the different system modules discussed previously. The top of the screen allows the user to directly browse through the equipment database. The modules can perform unit-level and fleet-level analysis. In the unit-level analysis, the manager can inspect a desired attribute for a specific equipment unit, as well as plot the attribute and the life-cycle cost history and trend. There is also a module to perform analysis at the make and model level. The fleet-level analysis modules generate the replacement priority lists for each selected classcode. The LCC analysis modules perform both fleet - and unit-level analyses. The LCC update module allows the user to override the default discount rates and/or hourly price of downtime embedded in the program and recalculate the LCC for the new values.

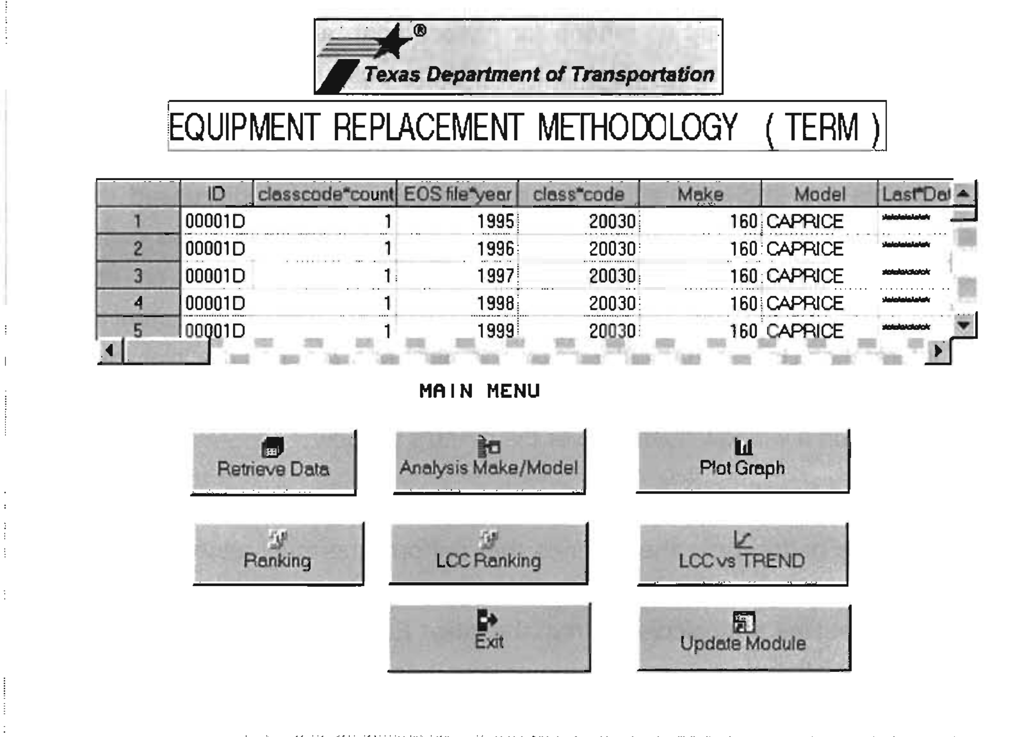


***Figure 5.8 TERM System Main Menu***

***Data Update Module***

The data update module should be used at least once a year, to include the newest EOS database records in the historical data set, and remove retired equipment from it. This module reads the selected records from the EOS file, applies the data validation criteria discussed in chapter 2, writes the flagged units to text files for inspection, separates retired from active equipment, and removes recently retired equipment from the active data set. This is the only module that was not designed with a menu-driven interface, since it is meant to be used by a system manager who must be proficient in the SAS programming language.

### *Reporting and Query Modules*

The reporting and data querying can be called by browsing through the table on top of the screen, and/or by clicking on the appropriate buttons the call the other modules designed to retrieve specific data from the historical data. As indicated in figure 5.8, these modules can print data tables and graphs for each unit, and generate summaries by make and model. The user utilizes each module interface menu to select equipment units (by ID) or class codes, as well as the types of tables or graphs to display and/or print.

### *Life-Cycle Cost Module*

The life-cycle cost (LCC) module calculates the annualized life-cycle costs of each equipment unit at a given time, which can be used as criteria for replacement, alone or in conjunction with other variables. This module contains default values for downtime costs and discount rates. Given the uncertainties surrounding such parameters, however, the system allows the use to override them, by using the LCC update module.

Figure 5.9 depicts the implementation of the trendscore analysis discussed in the previous chapter. At the top of this figure is the ranked list in order of trendscore for class code 1010 (Aerial Personnel Device Truck Mounted). The last column shows variable trendpct, an abbreviation for "trendscore percentile rank". In addition, the user is able to query a specific equipment ID and display historical EUALCC information. In this particular case, the user has requested a plot for equipment ID 06101C, the second replacement priority for this class code, and the complete life-cycle cost history and trend analysis are depicted on a window floating over the menu's window.

### *Multi-Attribute Ranking Module*

The ranking module button calls the routines that perform the multi-attribute ranking procedure previously discussed. The user inputs the weights, and they represent the relative importance s/he places on the attributes. The percentiles are calculated from the latest EOS data set, and represent the percent of equipment units that have attribute values equal to or less than those of the specific unit being ranked within any desired classcode. The user can print the replacement list.

### *Automatic Qualification Based on Thresholds*

The system allows the user to input thresholds for automatic replacement qualification, if desired. When an automatic qualification threshold is selected for an attribute, the system uses a two-level ranking procedure. Units above that threshold go to the top of the list, ranked by the multi-attribute method. Then come units below the threshold, also ranked by the multi-attribute method. This is a very important feature, for it allows the manager to enforce current TxDOT policies, and make a smooth transition between the old and new methods.

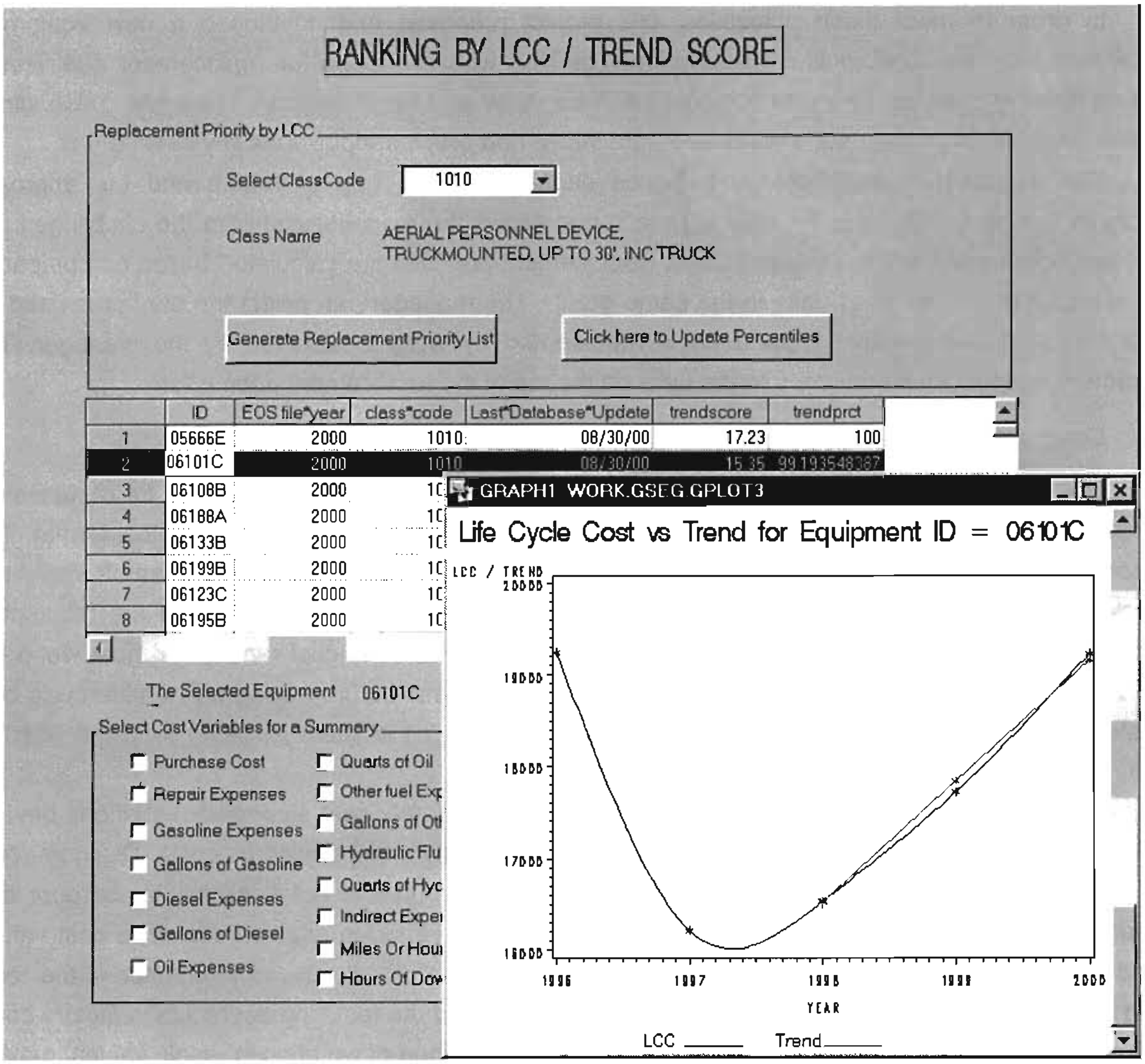


*Figure 5.9 Life-Cycle Cost Module*

## SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

### *Summary*

There are two sets of objectives that the new TERM system must fulfill. On a conceptual level, the system must rely on a replacement strategy that includes life-cycle costs, take full advantage of the existing data, and allow the manager to compare challenged units to the rest of the fleet, in addition to pre-determined thresholds. On the practical level, the system must be menu-driven and easy to use by someone not familiar with the underlying programming languages, while at the same time allowing programming of sophisticated statistical methods require for accurate analysis of the life-cycle cost time series.

In order to meet these objectives, this project proposed and developed a new equipment replacement approach, the multi-attribute priority ranking with an option for replacement qualification based on threshold values. This was combined with life-cycle cost trend analysis. The system also allows unit-level analysis, since the user can retrieve data tables and graph attributes for any desired unit.

The replacement methodology balances elements of the new approach and the approach currently in use by TxDOT. It is the only approach that allows the manager compare the challenged unit to all other active units within a desired class. Replacement priorities are calculated based on comparing the challenged unit to all other units in the same group. The manager can select the attributes used for comparison, and their relative importance is represented by weights selected by the manager. The replacement budget can be matched to the units on the top of the replacement priority list.

***Conclusions***

The life-cycle cost method theoretically combines all attributes that are relevant for replacement decisions into an annualized time-series that is quite straightforward to inspect in graphical format. The trendscore developed in this project allows the computer to mimic human decisions based on inspecting life-cycle cost graphs. It captures the two characteristics of a life-cycle cost graph that are relevant to replacement decisions: how long the unit has been beyond the optimal cost range, and how steep the upward cost trend is. However, the fleet manager should be careful before relying only on life-cycle cost estimates to make replacement decisions, for several reasons, all of them resulting from the need to assign monetary values to every relevant attribute.

Life-cycle costs are sensitive to variations in downtime hourly cost, especially variations beyond $20.00. Several researchers reported difficulties in accurately estimating downtime costs. Discount rates have less overall impact, and the slope of the life-cycle cost curve is not sensitive to discount rate variations within the range observed in the U.S. in the past 10 years. In addition, life-cycle cost values depend on estimates of the equipment residual (or resale) value. As discussed in chapter 4, the team tried to predict these values based on retired equipment data, and the resulting depreciation factors could be adjusted only to median resale values. There is a very wide range of variation in resale values, making very accurate predictions almost impossible.

The research team recommends that the trendscore (equivalent uniform annual life cycle cost trends) should not be used as the only or the dominant criterion for equipment replacement, at least in the beginning. We are still very far from being able to completely mimic the fleet manager's experience with a computer program.

The analysis of attribute contribution to the priority rank indicated that, when all weights are equal, the trendscore contribution to the rank is consistently greater than the other attributes (between 30 and 40 percent). The analysis also indicated that, in general, the heavier or the more complex the equipment is, the greater the trendscore contribution to the replacement rank. For most classcodes, the trendscore contribution has the widest variation. In addition, the values above the 3$^{rd}$ quartile are larger than those observed for the other attributes. The other attributes' contribution was less scattered, and was about 20 percent each. Only managerial experience can tell in which cases the life-cycle costs are really more important than the other attributes for replacement decisions. The manager has the ability to select weights that reflect his/her own experience with these issues.

### *Recommendations*

After getting acquainted with the TERM system, fleet managers should generate several lists, with different weights for the attributes, and analyze the results based on their experience. This will give users experience for assigning realistic weights to attributes in each classcode. Assigning large weights to downtime and usage, and less importance to repair cost and trendcore can capture intangibles such as obsolescence and expired warranties.

The multi-attribute ranking system has the advantage of eliminating any additional need for financial quantification of parameters known by experience to affect replacement decisions (such as downtime). A conceptually similar method was developed by Weissmann to rank priority replacement for bridges (Ref. 31). This system was programmed, and has been successfully used by TxDOT's bridge division for over 11 years. The research team regards this success as an indication that the multi-attribute ranking system has many advantages, and can generate useful and accurate priority replacement lists, especially after the user becomes familiar with the method and gets a good feel for the attribute weights in each particular case.

The conceptual framework discussed in this chapter is programmed into TERM, which is in the process of being implemented at TxDOT's General Services Division–Purchase and Equipment Sections for immediate use. This menu-driven software will allow TxDOT to use the new system immediately for the entire fleet. The system will also allow TxDOT to compare the LCC, multi-attribute ranking, and threshold methodologies, developing a basis not only for equipment replacement, but also for future modifications and upgrades on the software and the methodology developed by this project.

Every software in the market is constantly being upgraded to reflect customer's preferences and needs. The project team believes that experience with the system is the only means to verify how to improve and modify it. TERM should not be an exception to this rule. TxDOT should assign to TERM maintenance, someone very proficient in the SAS language, including IML subroutines, SAS/AF frames, SCL (Screen Control Language) and SAS Macros. As users identify needs for modifications and upgrades in the system, this person should program, implement, and test them. In order to better serve TxDOT, TERM should be viewed as an ongoing programming effort, rather than a one-time effort to be used until obsolescence.

# CHAPTER 6
# SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Research project 7-4941 originated from TxDOT's General Services Division–Purchase and Equipment Sections as a response to the need for developing equipment replacement analysis procedures based on engineering economics principles. The project developed a computerized Transportation Equipment Replacement Methodology (TERM) system for the State of Texas. TERM is a menu-driven software broken down into modules that allow the user to maintain an updated replacement database, retrieve information on specific equipment units or classes of equipment, and obtain fleet-level replacement priority lists based on criteria that include life-cycle costs, downtimes, mileage, and repairs, in combination or separately. TERM uses information from TxDOT's EOS database, a very comprehensive and accurate database that contains all data necessary to obtain life-cycle cost histories.

## BACKGROUND

Replacement strategies are very important for fleet managers, and as such have been and still are the subject of many studies. This project conducted a literature review and a survey of replacement strategies currently in use. This research indicated that replacement methods can be classified into the following six groups:

(1) **Threshold criteria**. Equipment units become candidates for replacement when they reach predetermined threshold values of indicators such as age, mileage, repair cost, and downtimes. This is the method currently in use by TxDOT.

(2) **Historical costs as percent of new costs**. Equipment units become candidates for replacement when their lifetime maintenance costs reach a predetermined percentage of the cost of a new unit.

(3) **Probability of failure**. Probability models are used to predict when a unit is approaching failure. This requires developing a subjective definition of "equipment failure". Units are replaced when their estimated probability of failure reaches a predetermined threshold.

(4) **Unit cost (e.g., cost per mile)**. Equipment units become candidates for replacement when their cost per mile reach a predetermined percentage of the cost per mile for a given class of equipment.

(5) **Life-cycle cost analysis**. Equipment units become candidates for replacement when their estimated total cost of ownership and operation reaches its minimum. A variation of this method uses incremental costs rather than costs over the entire life.

(6) **Weighted factors method.** Relevant parameters (such as age, usage, downtimes, etc.) are divided by base figures, and the resulting ratios are weighted and added up. Equipment units become candidates for replacement when their sums exceed a predetermined threshold value.

The most important conclusion of this literature review is that, conceptually, all strategies above are the same. They compare the condition of a challenged unit to some pre-determined threshold, which can be age, usage, downtimes, etc. (groups 1 and 6), cost ratios (groups 2, 4 and 5), or a probability of failure (group 3). None of these strategies provide a way to directly compare each unit with the rest of the fleet—in other words, a way to look at the entire fleet (or a desired subgroup) and see where the challenged unit stands in comparison with the rest of the fleet, rather than pre-determined values, thresholds, or cost ratios.

## OBJECTIVES

There are two levels of objectives that the new TERM system must fulfill:

(1) Conceptual level: the system must rely on a replacement strategy that includes life-cycle costs, takes full advantage of the existing data, and allows the manager to compare challenged units to the rest of the fleet, in addition to pre-determined thresholds.

(2) Practical level: a balance between a powerful software and its ease of use, and a gradual transition between threshold method and the new method.

In order to meet these objectives, this project proposed and developed a new equipment replacement approach, based on three concepts: multi-attribute priority ranking, life-cycle cost trend analysis, and automatic replacement qualification based on threshold values. The proposed methodology balances elements of the new approach and the approach currently in use by TxDOT. It is the only approach that allows the manager compare the challenged unit to all other active units within a desired class. The replacement budget can be matched to the units on the top of the replacement priority list.

## NEW REPLACEMENT STRATEGY

This project developed two new concepts: life-cycle cost trendscores, and multi-attribute priority ranking. The life-cycle cost trendscore is a number that captures two characteristics of a life-cycle cost graph that are relevant to replacement decisions: how long the unit has been beyond the optimal cost range, and how steep the upward life-cycle cost trend is. The trendscore was developed to make a computer mimic replacement priorities assigned by a person looking at a series of life-cycle cost graphs.

Multi-attribute priority ranking is a fleet-level methodology to rank units for replacement based on comparing the unit condition with the rest of the fleet in the same class. The attributes used for comparison can be selected by the manager, and include life-cycle cost trendscores, repair cost, cumulative usage, and downtimes. The relative importance of each of those attributes is captured by weights selected by the manager. The priority ranking is calculated for any combination of attributes and relative weights. The multi-attribute ranking can be done within units selected by the manager for automatic qualification. If a threshold for automatic qualification is selected, the system will place all automatic qualifiers on top of the list, sorted by their multi-attribute rank. Next will come the other units, also sorted by their rank. This two-level method allows fleet-level management combined with TxDOT policies and manager's experience on replacement thresholds.

## SYSTEM'S ARCHITECTURE

TERM is an automated PC based-system for equipment replacement analysis. TERM's menu-driven interface provides TxDOT personnel with a user-friendly environment to support equipment replacement decisions. The SAS programming language is used for the calculation modules of the TERM system and for the user interface. The SAS components used for user interface development were SAS/AF frames, SCL (Screen Control Language) and SAS Macros.

The conceptual system framework consists of 7 menu-driven modules that link to the historical data set and have graphical capabilities, and one set of programs to update the historical data set as needed. This set of programs is the only module that is not menu-driven; it is meant to be run periodically by the system manager, who must be proficient in the SAS programming language.

The main menu screen has several buttons to access the different system modules. The top of the screen allows the user to directly browse through the equipment database. The modules can perform unit-level and fleet-level analysis. In the unit-level analysis, the manager can inspect a desired attribute for a specific equipment unit, as well as plot the attribute and the life-cycle cost history and trend. There is also a module to perform analysis at the make and model level. The fleet-level analysis modules generate the replacement priority lists for each selected classcode. The LCC analysis modules perform both fleet - and unit-level analyses. The LCC update module allows the user to override the default discount rates and/or hourly price of downtime embedded in the program and recalculate the LCC for the new values. The ranking module performs the multi-attribute ranking procedure, with or without thresholds for automatic qualification threshold.

## CONCLUSIONS AND RECOMMENDATIONS

### *Life-Cycle Costs and Trendscore*

The life-cycle cost method theoretically combines all parameters that are relevant for replacement decisions into an annualized cost time-series that is quite straightforward to be visually evaluated by a decision maker. The trendscore, developed to allow a computer to mimic replacement priorities assigned by a decision maker looking at life-cycle cost graphs, is a powerful tool to effectively utilize the information provided by annualized life-cycle cost graphs. However, it reflects all advantages and disadvantages of the life-cycle cost concept. The major disadvantage is the need to assign monetary values to all parameters. Several researchers reported difficulties in accurately estimating downtime costs, and this project found that life-cycle costs are highly sensitive to downtime cost variations greater than $20.00 an hour. Discount rates have less overall impact, and the slope of the life-cycle cost curve is not sensitive to discount rate variations within the range observed in the U.S. in the past 10 years

Life-cycle cost values also depend on the equipment residual (or resale) value, and this is difficult to estimate. As discussed in chapter 4, the team tried to predict these values based on retired equipment data, and the resulting depreciation factors could only be adjusted to median resale values. There is a very wide range of variation in resale values, making accurate predictions almost impossible.

Repair costs include both major equipment upgrade (which should make replacement a low priority) and major repair expenses (which should rise the priority). A replacement list based on life-cycle costs alone may assign high replacement priorities to units that have been subject to upgrades.

The research team recommends that the trendscore should not be used as the only or the dominant criterion for equipment replacement, especially in the beginning, while the fleet managers are still developing experience with the new method. It is better to use the program's ability to generate priority lists based on different attributes, and compare criteria.

***Multi-Attribute Ranking and Automatic Qualification by Threshold***

The multi-attribute ranking system has the advantage of eliminating the need for financial quantification of parameters known by experience to affect replacement decisions (such as downtime). The team recommends that, after getting acquainted with the TERM system, experienced fleet managers should generate several lists with different relative weights, in order to develop a practical feel for assigning weights to attributes, as well as a feel for the accuracy and convenience of using the life-cycle cost trendscore in each classcode. Assigning large weights to parameters such as downtime and/or usage and lesser weights to repair costs and trendscores can capture intangibles such as obsolescence and expired warranties.

The analysis of attribute contribution to the priority rank indicated that, when all ranking weights are equal, the trendscore contribution to the rank (between 30 and 40 percent) is consistently greater than the other attributes. The analysis also indicated that, in general, the heavier or the more complex the equipment is, the greater the trendscore contribution to the replacement rank. For most classcodes, the trendscore contribution has the widest variation. In addition, the values above the 3$^{rd}$ quartile are larger than those observed for the other attributes. The other attributes' contribution was less scattered, at about 20 percent each. Only managerial experience can tell in which cases the life-cycle costs are really more important than the other attributes for replacement decisions. The manager has the ability to select weights that reflect his/her own experience with these issues.

**IMPLEMENTATION RECOMMENDATIONS**

The conceptual framework discussed in this chapter is programmed into TERM, which is in the process of being implemented at TxDOT's General Services Division–Purchase and Equipment Sections for immediate use. This menu-driven software will allow TxDOT to use the new system immediately for the entire fleet. The system will also allow TxDOT to compare the trendscore, multi-attribute ranking, and threshold methodologies, developing a basis not only for equipment replacement, but also for future modifications and upgrades on the software and the methodology developed by this project.

As discussed in chapter 3, managers' experience is extremely important for sound replacement decisions, and should always be an integral part of any system. Efficient replacement decisions depend on some factors (such as technical obsolescence) that cannot be directly quantified. Relative importance of factors is another important factor in replacement decisions; each class of equipment has a different set of priorities. For example, technical obsolescence is hardly a factor in replacing a water tank, while sophisticated equipment such as Falling Weight Deflectometer (FWD) can become obsolete whenever technology improves or changes.

The multi-attribute priority rank developed in this project provides two ways to incorporate the fleet manager's experience and TxDOT's policies into the automated TERM system. The ranking module allows the fleet manager to assign weights to the following attributes: cumulative downtime, trendscore, cumulative usage, and cumulative repair costs. The weights represent the relative importance each attribute will have on the replacement priorities, and experienced fleet managers know about this relative importance. However, it takes some experience with the new method for managers to become comfortable with quantifying the relative importance of these attributes in terms of a number from zero to one. The project Advisory Committee requested an analysis of the relative impacts of the four attributes that would serve as a starting point to develop such experience. This analysis' findings are useful to assist in selecting weights during initial program runs. Experience with the system and with fleet management is invaluable in refining these choices, and in no way can be substituted for any statistical analysis of the values in the database.

The project team believes that experience with the system is the only means to verify how to improve and modify it. Every software in the market is constantly being upgraded to reflect customer's preferences and needs. TERM should not be an exception to this rule. In order to do this, TxDOT should have at least one employee very proficient in the SAS language, including IML subroutines, SAS/AF frames, SCL (Screen Control Language) and SAS Macros. As users identify needs for modifications and upgrades in the system, this person should implement and test them. In order to better serve TxDOT, TERM should be viewed as an ongoing programming effort, rather than a capital acquisition to be used until obsolescence.

Agencies such as TxDOT, whose capital replacement budgets are fixed or subject to approval by legislative bodies, may not always have funds for all needed scheduled replacements. A prioritized replacement list will assist the manager in making purchase decisions, while at the same time making the effects of inadequate funding highly visible. The TERM system can help TxDOT accomplish these objectives.

# REFERENCES


1. Anderson, Virgil and Robert McLean. *Design of Experiments: A Realistic Approach*. Marcel Decker Inc., 1974.
2. Ardalan, Abol. *Economic & Financial Analysis for Engineering & Project Management.* Technomic Publishing Company, Inc. Lancaster, Pennsylvania 1704. 2000.
3. Automotive Fleet. *Strong Resale Values Decrease Net Depreciation for Trucks and Vans*. Automotive Fleet, Vol. 36, issue 1. Pp. 36-38, Nov. 1996.
4. Automotive Fleet. *The Double Declining Balance Method*. Automotive Fleet, Vol. 25, issue 7. Pp. 40-41, May 1986.
5. Bennett, C.R., and R.M.C. Dunn. *Depreciation of Motor Vehicles in New Zealand*. Transportation Research Record, isue 1262, pp. 12-20. TRB, 1990.
6. Bibona, Salvatore. *Vehicle Replacement Strategies*. Utility Fleet Manager, October 1996, pp. 19-27.
7. Blank, Leland T., Anthony J. Tarquin. *Engineering Economy*, Third Edition. McGraw-Hill, Inc. New York, 1989.
8. Brown, R. J. and R. R. Yanuck. *Introduction to Life Cycle Costing.* Prentice Hall, Englewood Cliffs, 1985.
9. Bury, Karl V. *Statistical Models in Applied Science*. John Wiley and Sons, 1975.
10. Butler Jr., B.C. *Use-Related Vehicle Depreciation*. Transportation Research Record, Issue 995, pp. 1-9. TRB, 1984.
11. Daniels, C. *Vehicle Operating Costs in Transport Studies*. Technical Series 1, The Economist Intelligence Unit Limited, London, England, 1974.
12. Dhilon, B.S.. *Life Cycle Costing*. Gordon and Breach Science Publishers, New York, 1989.
13. Di Jin, Hauke L. Kite-Powell. *Optimal fleet utilization and replacement.* Transportation Research Part E 36 (2000) 3-20.
14. Elandt-Johnson, Regina, and N. L. Johnson. *Survival Models and Data Analysis*. John Wiley and Sons, N.Y., 1980.
15. *Equipment Resource Management into the 21$^{st}$ Century*. Edited by Sandra L. Weber. Published by the American Society of Civil Engineers, 345 East 47$^{th}$ street, New York 10017-2398, 1995.
16. Grant, E.L., W.G. Ireson and R.S. Leavenworth. *Principles of Engineering Economy.* John Wiley and Sons, New York, 1990.
17. Gray, Gilbert W.. *An Earthmoving Equipment Management Policy.* Earthmoving Industry Conference, Central Illinois Section, Peoria, IL. April 23-25, 1979.
18. Hanson, Robert, and Cherie A. Kyte. *Investigation of Passenger Vehicles Rental Rates.* Transportation Research Record 1700, paper 00-0296, pp.45-51.
19. Hide, H. and S. W. Abayanayaka. *Vehicle Operating Costs Relationships for Developing Countries.* University of Warwick, Proceedings of the Seminar "Transport Planning in Developing Countries", England, pp.91-104. July 1975.
20. Jaafari A. and V. K. Mateffy. *Realistic Model for Equipment Replacement.* Journal of Construction and Management, Vol. 116, No.3, September, 1990.
21. Kalbfleisch, J.D, and R. L. Prentice. *The Statistical Analysis of Failure Time Data*. John Wiley and Sons, N.Y., 1980.

22. Moore, Tom. *Trade Cycle Strategies*. Fleet Owner, November 1996, Pp. 50-53.

23. National Cooperative Highway Research Program. *Fleet Management and Selection Systems for Highway Maintenance Equipment.* Synthesis of Highway Practice 283, National Academy Press, Washington, D.C. 2000.

24. Robert A. Hanson. *Determining the Right Size of a Rental Vehicle Fleet.* Transportation Research Record 1672, Paper No. 99-0147

25. Roos, D., T. Melone, F. Little, E. Porter, N. Wilson, and J. Sussman. *The Dial-A-Ride Transportation System—Summary Report.* Massachusetts Institute of Technology, Urban Systems Laboratory, March 1971.

26. Snedecor, George W., and W. G. Cochran. *Statistical Methods*. Iowa State University Press, 1980.

27. *Southeastern States Equipment Manager's Meeting*. Proceedings, May 2000.

28. Texas Department of Transportation. *File number 29, ADY.DIC.0204* (Data dictionary).

29. Vorster, C. M., and J. M. Garza. *Consequential Equipment Costs Associated with Lack of Availability and Downtime*. ASCE, Journal of the Construction Engineering and Management, Vol.116, No. 4, Dec. 1990.

30. Wadell, Richard. *A Model for Equipment Replacement Decisions and Policies*. The Institute of Management Sciences, Interfaces 13:4, August 1983, pp. 1-7.

31. Weissmann, J., N. H. Burns, and W. R. Hudson. *Operating the Texas Eligible Bridge Selection System (TEBSS)*, Research Report N° 1911-1F, Center for Transportation Research, The University of Texas at Austin, 1991.

32. Weissmann, J., and Angela J. Weissmann, *Analysis of Cost Data and Development of Equipment Replacement Framework*, Research Report 4941-1, University of Texas at San Antonio, San Antonio, January 2002.

33. Weissmann, José, R. Harrison, and M. Euritt. *Conversion of the Texas Department of Transportation 6- and 10- yard dump truck fleet from standard to automatic transmissions*. Research Report 979-1F, Center for Transportation Research, Bureau of Engineering Research, The University of Texas at Austin, November, 1991.

# APPENDIX

Attribute Contributions to Replacement Priority Rank

Summary Statistics by Classcode

| Classcode | Description | Data Points | Attribute | Minimum | 1st Quartile | Median | 3rd Quartile | Mean | St. Dev. | Conf.Int. | Maximum |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1010 | AERIAL PERSONNEL DEVICE, TRUCKMOUNTED, UP TO 30', INC TRUCK | 123 | Downtime | 0.6% | 12.7% | 19.5% | 26.7% | 20.2% | 9.2% | 1.6% | 41.9% |
| 1010 | AERIAL PERSONNEL DEVICE, TRUCKMOUNTED, UP TO 30', INC TRUCK | 123 | Trendscore | 21.9% | 28.8% | 34.5% | 45.2% | 40.0% | 15.5% | 2.7% | 94.3% |
| 1010 | AERIAL PERSONNEL DEVICE, TRUCKMOUNTED, UP TO 30', INC TRUCK | 123 | Usage | 0.6% | 14.2% | 20.7% | 26.2% | 20.0% | 8.9% | 1.6% | 40.2% |
| 1010 | AERIAL PERSONNEL DEVICE, TRUCKMOUNTED, UP TO 30', INC TRUCK | 123 | Repair | 0.9% | 12.6% | 21.1% | 25.8% | 19.8% | 8.5% | 1.5% | 41.0% |
| | | | Total (median) | | | 95.8% | | | | | |
| 1020 | AERIAL PERSONNEL DEVICE, TRUCKMOUNTED, 31' TO 40', INC TRUCK | 62 | Downtime | 1.7% | 13.6% | 21.1% | 27.0% | 20.3% | 9.0% | 2.2% | 38.2% |
| 1020 | AERIAL PERSONNEL DEVICE, TRUCKMOUNTED, 31' TO 40', INC TRUCK | 62 | Trendscore | 22.6% | 29.0% | 33.6% | 48.1% | 39.5% | 14.9% | 3.7% | 83.3% |
| 1020 | AERIAL PERSONNEL DEVICE, TRUCKMOUNTED, 31' TO 40', INC TRUCK | 62 | Usage | 0.9% | 14.2% | 20.5% | 26.7% | 20.5% | 9.5% | 2.4% | 41.0% |
| 1020 | AERIAL PERSONNEL DEVICE, TRUCKMOUNTED, 31' TO 40', INC TRUCK | 62 | Repair | 1.7% | 14.9% | 20.4% | 25.6% | 19.7% | 7.9% | 2.0% | 33.3% |
| | | | Total (median) | | | 95.6% | | | | | |
| 1030 | AERIAL PERSONNEL DEVICE, TRUCKMOUNTED, 41' TO 59', INC TRUCK | 27 | Downtime | 2.7% | 12.8% | 20.8% | 25.3% | 19.0% | 7.6% | 2.9% | 33.3% |
| 1030 | AERIAL PERSONNEL DEVICE, TRUCKMOUNTED, 41' TO 59', INC TRUCK | 27 | Trendscore | 25.5% | 29.9% | 37.1% | 52.0% | 43.1% | 16.5% | 6.2% | 78.8% |
| 1030 | AERIAL PERSONNEL DEVICE, TRUCKMOUNTED, 41' TO 59', INC TRUCK | 27 | Usage | 3.0% | 12.9% | 20.8% | 25.6% | 18.9% | 7.3% | 2.7% | 30.4% |
| 1030 | AERIAL PERSONNEL DEVICE, TRUCKMOUNTED, 41' TO 59', INC TRUCK | 27 | Repair | 3.0% | 14.0% | 19.4% | 24.0% | 18.9% | 7.4% | 2.8% | 33.3% |
| | | | Total (median) | | | 98.2% | | | | | |
| 1040 | AERIAL PERSONNEL DEVICE, TRUCKMOUNTED, 60' AND GREATER, INC TRUCK | 9 | Downtime | 8.3% | 12.5% | 21.4% | 26.3% | 19.8% | 8.3% | 5.4% | 32.0% |
| 1040 | AERIAL PERSONNEL DEVICE, TRUCKMOUNTED, 60' AND GREATER, INC TRUCK | 9 | Trendscore | 25.0% | 32.1% | 36.0% | 47.4% | 41.5% | 15.6% | 10.2% | 75.0% |
| 1040 | AERIAL PERSONNEL DEVICE, TRUCKMOUNTED, 60' AND GREATER, INC TRUCK | 9 | Usage | 8.3% | 16.0% | 19.2% | 25.0% | 19.4% | 6.7% | 4.4% | 27.6% |
| 1040 | AERIAL PERSONNEL DEVICE, TRUCKMOUNTED, 60' AND GREATER, INC TRUCK | 9 | Repair | 8.3% | 15.8% | 19.2% | 25.0% | 19.3% | 6.8% | 4.4% | 28.0% |
| | | | Total (median) | | | 95.9% | | | | | |
| 1050 | AERIAL PERSONNEL DEVICE, TRUCKMOUNTED, MILEAGE | 23 | Downtime | 4.2% | 13.5% | 20.0% | 25.0% | 19.6% | 7.3% | 3.0% | 33.3% |
| 1050 | AERIAL PERSONNEL DEVICE, TRUCKMOUNTED, MILEAGE | 23 | Trendscore | 25.0% | 27.7% | 35.1% | 54.1% | 41.1% | 16.5% | 6.7% | 83.3% |
| 1050 | AERIAL PERSONNEL DEVICE, TRUCKMOUNTED, MILEAGE | 23 | Usage | 2.1% | 16.1% | 22.0% | 24.0% | 19.9% | 6.9% | 2.8% | 29.2% |
| 1050 | AERIAL PERSONNEL DEVICE, TRUCKMOUNTED, MILEAGE | 23 | Repair | 4.2% | 14.6% | 20.5% | 25.0% | 19.4% | 6.6% | 2.7% | 26.8% |
| | | | Total (median) | | | 97.5% | | | | | |
| 2000 | AERIAL PERSONNEL DEVICE, TRAILER MOUNTED | 2 | Downtime | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | 0.0% | 0.0% | 25.0% |
| 2000 | AERIAL PERSONNEL DEVICE, TRAILER MOUNTED | 2 | Trendscore | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | 0.0% | 0.0% | 25.0% |
| 2000 | AERIAL PERSONNEL DEVICE, TRAILER MOUNTED | 2 | Usage | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | 0.0% | 0.0% | 25.0% |
| 2000 | AERIAL PERSONNEL DEVICE, TRAILER MOUNTED | 2 | Repair | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | 0.0% | 0.0% | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |
| 3010 | AIR COMPRESSOR, PORTABLE, UP TO 125 CFM | 54 | Downtime | 2.5% | 14.7% | 21.8% | 27.8% | 21.2% | 8.6% | 2.3% | 38.8% |
| 3010 | AIR COMPRESSOR, PORTABLE, UP TO 125 CFM | 54 | Trendscore | 19.9% | 26.0% | 30.4% | 44.7% | 36.4% | 16.1% | 4.3% | 89.5% |
| 3010 | AIR COMPRESSOR, PORTABLE, UP TO 125 CFM | 54 | Usage | 2.6% | 15.8% | 22.7% | 26.9% | 21.6% | 9.4% | 2.5% | 41.6% |
| 3010 | AIR COMPRESSOR, PORTABLE, UP TO 125 CFM | 54 | Repair | 2.6% | 15.3% | 21.1% | 27.0% | 20.8% | 7.6% | 2.0% | 34.3% |
| | | | Total (median) | | | 95.9% | | | | | |

| Classcode | Description | Data Points | Attribute | Minimum | 1st Quartile | Median | 3rd Quartile | Mean | St. Dev. | Conf.Int. | Maximum |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3020 | AIR COMPRESSOR, PORTABLE, 126 T0 199 CFM | 43 | Downtime | 3.3% | 16.5% | 21.2% | 26.7% | 21.4% | 7.6% | 2.3% | 35.3% |
| 3020 | AIR COMPRESSOR, PORTABLE, 126 T0 199 CFM | 43 | Trendscore | 19.2% | 24.5% | 30.5% | 40.3% | 35.7% | 16.4% | 4.9% | 83.3% |
| 3020 | AIR COMPRESSOR, PORTABLE, 126 T0 199 CFM | 43 | Usage | 3.2% | 15.2% | 21.8% | 26.5% | 21.6% | 8.5% | 2.5% | 41.9% |
| 3020 | AIR COMPRESSOR, PORTABLE, 126 T0 199 CFM | 43 | Repair | 2.9% | 15.4% | 22.7% | 27.1% | 21.3% | 7.3% | 2.2% | 33.6% |
| | | | Total (median) | | | 96.2% | | | | | |
| 3030 | AIR COMPRESSOR, PORTABLE, 200 TO 299 CFM | 53 | Downtime | 2.6% | 15.6% | 22.7% | 28.4% | 21.4% | 7.9% | 2.1% | 33.0% |
| 3030 | AIR COMPRESSOR, PORTABLE, 200 TO 299 CFM | 53 | Trendscore | 17.4% | 25.0% | 29.0% | 39.2% | 35.8% | 16.8% | 4.5% | 86.1% |
| 3030 | AIR COMPRESSOR, PORTABLE, 200 TO 299 CFM | 53 | Usage | 2.5% | 14.7% | 22.4% | 29.0% | 21.7% | 9.2% | 2.5% | 41.7% |
| 3030 | AIR COMPRESSOR, PORTABLE, 200 TO 299 CFM | 53 | Repair | 2.8% | 16.2% | 23.4% | 26.8% | 21.1% | 7.5% | 2.0% | 32.7% |
| | | | Total (median) | | | 97.5% | | | | | |
| 3040 | AIR COMPRESSOR, PORTABLE, 300 CFM AND GREATER | 8 | Downtime | 7.7% | 19.1% | 20.4% | 25.4% | 20.5% | 6.0% | 4.1% | 26.1% |
| 3040 | AIR COMPRESSOR, PORTABLE, 300 CFM AND GREATER | 8 | Trendscore | 22.6% | 28.9% | 32.7% | 50.3% | 38.7% | 14.4% | 10.0% | 63.6% |
| 3040 | AIR COMPRESSOR, PORTABLE, 300 CFM AND GREATER | 8 | Usage | 9.1% | 15.4% | 22.3% | 25.4% | 20.5% | 6.8% | 4.7% | 29.2% |
| 3040 | AIR COMPRESSOR, PORTABLE, 300 CFM AND GREATER | 8 | Repair | 9.1% | 17.7% | 20.4% | 25.4% | 20.3% | 5.8% | 4.0% | 26.1% |
| | | | Total (median) | | | 95.8% | | | | | |
| 3050 | AIR COMPRESSOR, TRUCK MOUNTED,200 CFM AND GREATER, INC TRUCK | 1 | Downtime | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 3050 | AIR COMPRESSOR, TRUCK MOUNTED,200 CFM AND GREATER, INC TRUCK | 1 | Trendscore | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 3050 | AIR COMPRESSOR, TRUCK MOUNTED,200 CFM AND GREATER, INC TRUCK | 1 | Usage | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 3050 | AIR COMPRESSOR, TRUCK MOUNTED,200 CFM AND GREATER, INC TRUCK | 1 | Repair | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |
| 10010 | ASPHALT BOOSTER TANK, TRAILER MOUNTED | 14 | Downtime | 5.0% | 16.2% | 23.0% | 31.0% | 22.8% | 11.2% | 5.9% | 44.4% |
| 10010 | ASPHALT BOOSTER TANK, TRAILER MOUNTED | 14 | Trendscore | 16.0% | 21.6% | 30.5% | 42.1% | 31.9% | 10.9% | 5.7% | 50.0% |
| 10010 | ASPHALT BOOSTER TANK, TRAILER MOUNTED | 14 | Usage | 4.2% | 10.5% | 27.2% | 32.1% | 23.2% | 11.4% | 6.0% | 40.0% |
| 10010 | ASPHALT BOOSTER TANK, TRAILER MOUNTED | 14 | Repair | 5.0% | 14.8% | 26.2% | 29.7% | 22.2% | 9.7% | 5.1% | 34.2% |
| | | | Total (median) | | | 106.9% | | | | | |
| 10020 | ASPHALT BOOSTER TANK, TRUCK MOUNTED, INC. TRUCK | 2 | Downtime | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | 0.0% | 0.0% | 25.0% |
| 10020 | ASPHALT BOOSTER TANK, TRUCK MOUNTED, INC. TRUCK | 2 | Trendscore | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | 0.0% | 0.0% | 25.0% |
| 10020 | ASPHALT BOOSTER TANK, TRUCK MOUNTED, INC. TRUCK | 2 | Usage | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | 0.0% | 0.0% | 25.0% |
| 10020 | ASPHALT BOOSTER TANK, TRUCK MOUNTED, INC. TRUCK | 2 | Repair | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | 0.0% | 0.0% | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |
| 11010 | ASPHALT DISTRIBUTOR, TRUCK MOUNTED, (INCLUDES TRUCK) | 16 | Downtime | 6.3% | 16.6% | 19.4% | 26.7% | 20.2% | 7.4% | 3.6% | 32.5% |
| 11010 | ASPHALT DISTRIBUTOR, TRUCK MOUNTED, (INCLUDES TRUCK) | 16 | Trendscore | 22.8% | 28.2% | 32.9% | 47.6% | 39.2% | 16.3% | 8.0% | 81.3% |
| 11010 | ASPHALT DISTRIBUTOR, TRUCK MOUNTED, (INCLUDES TRUCK) | 16 | Usage | 6.3% | 16.8% | 20.0% | 28.4% | 20.4% | 7.8% | 3.8% | 30.3% |
| 11010 | ASPHALT DISTRIBUTOR, TRUCK MOUNTED, (INCLUDES TRUCK) | 16 | Repair | 6.3% | 14.0% | 22.0% | 25.9% | 20.1% | 7.1% | 3.5% | 28.6% |
| | | | Total (median) | | | 94.4% | | | | | |
| 12010 | ASPHALT MAINTENANCE UNIT, 600 GALLON, TRAILER MOUNTED | 8 | Downtime | 6.3% | 13.4% | 23.2% | 31.7% | 22.8% | 11.5% | 8.0% | 40.0% |
| 12010 | ASPHALT MAINTENANCE UNIT, 600 GALLON, TRAILER MOUNTED | 8 | Trendscore | 20.8% | 24.5% | 30.7% | 36.6% | 30.6% | 7.3% | 5.1% | 40.0% |
| 12010 | ASPHALT MAINTENANCE UNIT, 600 GALLON, TRAILER MOUNTED | 8 | Usage | 5.0% | 12.1% | 23.0% | 38.1% | 24.4% | 14.6% | 10.1% | 43.8% |
| 12010 | ASPHALT MAINTENANCE UNIT, 600 GALLON, TRAILER MOUNTED | 8 | Repair | 7.1% | 13.8% | 23.2% | 31.7% | 22.2% | 10.0% | 6.9% | 33.3% |
| | | | Total (median) | | | 100.0% | | | | | |

| Classcode | Description | Data Points | Attribute | Minimum | 1st Quartile | Median | 3rd Quartile | Mean | St. Dev. | Conf.Int. | Maximum |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 12020 | ASPHALT MAINTENANCE UNIT, 1000GALLON, TRAILER MOUNTED | 202 | Downtime | 0.5% | 15.8% | 20.5% | 26.4% | 20.4% | 8.4% | 1.2% | 47.2% |
| 12020 | ASPHALT MAINTENANCE UNIT, 1000GALLON, TRAILER MOUNTED | 202 | Trendscore | 20.6% | 26.5% | 33.5% | 46.6% | 39.5% | 16.7% | 2.3% | 94.3% |
| 12020 | ASPHALT MAINTENANCE UNIT, 1000GALLON, TRAILER MOUNTED | 202 | Usage | 0.6% | 16.1% | 21.6% | 26.0% | 20.2% | 7.9% | 1.1% | 37.0% |
| 12020 | ASPHALT MAINTENANCE UNIT, 1000GALLON, TRAILER MOUNTED | 202 | Repair | 0.6% | 15.5% | 21.9% | 25.3% | 19.9% | 7.1% | 1.0% | 31.5% |
| | | | Total (median) | | | 97.5% | | | | | |
| 12030 | ASPHALT MAINTENANCE UNIT, TRUCK MOUNTED | 151 | Downtime | 0.7% | 13.1% | 20.9% | 24.8% | 19.0% | 7.5% | 1.2% | 34.6% |
| 12030 | ASPHALT MAINTENANCE UNIT, TRUCK MOUNTED | 151 | Trendscore | 23.9% | 29.5% | 38.3% | 52.7% | 43.2% | 17.4% | 2.8% | 96.5% |
| 12030 | ASPHALT MAINTENANCE UNIT, TRUCK MOUNTED | 151 | Usage | 0.6% | 14.0% | 21.1% | 25.1% | 19.0% | 7.6% | 1.2% | 32.3% |
| 12030 | ASPHALT MAINTENANCE UNIT, TRUCK MOUNTED | 151 | Repair | 0.6% | 14.3% | 20.4% | 24.7% | 18.8% | 7.2% | 1.2% | 29.8% |
| | | | Total (median) | | | 100.8% | | | | | |
| 12040 | ASPHALT MAINTENANCE UNIT, DUMPBODY CONTAINED | 2 | Downtime | 20.0% | 20.0% | 22.5% | 25.0% | 22.5% | 3.5% | 4.9% | 25.0% |
| 12040 | ASPHALT MAINTENANCE UNIT, DUMPBODY CONTAINED | 2 | Trendscore | 25.0% | 25.0% | 32.5% | 40.0% | 32.5% | 10.6% | 14.7% | 40.0% |
| 12040 | ASPHALT MAINTENANCE UNIT, DUMPBODY CONTAINED | 2 | Usage | 20.0% | 20.0% | 22.5% | 25.0% | 22.5% | 3.5% | 4.9% | 25.0% |
| 12040 | ASPHALT MAINTENANCE UNIT, DUMPBODY CONTAINED | 2 | Repair | 20.0% | 20.0% | 22.5% | 25.0% | 22.5% | 3.5% | 4.9% | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |
| 13010 | ASPHALT POTHOLE PATCHER, TRUCKMOUNTED | 6 | Downtime | 10.0% | 17.6% | 20.2% | 23.8% | 19.9% | 6.0% | 4.8% | 27.3% |
| 13010 | ASPHALT POTHOLE PATCHER, TRUCKMOUNTED | 6 | Trendscore | 27.3% | 28.6% | 34.3% | 54.5% | 39.8% | 13.9% | 11.1% | 60.0% |
| 13010 | ASPHALT POTHOLE PATCHER, TRUCKMOUNTED | 6 | Usage | 9.1% | 16.7% | 19.1% | 28.6% | 20.3% | 7.7% | 6.1% | 29.4% |
| 13010 | ASPHALT POTHOLE PATCHER, TRUCKMOUNTED | 6 | Repair | 10.0% | 17.6% | 18.6% | 27.3% | 20.0% | 6.7% | 5.3% | 27.8% |
| | | | Total (median) | | | 92.2% | | | | | |
| 13020 | ASPHALT POTHOLE PATCHER, TRAILER MOUNTED | 9 | Downtime | 10.0% | 18.2% | 26.7% | 27.6% | 23.3% | 6.6% | 4.3% | 30.0% |
| 13020 | ASPHALT POTHOLE PATCHER, TRAILER MOUNTED | 9 | Trendscore | 19.2% | 25.0% | 27.6% | 36.4% | 29.7% | 7.5% | 4.9% | 40.0% |
| 13020 | ASPHALT POTHOLE PATCHER, TRAILER MOUNTED | 9 | Usage | 10.0% | 18.2% | 20.7% | 30.8% | 23.9% | 9.6% | 6.3% | 40.0% |
| 13020 | ASPHALT POTHOLE PATCHER, TRAILER MOUNTED | 9 | Repair | 10.0% | 20.0% | 24.1% | 26.7% | 23.1% | 6.3% | 4.1% | 32.1% |
| | | | Total (median) | | | 99.1% | | | | | |
| 14000 | ASPHALT MELTING KETTLE (HTR.),TRAILER MOUNTED | 42 | Downtime | 2.8% | 14.0% | 20.9% | 27.2% | 20.9% | 9.2% | 2.8% | 38.2% |
| 14000 | ASPHALT MELTING KETTLE (HTR.),TRAILER MOUNTED | 42 | Trendscore | 20.0% | 26.7% | 33.7% | 40.8% | 38.2% | 16.2% | 4.9% | 86.1% |
| 14000 | ASPHALT MELTING KETTLE (HTR.),TRAILER MOUNTED | 42 | Usage | 2.3% | 13.3% | 21.4% | 26.7% | 20.7% | 8.9% | 2.7% | 36.2% |
| 14000 | ASPHALT MELTING KETTLE (HTR.),TRAILER MOUNTED | 42 | Repair | 2.8% | 15.7% | 20.4% | 25.0% | 20.2% | 8.0% | 2.4% | 35.0% |
| | | | Total (median) | | | 96.4% | | | | | |

| Classcode | Description | Data Points | Attribute | Minimum | 1st Quartile | Median | 3rd Quartile | Mean | St. Dev. | Conf.Int. | Maximum |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 16000 | ASPHALT TANK CAR HEATER- CIRCULATOR | 9 | Downtime | 11.1% | 15.8% | 22.6% | 27.6% | 22.2% | 7.4% | 4.9% | 31.3% |
| 16000 | ASPHALT TANK CAR HEATER- CIRCULATOR | 9 | Trendscore | 16.7% | 22.7% | 31.3% | 46.7% | 32.8% | 14.0% | 9.2% | 55.6% |
| 16000 | ASPHALT TANK CAR HEATER- CIRCULATOR | 9 | Usage | 10.5% | 20.0% | 23.3% | 27.6% | 22.4% | 7.5% | 4.9% | 31.3% |
| 16000 | ASPHALT TANK CAR HEATER- CIRCULATOR | 9 | Repair | 6.3% | 21.1% | 22.6% | 27.6% | 22.7% | 7.4% | 4.8% | 31.6% |
| | | | Total (median) | | | 99.7% | | | | | |
| 17000 | ASPHALT TRANSFER TANK, TRAILERMOUNTED | 2 | Downtime | 16.7% | 16.7% | 22.6% | 28.6% | 22.6% | 8.4% | 11.7% | 28.6% |
| 17000 | ASPHALT TRANSFER TANK, TRAILERMOUNTED | 2 | Trendscore | 28.6% | 28.6% | 31.0% | 33.3% | 31.0% | 3.4% | 4.7% | 33.3% |
| 17000 | ASPHALT TRANSFER TANK, TRAILERMOUNTED | 2 | Usage | 16.7% | 16.7% | 22.6% | 28.6% | 22.6% | 8.4% | 11.7% | 28.6% |
| 17000 | ASPHALT TRANSFER TANK, TRAILERMOUNTED | 2 | Repair | 14.3% | 14.3% | 23.8% | 33.3% | 23.8% | 13.5% | 18.7% | 33.3% |
| | | | Total (median) | | | 100.0% | | | | | |
| 19000 | ASPHALT INPLACE RECLAIMER, S PHYDROSTATIC, DIESEL W/LIQ ADD CAPABILITY | 25 | Downtime | 3.0% | 14.3% | 20.0% | 25.3% | 18.7% | 7.1% | 2.8% | 28.4% |
| 19000 | ASPHALT INPLACE RECLAIMER, S PHYDROSTATIC, DIESEL W/LIQ ADD CAPABILITY | 25 | Trendscore | 25.3% | 30.5% | 37.9% | 56.8% | 43.6% | 15.7% | 6.1% | 75.8% |
| 19000 | ASPHALT INPLACE RECLAIMER, S PHYDROSTATIC, DIESEL W/LIQ ADD CAPABILITY | 25 | Usage | 2.7% | 13.7% | 19.5% | 24.2% | 18.9% | 7.8% | 3.1% | 30.6% |
| 19000 | ASPHALT INPLACE RECLAIMER, S PHYDROSTATIC, DIESEL W/LIQ ADD CAPABILITY | 25 | Repair | 3.0% | 14.5% | 19.7% | 23.5% | 18.7% | 7.3% | 2.8% | 31.8% |
| | | | Total (median) | | | 97.1% | | | | | |
| 20020 | AUTOMOBILES, SEDAN, 100 THRU 112.9 IN. WHEELBASE | 314 | Downtime | 0.8% | 12.6% | 20.5% | 28.6% | 20.6% | 10.2% | 1.1% | 42.4% |
| 20020 | AUTOMOBILES, SEDAN, 100 THRU 112.9 IN. WHEELBASE | 314 | Trendscore | 22.1% | 28.3% | 33.9% | 43.6% | 39.7% | 16.2% | 1.8% | 98.4% |
| 20020 | AUTOMOBILES, SEDAN, 100 THRU 112.9 IN. WHEELBASE | 314 | Usage | 0.4% | 13.3% | 21.1% | 27.0% | 20.1% | 8.9% | 1.0% | 39.3% |
| 20020 | AUTOMOBILES, SEDAN, 100 THRU 112.9 IN. WHEELBASE | 314 | Repair | 0.4% | 13.7% | 20.6% | 26.2% | 19.7% | 8.1% | 0.9% | 38.1% |
| | | | Total (median) | | | 96.1% | | | | | |
| 20030 | AUTOMOBILES, SEDAN, 113 IN. WHEELBASE AND GREATER | 198 | Downtime | 0.6% | 13.5% | 20.7% | 27.7% | 20.9% | 10.2% | 1.4% | 44.4% |
| 20030 | AUTOMOBILES, SEDAN, 113 IN. WHEELBASE AND GREATER | 198 | Trendscore | 22.0% | 27.7% | 32.8% | 46.0% | 38.8% | 15.2% | 2.1% | 92.0% |
| 20030 | AUTOMOBILES, SEDAN, 113 IN. WHEELBASE AND GREATER | 198 | Usage | 0.5% | 14.5% | 21.1% | 26.9% | 20.3% | 8.7% | 1.2% | 38.0% |
| 20030 | AUTOMOBILES, SEDAN, 113 IN. WHEELBASE AND GREATER | 198 | Repair | 0.5% | 15.4% | 21.4% | 26.3% | 20.0% | 7.9% | 1.1% | 33.4% |
| | | | Total (median) | | | 96.0% | | | | | |
| 25010 | AUTOMOBILES, STATION WAGONS UP TO 112.9 IN. WHEELBASE | 18 | Downtime | 3.0% | 14.3% | 22.3% | 26.9% | 21.1% | 9.8% | 4.5% | 36.7% |
| 25010 | AUTOMOBILES, STATION WAGONS UP TO 112.9 IN. WHEELBASE | 18 | Trendscore | 23.0% | 28.6% | 34.7% | 40.0% | 36.0% | 9.4% | 4.4% | 58.3% |
| 25010 | AUTOMOBILES, STATION WAGONS UP TO 112.9 IN. WHEELBASE | 18 | Usage | 3.2% | 12.5% | 23.3% | 27.7% | 21.9% | 12.3% | 5.7% | 51.5% |
| 25010 | AUTOMOBILES, STATION WAGONS UP TO 112.9 IN. WHEELBASE | 18 | Repair | 3.0% | 12.5% | 20.3% | 26.2% | 21.1% | 10.0% | 4.6% | 37.5% |
| | | | Total (median) | | | 100.6% | | | | | |
| 26010 | BUS | 10 | Downtime | 5.3% | 11.5% | 20.4% | 26.5% | 20.1% | 10.1% | 6.3% | 40.0% |
| 26010 | BUS | 10 | Trendscore | 27.8% | 33.3% | 36.5% | 50.0% | 39.8% | 9.8% | 6.1% | 55.6% |
| 26010 | BUS | 10 | Usage | 5.0% | 10.3% | 21.4% | 30.8% | 20.5% | 10.1% | 6.3% | 33.3% |
| 26010 | BUS | 10 | Repair | 5.0% | 13.3% | 20.0% | 27.8% | 19.7% | 8.5% | 5.2% | 31.0% |
| | | | Total (median) | | | 98.3% | | | | | |
| 30010 | BARGE, CORE DRILL/MAINTENANCE UNIT/WORK | 1 | Downtime | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 30010 | BARGE, CORE DRILL/MAINTENANCE UNIT/WORK | 1 | Trendscore | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 30010 | BARGE, CORE DRILL/MAINTENANCE UNIT/WORK | 1 | Usage | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 30010 | BARGE, CORE DRILL/MAINTENANCE UNIT/WORK | 1 | Repair | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |

| Classcode | Description | Data Points | Attribute | Minimum | 1st Quartile | Median | 3rd Quartile | Mean | St. Dev. | Conf.Int. | Maximum |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 30020 | BARGE, WORK, WITH CRANE AND PILE DRIVER | 1 | Downtime | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 30020 | BARGE, WORK, WITH CRANE AND PILE DRIVER | 1 | Trendscore | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 30020 | BARGE, WORK, WITH CRANE AND PILE DRIVER | 1 | Usage | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 30020 | BARGE, WORK, WITH CRANE AND PILE DRIVER | 1 | Repair | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |
| 34000 | CHIPPER, BRUSH | 29 | Downtime | 2.9% | 15.6% | 22.2% | 25.2% | 20.9% | 7.8% | 2.9% | 37.0% |
| 34000 | CHIPPER, BRUSH | 29 | Trendscore | 20.6% | 26.7% | 33.3% | 39.2% | 36.9% | 14.1% | 5.1% | 71.4% |
| 34000 | CHIPPER, BRUSH | 29 | Usage | 3.6% | 16.1% | 23.2% | 27.8% | 21.4% | 8.8% | 3.2% | 37.8% |
| 34000 | CHIPPER, BRUSH | 29 | Repair | 2.2% | 17.0% | 23.4% | 26.0% | 20.8% | 6.8% | 2.5% | 29.2% |
| | | | Total (median) | | | 102.2% | | | | | |
| 35000 | CHIPPER, TREE, PORTABLE WITH HYDRAULIC GRAPPLE ARM FEEDER | 1 | Downtime | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 35000 | CHIPPER, TREE, PORTABLE WITH HYDRAULIC GRAPPLE ARM FEEDER | 1 | Trendscore | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 35000 | CHIPPER, TREE, PORTABLE WITH HYDRAULIC GRAPPLE ARM FEEDER | 1 | Usage | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 35000 | CHIPPER, TREE, PORTABLE WITH HYDRAULIC GRAPPLE ARM FEEDER | 1 | Repair | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |
| 36000 | CLEANING UNIT, HIGH PRESSURE WATER TYPE, 10000 PSI MINIMUM | 6 | Downtime | 7.7% | 14.3% | 25.5% | 28.6% | 21.9% | 8.9% | 7.1% | 30.0% |
| 36000 | CLEANING UNIT, HIGH PRESSURE WATER TYPE, 10000 PSI MINIMUM | 6 | Trendscore | 21.7% | 30.0% | 35.7% | 38.5% | 35.3% | 9.4% | 7.5% | 50.0% |
| 36000 | CLEANING UNIT, HIGH PRESSURE WATER TYPE, 10000 PSI MINIMUM | 6 | Usage | 10.0% | 14.3% | 20.7% | 26.1% | 21.7% | 10.0% | 8.0% | 38.5% |
| 36000 | CLEANING UNIT, HIGH PRESSURE WATER TYPE, 10000 PSI MINIMUM | 6 | Repair | 10.0% | 15.4% | 23.2% | 26.1% | 21.1% | 7.1% | 5.7% | 28.6% |
| | | | Total (median) | | | 105.2% | | | | | |
| 40020 | CORE DRILL, FOUNDATION, MAX. DEPTH 2000 FT., TRUCK MOUNTED | 3 | Downtime | 14.3% | 14.3% | 25.0% | 25.0% | 21.4% | 6.2% | 7.0% | 25.0% |
| 40020 | CORE DRILL, FOUNDATION, MAX. DEPTH 2000 FT., TRUCK MOUNTED | 3 | Trendscore | 25.0% | 25.0% | 37.5% | 42.9% | 35.1% | 9.2% | 10.4% | 42.9% |
| 40020 | CORE DRILL, FOUNDATION, MAX. DEPTH 2000 FT., TRUCK MOUNTED | 3 | Usage | 14.3% | 14.3% | 25.0% | 25.0% | 21.4% | 6.2% | 7.0% | 25.0% |
| 40020 | CORE DRILL, FOUNDATION, MAX. DEPTH 2000 FT., TRUCK MOUNTED | 3 | Repair | 12.5% | 12.5% | 25.0% | 28.6% | 22.0% | 8.4% | 9.5% | 28.6% |
| | | | Total (median) | | | 112.5% | | | | | |
| 42000 | CORE DRILL, PAVEMENT/CONCRETE SPECIMEN, TRUCK MOUNTED | 5 | Downtime | 16.7% | 25.0% | 25.0% | 25.0% | 24.0% | 4.4% | 3.9% | 28.6% |
| 42000 | CORE DRILL, PAVEMENT/CONCRETE SPECIMEN, TRUCK MOUNTED | 5 | Trendscore | 25.0% | 25.0% | 25.0% | 28.6% | 27.4% | 3.7% | 3.2% | 33.3% |
| 42000 | CORE DRILL, PAVEMENT/CONCRETE SPECIMEN, TRUCK MOUNTED | 5 | Usage | 16.7% | 25.0% | 25.0% | 25.0% | 24.0% | 4.4% | 3.9% | 28.6% |
| 42000 | CORE DRILL, PAVEMENT/CONCRETE SPECIMEN, TRUCK MOUNTED | 5 | Repair | 14.3% | 25.0% | 25.0% | 25.0% | 24.5% | 6.8% | 5.9% | 33.3% |
| | | | Total (median) | | | 100.0% | | | | | |
| 44000 | EARTH BORING MACHINE, TRUCK MOUNTED (INCLUDES TRUCK) | 13 | Downtime | 8.3% | 15.0% | 20.5% | 27.1% | 21.3% | 8.4% | 4.5% | 35.7% |
| 44000 | EARTH BORING MACHINE, TRUCK MOUNTED (INCLUDES TRUCK) | 13 | Trendscore | 21.4% | 27.1% | 30.0% | 33.3% | 36.0% | 15.9% | 8.6% | 75.0% |
| 44000 | EARTH BORING MACHINE, TRUCK MOUNTED (INCLUDES TRUCK) | 13 | Usage | 7.1% | 18.4% | 22.2% | 26.2% | 21.7% | 9.2% | 5.0% | 40.6% |
| 44000 | EARTH BORING MACHINE, TRUCK MOUNTED (INCLUDES TRUCK) | 13 | Repair | 8.3% | 16.7% | 25.0% | 26.5% | 21.0% | 7.2% | 3.9% | 29.6% |
| | | | Total (median) | | | 97.7% | | | | | |
| 50000 | CRANE,BRIDGE INSPECTION/MAINT TRUCK MOUNTED (INCLUDES TRUCK) | 9 | Downtime | 8.3% | 12.5% | 23.3% | 26.1% | 20.5% | 8.0% | 5.2% | 31.3% |
| 50000 | CRANE,BRIDGE INSPECTION/MAINT TRUCK MOUNTED (INCLUDES TRUCK) | 9 | Trendscore | 22.9% | 30.0% | 34.8% | 50.0% | 39.0% | 14.0% | 9.1% | 66.7% |
| 50000 | CRANE,BRIDGE INSPECTION/MAINT TRUCK MOUNTED (INCLUDES TRUCK) | 9 | Usage | 6.3% | 18.8% | 21.7% | 24.0% | 20.2% | 6.2% | 4.1% | 26.7% |
| 50000 | CRANE,BRIDGE INSPECTION/MAINT TRUCK MOUNTED (INCLUDES TRUCK) | 9 | Repair | 8.3% | 17.4% | 20.0% | 23.8% | 20.2% | 7.1% | 4.6% | 32.0% |
| | | | Total (median) | | | 99.9% | | | | | |

| Classcode | Description | Data Points | Attribute | Minimum | 1st Quartile | Median | 3rd Quartile | Mean | St. Dev. | Conf.Int. | Maximum |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50010 | CRANE,BRIDGE INSPECTION/MAINT TRAILER MOUNTED | 1 | Downtime | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 50010 | CRANE,BRIDGE INSPECTION/MAINT TRAILER MOUNTED | 1 | Trendscore | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 50010 | CRANE,BRIDGE INSPECTION/MAINT TRAILER MOUNTED | 1 | Usage | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 50010 | CRANE,BRIDGE INSPECTION/MAINT TRAILER MOUNTED | 1 | Repair | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |
| 52010 | CRANE, CARRIER MOUNTED, CABLE CONTROL | 11 | Downtime | 6.7% | 14.3% | 18.2% | 25.0% | 19.2% | 6.7% | 3.9% | 28.9% |
| 52010 | CRANE, CARRIER MOUNTED, CABLE CONTROL | 11 | Trendscore | 25.6% | 28.9% | 37.9% | 52.4% | 42.6% | 16.4% | 9.7% | 73.3% |
| 52010 | CRANE, CARRIER MOUNTED, CABLE CONTROL | 11 | Usage | 6.3% | 14.3% | 19.4% | 25.6% | 19.1% | 6.3% | 3.7% | 27.3% |
| 52010 | CRANE, CARRIER MOUNTED, CABLE CONTROL | 11 | Repair | 6.7% | 13.6% | 21.1% | 25.0% | 19.1% | 6.1% | 3.6% | 26.3% |
| | | | Total (median) | | | 96.6% | | | | | |
| 52020 | CRANE, CRAWLER TYPE, CABLE CONTROL | 3 | Downtime | 18.2% | 18.2% | 20.0% | 33.3% | 23.8% | 8.3% | 9.4% | 33.3% |
| 52020 | CRANE, CRAWLER TYPE, CABLE CONTROL | 3 | Trendscore | 22.2% | 22.2% | 27.3% | 40.0% | 29.8% | 9.2% | 10.4% | 40.0% |
| 52020 | CRANE, CRAWLER TYPE, CABLE CONTROL | 3 | Usage | 20.0% | 20.0% | 22.2% | 27.3% | 23.2% | 3.7% | 4.2% | 27.3% |
| 52020 | CRANE, CRAWLER TYPE, CABLE CONTROL | 3 | Repair | 20.0% | 20.0% | 22.2% | 27.3% | 23.2% | 3.7% | 4.2% | 27.3% |
| | | | Total (median) | | | 91.7% | | | | | |
| 54000 | CRANE, TELESCOPING BOOM, TRUCKMOUNTED (INCLUDES TRUCK) | 35 | Downtime | 2.3% | 13.6% | 18.5% | 25.8% | 18.8% | 8.4% | 2.8% | 34.9% |
| 54000 | CRANE, TELESCOPING BOOM, TRUCKMOUNTED (INCLUDES TRUCK) | 35 | Trendscore | 26.3% | 30.4% | 40.7% | 53.0% | 43.6% | 15.6% | 5.2% | 89.7% |
| 54000 | CRANE, TELESCOPING BOOM, TRUCKMOUNTED (INCLUDES TRUCK) | 35 | Usage | 2.6% | 13.6% | 19.2% | 25.0% | 18.8% | 7.9% | 2.6% | 32.0% |
| 54000 | CRANE, TELESCOPING BOOM, TRUCKMOUNTED (INCLUDES TRUCK) | 35 | Repair | 2.6% | 13.6% | 20.0% | 25.0% | 18.8% | 7.9% | 2.6% | 32.3% |
| | | | Total (median) | | | 98.4% | | | | | |
| 56000 | CRANE, YARD/INDUSTRIAL, SELF PROPELLED | 20 | Downtime | 2.7% | 15.0% | 20.1% | 27.3% | 20.7% | 9.0% | 3.9% | 39.5% |
| 56000 | CRANE, YARD/INDUSTRIAL, SELF PROPELLED | 20 | Trendscore | 22.5% | 28.9% | 32.3% | 48.3% | 37.9% | 12.7% | 5.6% | 66.7% |
| 56000 | CRANE, YARD/INDUSTRIAL, SELF PROPELLED | 20 | Usage | 4.2% | 13.9% | 22.1% | 27.0% | 20.9% | 9.6% | 4.2% | 43.2% |
| 56000 | CRANE, YARD/INDUSTRIAL, SELF PROPELLED | 20 | Repair | 3.4% | 17.4% | 20.4% | 26.1% | 20.4% | 8.2% | 3.6% | 36.0% |
| | | | Total (median) | | | 95.0% | | | | | |
| 64000 | DYNAMIC DEFLECTION SYSTEM, TRAILER MOUNTED | 16 | Downtime | 5.6% | 14.7% | 20.9% | 24.7% | 19.3% | 7.3% | 3.6% | 30.8% |
| 64000 | DYNAMIC DEFLECTION SYSTEM, TRAILER MOUNTED | 16 | Trendscore | 25.4% | 29.3% | 39.0% | 46.9% | 41.7% | 16.4% | 8.0% | 83.3% |
| 64000 | DYNAMIC DEFLECTION SYSTEM, TRAILER MOUNTED | 16 | Usage | 5.6% | 12.7% | 21.2% | 25.5% | 19.4% | 7.4% | 3.6% | 29.5% |
| 64000 | DYNAMIC DEFLECTION SYSTEM, TRAILER MOUNTED | 16 | Repair | 5.6% | 12.5% | 19.4% | 25.2% | 19.5% | 7.9% | 3.9% | 32.3% |
| | | | Total (median) | | | 100.6% | | | | | |
| 66010 | EPOXY DISPENSING MACHINE, SKIDMOUNTED | 3 | Downtime | 20.0% | 20.0% | 22.2% | 27.3% | 23.2% | 3.7% | 4.2% | 27.3% |
| 66010 | EPOXY DISPENSING MACHINE, SKIDMOUNTED | 3 | Trendscore | 18.2% | 18.2% | 33.3% | 40.0% | 30.5% | 11.2% | 12.7% | 40.0% |
| 66010 | EPOXY DISPENSING MACHINE, SKIDMOUNTED | 3 | Usage | 20.0% | 20.0% | 22.2% | 27.3% | 23.2% | 3.7% | 4.2% | 27.3% |
| 66010 | EPOXY DISPENSING MACHINE, SKIDMOUNTED | 3 | Repair | 20.0% | 20.0% | 22.2% | 27.3% | 23.2% | 3.7% | 4.2% | 27.3% |
| | | | Total (median) | | | 100.0% | | | | | |
| 66020 | EPOXY DISPENSING MACHINE- BITUMINOUS TYPE MARKER APPLIC.TRLR MTD | 6 | Downtime | 7.1% | 22.2% | 22.6% | 23.8% | 21.7% | 8.0% | 6.4% | 31.6% |
| 66020 | EPOXY DISPENSING MACHINE- BITUMINOUS TYPE MARKER APPLIC.TRLR MTD | 6 | Trendscore | 23.8% | 26.3% | 31.7% | 46.2% | 35.9% | 12.6% | 10.1% | 55.6% |
| 66020 | EPOXY DISPENSING MACHINE- BITUMINOUS TYPE MARKER APPLIC.TRLR MTD | 6 | Usage | 11.1% | 15.4% | 18.9% | 28.6% | 21.4% | 9.2% | 7.3% | 35.7% |
| 66020 | EPOXY DISPENSING MACHINE- BITUMINOUS TYPE MARKER APPLIC.TRLR MTD | 6 | Repair | 11.1% | 15.4% | 21.2% | 23.8% | 21.0% | 7.6% | 6.1% | 33.3% |
| | | | Total (median) | | | 94.5% | | | | | |

| Classcode | Description | Data Points | Attribute | Minimum | 1st Quartile | Median | 3rd Quartile | Mean | St. Dev. | Conf.Int. | Maximum |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 70010 | EXCAVATOR, HINGED OR TELESCOP-ING BOOM, CRAWLER TYPE | 10 | Downtime | 9.1% | 14.3% | 23.5% | 26.9% | 20.9% | 8.2% | 5.1% | 30.8% |
| 70010 | EXCAVATOR, HINGED OR TELESCOP-ING BOOM, CRAWLER TYPE | 10 | Trendscore | 25.6% | 28.6% | 31.4% | 40.0% | 36.8% | 13.8% | 8.5% | 72.7% |
| 70010 | EXCAVATOR, HINGED OR TELESCOP-ING BOOM, CRAWLER TYPE | 10 | Usage | 9.1% | 12.0% | 19.2% | 32.1% | 21.6% | 10.8% | 6.7% | 40.0% |
| 70010 | EXCAVATOR, HINGED OR TELESCOP-ING BOOM, CRAWLER TYPE | 10 | Repair | 9.1% | 14.3% | 22.1% | 25.6% | 20.7% | 7.5% | 4.7% | 32.0% |
| | | | Total (median) | | | 96.2% | | | | | |
| 70020 | EXCAVATOR, HINGED BOOM, PNEUMATIC TIRED CARRIER | 2 | Downtime | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | 0.0% | 0.0% | 25.0% |
| 70020 | EXCAVATOR, HINGED BOOM, PNEUMATIC TIRED CARRIER | 2 | Trendscore | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | 0.0% | 0.0% | 25.0% |
| 70020 | EXCAVATOR, HINGED BOOM, PNEUMATIC TIRED CARRIER | 2 | Usage | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | 0.0% | 0.0% | 25.0% |
| 70020 | EXCAVATOR, HINGED BOOM, PNEUMATIC TIRED CARRIER | 2 | Repair | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | 0.0% | 0.0% | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |
| 75010 | EXCAVATOR, TELESCOPING BOOM, CARRIER MOUNTED, CLASS I | 48 | Downtime | 3.7% | 14.8% | 19.6% | 24.1% | 18.7% | 6.7% | 1.9% | 30.2% |
| 75010 | EXCAVATOR, TELESCOPING BOOM, CARRIER MOUNTED, CLASS I | 48 | Trendscore | 24.7% | 29.4% | 38.4% | 52.7% | 44.2% | 18.0% | 5.1% | 90.2% |
| 75010 | EXCAVATOR, TELESCOPING BOOM, CARRIER MOUNTED, CLASS I | 48 | Usage | 1.8% | 13.1% | 21.1% | 23.2% | 18.6% | 6.8% | 1.9% | 27.8% |
| 75010 | EXCAVATOR, TELESCOPING BOOM, CARRIER MOUNTED, CLASS I | 48 | Repair | 2.0% | 14.7% | 20.2% | 23.5% | 18.5% | 6.5% | 1.8% | 26.1% |
| | | | Total (median) | | | 99.2% | | | | | |
| 75020 | EXCAVATOR, TELESCOPING BOOM, CARRIER MOUNTED, CLASS II | 33 | Downtime | 2.3% | 14.5% | 21.8% | 24.6% | 19.6% | 7.3% | 2.5% | 33.3% |
| 75020 | EXCAVATOR, TELESCOPING BOOM, CARRIER MOUNTED, CLASS II | 33 | Trendscore | 22.8% | 28.4% | 38.7% | 46.8% | 41.7% | 16.4% | 5.6% | 82.9% |
| 75020 | EXCAVATOR, TELESCOPING BOOM, CARRIER MOUNTED, CLASS II | 33 | Usage | 2.9% | 15.0% | 21.3% | 24.7% | 19.4% | 7.1% | 2.4% | 29.0% |
| 75020 | EXCAVATOR, TELESCOPING BOOM, CARRIER MOUNTED, CLASS II | 33 | Repair | 2.9% | 16.7% | 22.1% | 25.0% | 19.3% | 6.8% | 2.3% | 28.6% |
| | | | Total (median) | | | 103.9% | | | | | |
| 75030 | EXCAVATOR, TELESCOPING BOOM, CARRIER MOUNTED, CLASS III | 23 | Downtime | 3.2% | 14.9% | 20.8% | 23.2% | 18.7% | 6.8% | 2.8% | 29.3% |
| 75030 | EXCAVATOR, TELESCOPING BOOM, CARRIER MOUNTED, CLASS III | 23 | Trendscore | 25.8% | 29.5% | 41.1% | 53.5% | 43.9% | 16.4% | 6.7% | 76.7% |
| 75030 | EXCAVATOR, TELESCOPING BOOM, CARRIER MOUNTED, CLASS III | 23 | Usage | 3.2% | 14.0% | 18.9% | 24.4% | 18.8% | 7.2% | 2.9% | 30.4% |
| 75030 | EXCAVATOR, TELESCOPING BOOM, CARRIER MOUNTED, CLASS III | 23 | Repair | 3.3% | 16.1% | 20.6% | 24.4% | 18.6% | 6.7% | 2.7% | 27.1% |
| | | | Total (median) | | | 101.3% | | | | | |
| 78010 | FERRY, 20 CAR | 5 | Downtime | 16.7% | 18.8% | 22.2% | 25.0% | 22.8% | 5.7% | 5.0% | 31.3% |
| 78010 | FERRY, 20 CAR | 5 | Trendscore | 18.8% | 25.0% | 31.3% | 33.3% | 31.7% | 11.7% | 10.3% | 50.0% |
| 78010 | FERRY, 20 CAR | 5 | Usage | 16.7% | 18.8% | 22.2% | 25.0% | 22.8% | 5.7% | 5.0% | 31.3% |
| 78010 | FERRY, 20 CAR | 5 | Repair | 16.7% | 18.8% | 22.2% | 25.0% | 22.8% | 5.7% | 5.0% | 31.3% |
| | | | Total (median) | | | 97.9% | | | | | |
| 78020 | FERRY, 21 CAR AND GREATER | 5 | Downtime | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | 0.0% | 0.0% | 25.0% |
| 78020 | FERRY, 21 CAR AND GREATER | 5 | Trendscore | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | 0.0% | 0.0% | 25.0% |
| 78020 | FERRY, 21 CAR AND GREATER | 5 | Usage | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | 0.0% | 0.0% | 25.0% |
| 78020 | FERRY, 21 CAR AND GREATER | 5 | Repair | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | 0.0% | 0.0% | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |
| 80000 | FORKLIFT, ELECTRIC | 34 | Downtime | 5.7% | 10.3% | 19.7% | 29.0% | 20.0% | 8.9% | 3.0% | 35.7% |
| 80000 | FORKLIFT, ELECTRIC | 34 | Trendscore | 26.4% | 31.7% | 39.3% | 45.7% | 40.7% | 12.4% | 4.2% | 76.2% |
| 80000 | FORKLIFT, ELECTRIC | 34 | Usage | 1.7% | 11.1% | 19.1% | 25.6% | 19.7% | 10.1% | 3.4% | 44.3% |
| 80000 | FORKLIFT, ELECTRIC | 34 | Repair | 4.3% | 11.3% | 21.4% | 26.4% | 19.6% | 8.6% | 2.9% | 32.6% |
| | | | Total (median) | | | 99.4% | | | | | |

| Classcode | Description | Data Points | Attribute | Minimum | 1st Quartile | Median | 3rd Quartile | Mean | St. Dev. | Conf.Int. | Maximum |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 85010 | FORKLIFT, ENGINE DRIVEN, UP TO3999 LB. OPERATING CAPACITY | 6 | Downtime | 10.0% | 18.8% | 24.3% | 25.0% | 22.3% | 7.3% | 5.8% | 31.6% |
| 85010 | FORKLIFT, ENGINE DRIVEN, UP TO3999 LB. OPERATING CAPACITY | 6 | Trendscore | 20.0% | 25.0% | 30.5% | 40.0% | 32.7% | 10.8% | 8.7% | 50.0% |
| 85010 | FORKLIFT, ENGINE DRIVEN, UP TO3999 LB. OPERATING CAPACITY | 6 | Usage | 10.5% | 12.5% | 24.3% | 30.0% | 23.2% | 10.3% | 8.2% | 37.5% |
| 85010 | FORKLIFT, ENGINE DRIVEN, UP TO3999 LB. OPERATING CAPACITY | 6 | Repair | 12.5% | 18.8% | 21.8% | 26.3% | 21.8% | 6.2% | 4.9% | 30.0% |
| | | | Total (median) | | | 100.8% | | | | | |
| 85020 | FORKLIFT, ENGINE DRIVEN, 4000 LB. AND OVER OPERATING CAP. | 235 | Downtime | 3.2% | 13.9% | 21.7% | 25.1% | 19.4% | 7.7% | 1.0% | 34.8% |
| 85020 | FORKLIFT, ENGINE DRIVEN, 4000 LB. AND OVER OPERATING CAP. | 235 | Trendscore | 23.6% | 29.0% | 38.8% | 50.6% | 42.0% | 15.6% | 2.0% | 92.9% |
| 85020 | FORKLIFT, ENGINE DRIVEN, 4000 LB. AND OVER OPERATING CAP. | 235 | Usage | 0.2% | 13.6% | 20.4% | 25.3% | 19.3% | 8.3% | 1.1% | 43.4% |
| 85020 | FORKLIFT, ENGINE DRIVEN, 4000 LB. AND OVER OPERATING CAP. | 235 | Repair | 0.4% | 14.8% | 22.1% | 25.1% | 19.2% | 7.5% | 1.0% | 31.3% |
| | | | Total (median) | | | 103.0% | | | | | |
| 86000 | FORK LIFT, ROUGH TERRAIN | 24 | Downtime | 2.6% | 13.4% | 21.9% | 25.3% | 19.5% | 8.0% | 3.2% | 32.6% |
| 86000 | FORK LIFT, ROUGH TERRAIN | 24 | Trendscore | 24.2% | 29.2% | 37.2% | 47.3% | 41.2% | 15.1% | 6.0% | 78.6% |
| 86000 | FORK LIFT, ROUGH TERRAIN | 24 | Usage | 3.0% | 11.8% | 21.3% | 27.1% | 20.0% | 9.2% | 3.7% | 35.9% |
| 86000 | FORK LIFT, ROUGH TERRAIN | 24 | Repair | 3.6% | 13.4% | 19.5% | 26.3% | 19.3% | 7.7% | 3.1% | 29.1% |
| | | | Total (median) | | | 99.9% | | | | | |
| 88000 | GENERATOR, 100 KW AND GREATER | 2 | Downtime | 16.7% | 16.7% | 22.6% | 28.6% | 22.6% | 8.4% | 11.7% | 28.6% |
| 88000 | GENERATOR, 100 KW AND GREATER | 2 | Trendscore | 28.6% | 28.6% | 31.0% | 33.3% | 31.0% | 3.4% | 4.7% | 33.3% |
| 88000 | GENERATOR, 100 KW AND GREATER | 2 | Usage | 16.7% | 16.7% | 22.6% | 28.6% | 22.6% | 8.4% | 11.7% | 28.6% |
| 88000 | GENERATOR, 100 KW AND GREATER | 2 | Repair | 14.3% | 14.3% | 23.8% | 33.3% | 23.8% | 13.5% | 18.7% | 33.3% |
| | | | Total (median) | | | 100.0% | | | | | |
| 90010 | GRADER, MOTOR, CLASS I, UP TO 79 H.P. | 33 | Downtime | 2.6% | 12.5% | 21.1% | 24.7% | 18.7% | 7.6% | 2.6% | 28.9% |
| 90010 | GRADER, MOTOR, CLASS I, UP TO 79 H.P. | 33 | Trendscore | 26.0% | 31.4% | 39.8% | 53.2% | 44.2% | 16.9% | 5.8% | 86.8% |
| 90010 | GRADER, MOTOR, CLASS I, UP TO 79 H.P. | 33 | Usage | 2.3% | 13.3% | 20.6% | 23.2% | 18.6% | 7.3% | 2.5% | 31.8% |
| 90010 | GRADER, MOTOR, CLASS I, UP TO 79 H.P. | 33 | Repair | 2.6% | 13.3% | 19.3% | 25.2% | 18.5% | 7.1% | 2.4% | 27.7% |
| | | | Total (median) | | | 100.7% | | | | | |
| 90020 | GRADER, MOTOR, CLASS II, 80 TO124 H.P. | 120 | Downtime | 0.9% | 14.6% | 22.2% | 25.3% | 19.7% | 7.7% | 1.4% | 32.1% |
| 90020 | GRADER, MOTOR, CLASS II, 80 TO124 H.P. | 120 | Trendscore | 22.1% | 28.0% | 37.5% | 49.1% | 41.2% | 16.7% | 3.0% | 90.9% |
| 90020 | GRADER, MOTOR, CLASS II, 80 TO124 H.P. | 120 | Usage | 0.8% | 13.5% | 21.7% | 25.8% | 19.6% | 7.8% | 1.4% | 36.9% |
| 90020 | GRADER, MOTOR, CLASS II, 80 TO124 H.P. | 120 | Repair | 0.9% | 15.3% | 21.5% | 25.3% | 19.4% | 7.2% | 1.3% | 29.5% |
| | | | Total (median) | | | 102.8% | | | | | |
| 90030 | GRADER, MOTOR, CLASS III, 125 TO 149 H.P. | 182 | Downtime | 1.1% | 13.9% | 21.0% | 24.4% | 19.0% | 7.4% | 1.1% | 32.6% |
| 90030 | GRADER, MOTOR, CLASS III, 125 TO 149 H.P. | 182 | Trendscore | 23.6% | 28.3% | 38.4% | 52.4% | 43.1% | 17.5% | 2.5% | 92.7% |
| 90030 | GRADER, MOTOR, CLASS III, 125 TO 149 H.P. | 182 | Usage | 0.5% | 13.9% | 20.7% | 24.8% | 19.0% | 7.2% | 1.1% | 36.1% |
| 90030 | GRADER, MOTOR, CLASS III, 125 TO 149 H.P. | 182 | Repair | 0.5% | 13.8% | 21.1% | 24.3% | 18.8% | 6.9% | 1.0% | 27.1% |
| | | | Total (median) | | | 101.2% | | | | | |

| Classcode | Description | Data Points | Attribute | Minimum | 1st Quartile | Median | 3rd Quartile | Mean | St. Dev. | Conf.Int. | Maximum |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 90040 | GRADER, MOTOR, CLASS IV, 150 H.P. AND GREATER | 155 | Downtime | 0.6% | 13.0% | 19.6% | 24.6% | 18.8% | 7.6% | 1.2% | 35.4% |
| 90040 | GRADER, MOTOR, CLASS IV, 150 H.P. AND GREATER | 155 | Trendscore | 24.0% | 29.8% | 37.4% | 53.9% | 43.7% | 17.6% | 2.8% | 91.2% |
| 90040 | GRADER, MOTOR, CLASS IV, 150 H.P. AND GREATER | 155 | Usage | 0.6% | 13.2% | 18.9% | 24.8% | 18.8% | 7.9% | 1.2% | 38.5% |
| 90040 | GRADER, MOTOR, CLASS IV, 150 H.P. AND GREATER | 155 | Repair | 0.6% | 13.1% | 20.4% | 24.7% | 18.6% | 7.2% | 1.1% | 29.3% |
| | | | Total (median) | | | 96.3% | | | | | |
| 100000 | GUARDRAIL STRAIGHTENING MACHINE | 1 | Downtime | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 100000 | GUARDRAIL STRAIGHTENING MACHINE | 1 | Trendscore | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 100000 | GUARDRAIL STRAIGHTENING MACHINE | 1 | Usage | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 100000 | GUARDRAIL STRAIGHTENING MACHINE | 1 | Repair | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |
| 102000 | HYDROSEEDER, SKID MOUNTED, SELF POWERED | 2 | Downtime | 16.7% | 16.7% | 25.0% | 33.3% | 25.0% | 11.8% | 16.3% | 33.3% |
| 102000 | HYDROSEEDER, SKID MOUNTED, SELF POWERED | 2 | Trendscore | 16.7% | 16.7% | 25.0% | 33.3% | 25.0% | 11.8% | 16.3% | 33.3% |
| 102000 | HYDROSEEDER, SKID MOUNTED, SELF POWERED | 2 | Usage | 16.7% | 16.7% | 25.0% | 33.3% | 25.0% | 11.8% | 16.3% | 33.3% |
| 102000 | HYDROSEEDER, SKID MOUNTED, SELF POWERED | 2 | Repair | 16.7% | 16.7% | 25.0% | 33.3% | 25.0% | 11.8% | 16.3% | 33.3% |
| | | | Total (median) | | | 100.0% | | | | | |
| 102010 | NO TILL DRILL SEEDER | 12 | Downtime | 5.0% | 15.6% | 23.3% | 25.0% | 20.7% | 8.2% | 4.6% | 34.3% |
| 102010 | NO TILL DRILL SEEDER | 12 | Trendscore | 24.4% | 27.8% | 30.6% | 50.0% | 38.0% | 12.5% | 7.1% | 55.6% |
| 102010 | NO TILL DRILL SEEDER | 12 | Usage | 11.1% | 14.6% | 21.7% | 26.4% | 21.1% | 7.3% | 4.2% | 32.4% |
| 102010 | NO TILL DRILL SEEDER | 12 | Repair | 5.6% | 16.9% | 21.4% | 25.5% | 20.2% | 6.9% | 3.9% | 27.8% |
| | | | Total (median) | | | 97.1% | | | | | |
| 110010 | LOADER, CRAWLER, UP TO 1.9 CU.YD. CAPACITY | 36 | Downtime | 3.2% | 15.9% | 21.6% | 24.6% | 20.3% | 7.4% | 2.4% | 34.7% |
| 110010 | LOADER, CRAWLER, UP TO 1.9 CU.YD. CAPACITY | 36 | Trendscore | 20.9% | 28.4% | 33.8% | 47.8% | 39.2% | 17.1% | 5.6% | 87.1% |
| 110010 | LOADER, CRAWLER, UP TO 1.9 CU.YD. CAPACITY | 36 | Usage | 3.0% | 15.3% | 21.4% | 27.1% | 20.3% | 7.6% | 2.5% | 35.2% |
| 110010 | LOADER, CRAWLER, UP TO 1.9 CU.YD. CAPACITY | 36 | Repair | 3.2% | 15.0% | 22.0% | 24.7% | 20.1% | 6.9% | 2.2% | 28.6% |
| | | | Total (median) | | | 98.8% | | | | | |
| 110020 | LOADER, CRAWLER, 2 CU. YD. CAPACITY AND GREATER | 60 | Downtime | 1.5% | 13.4% | 20.7% | 24.5% | 18.8% | 7.5% | 1.9% | 32.6% |
| 110020 | LOADER, CRAWLER, 2 CU. YD. CAPACITY AND GREATER | 60 | Trendscore | 24.2% | 30.6% | 39.3% | 52.8% | 43.7% | 17.2% | 4.4% | 87.7% |
| 110020 | LOADER, CRAWLER, 2 CU. YD. CAPACITY AND GREATER | 60 | Usage | 1.5% | 14.9% | 21.3% | 24.6% | 18.9% | 7.3% | 1.9% | 29.9% |
| 110020 | LOADER, CRAWLER, 2 CU. YD. CAPACITY AND GREATER | 60 | Repair | 1.5% | 14.5% | 20.6% | 24.1% | 18.6% | 6.8% | 1.7% | 27.3% |
| | | | Total (median) | | | 102.0% | | | | | |
| 115000 | LOADER, PNEUMATIC TIRED, UP TO3000 LB. OPS. CAP (UNDER 1 CU.YD.) | 41 | Downtime | 1.6% | 13.6% | 20.0% | 25.0% | 19.6% | 9.4% | 2.9% | 43.9% |
| 115000 | LOADER, PNEUMATIC TIRED, UP TO3000 LB. OPS. CAP (UNDER 1 CU.YD.) | 41 | Trendscore | 24.8% | 30.4% | 39.6% | 49.4% | 41.6% | 14.4% | 4.4% | 88.4% |
| 115000 | LOADER, PNEUMATIC TIRED, UP TO3000 LB. OPS. CAP (UNDER 1 CU.YD.) | 41 | Usage | 1.6% | 13.4% | 21.1% | 25.4% | 19.2% | 7.8% | 2.4% | 30.9% |
| 115000 | LOADER, PNEUMATIC TIRED, UP TO3000 LB. OPS. CAP (UNDER 1 CU.YD.) | 41 | Repair | 2.3% | 11.0% | 22.8% | 24.8% | 19.6% | 8.7% | 2.7% | 34.4% |
| | | | Total (median) | | | 103.4% | | | | | |
| 115010 | LOADER, PNEUMATIC TIRED, INTE-GRAL UNIT, MAX 5199 LB. OPS. CAPACITY | 90 | Downtime | 1.1% | 12.1% | 20.7% | 25.6% | 19.1% | 8.3% | 1.7% | 39.6% |
| 115010 | LOADER, PNEUMATIC TIRED, INTE-GRAL UNIT, MAX 5199 LB. OPS. CAPACITY | 90 | Trendscore | 24.7% | 30.8% | 37.4% | 50.9% | 43.1% | 17.0% | 3.5% | 93.3% |
| 115010 | LOADER, PNEUMATIC TIRED, INTE-GRAL UNIT, MAX 5199 LB. OPS. CAPACITY | 90 | Usage | 1.1% | 12.8% | 20.1% | 25.0% | 19.1% | 8.5% | 1.7% | 37.3% |
| 115010 | LOADER, PNEUMATIC TIRED, INTE-GRAL UNIT, MAX 5199 LB. OPS. CAPACITY | 90 | Repair | 1.1% | 13.7% | 20.0% | 25.1% | 18.7% | 7.4% | 1.5% | 29.5% |
| | | | Total (median) | | | 98.3% | | | | | |

| Classcode | Description | Data Points | Attribute | Minimum | 1st Quartile | Median | 3rd Quartile | Mean | St. Dev. | Conf.Int. | Maximum |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 115030 | LOADER, PNEUMATIC TIRED, INTE-GRAL UNIT, 6700 TO 8000 LBS. OPS. CAP. | 295 | Downtime | 0.3% | 12.8% | 20.7% | 25.1% | 18.8% | 8.0% | 0.9% | 35.1% |
| 115030 | LOADER, PNEUMATIC TIRED, INTE-GRAL UNIT, 6700 TO 8000 LBS. OPS. CAP. | 295 | Trendscore | 24.8% | 30.9% | 39.2% | 53.1% | 44.2% | 16.7% | 1.9% | 95.7% |
| 115030 | LOADER, PNEUMATIC TIRED, INTE-GRAL UNIT, 6700 TO 8000 LBS. OPS. CAP. | 295 | Usage | 0.3% | 13.0% | 20.4% | 24.1% | 18.6% | 7.5% | 0.9% | 33.3% |
| 115030 | LOADER, PNEUMATIC TIRED, INTE-GRAL UNIT, 6700 TO 8000 LBS. OPS. CAP. | 295 | Repair | 0.3% | 13.8% | 20.6% | 24.3% | 18.4% | 7.1% | 0.8% | 30.6% |
| | | | Total (median) | | | 100.9% | | | | | |
| 115040 | LOADER, PNEUMATIC TIRED, INTE-GRAL UNIT, 8001 LB OPS. CAP. &GREATER | 24 | Downtime | 3.4% | 13.4% | 18.9% | 23.7% | 18.7% | 7.6% | 3.0% | 35.8% |
| 115040 | LOADER, PNEUMATIC TIRED, INTE-GRAL UNIT, 8001 LB OPS. CAP. &GREATER | 24 | Trendscore | 26.4% | 32.7% | 36.9% | 49.7% | 43.8% | 17.1% | 6.8% | 82.8% |
| 115040 | LOADER, PNEUMATIC TIRED, INTE-GRAL UNIT, 8001 LB OPS. CAP. &GREATER | 24 | Usage | 3.4% | 13.3% | 19.2% | 25.0% | 18.8% | 7.7% | 3.1% | 29.9% |
| 115040 | LOADER, PNEUMATIC TIRED, INTE-GRAL UNIT, 8001 LB OPS. CAP. &GREATER | 24 | Repair | 3.4% | 13.5% | 19.7% | 25.1% | 18.6% | 7.3% | 2.9% | 30.4% |
| | | | Total (median) | | | 94.8% | | | | | |
| 122010 | MIXER, CONCRETE, PORTABLE, UP TO 6 CU. FT. CAPACITY | 78 | Downtime | 3.0% | 14.8% | 22.5% | 29.6% | 24.0% | 12.6% | 2.8% | 54.7% |
| 122010 | MIXER, CONCRETE, PORTABLE, UP TO 6 CU. FT. CAPACITY | 78 | Trendscore | 13.7% | 23.4% | 28.9% | 37.5% | 31.4% | 11.8% | 2.6% | 69.2% |
| 122010 | MIXER, CONCRETE, PORTABLE, UP TO 6 CU. FT. CAPACITY | 78 | Usage | 1.7% | 15.6% | 22.7% | 29.2% | 22.6% | 10.0% | 2.2% | 46.7% |
| 122010 | MIXER, CONCRETE, PORTABLE, UP TO 6 CU. FT. CAPACITY | 78 | Repair | 1.8% | 13.8% | 24.1% | 28.8% | 22.0% | 9.3% | 2.1% | 41.1% |
| | | | Total (median) | | | 98.1% | | | | | |
| 122020 | MIXER, CONCRETE, PORTABLE, 9 CU. FT. CAPACITY AND GREATER | 15 | Downtime | 6.3% | 13.6% | 23.8% | 26.3% | 20.3% | 7.0% | 3.5% | 29.0% |
| 122020 | MIXER, CONCRETE, PORTABLE, 9 CU. FT. CAPACITY AND GREATER | 15 | Trendscore | 24.5% | 27.1% | 34.2% | 44.8% | 39.8% | 15.5% | 7.8% | 81.3% |
| 122020 | MIXER, CONCRETE, PORTABLE, 9 CU. FT. CAPACITY AND GREATER | 15 | Usage | 6.3% | 17.6% | 22.8% | 26.3% | 20.3% | 7.7% | 3.9% | 30.0% |
| 122020 | MIXER, CONCRETE, PORTABLE, 9 CU. FT. CAPACITY AND GREATER | 15 | Repair | 6.3% | 13.8% | 22.5% | 24.5% | 19.7% | 6.7% | 3.4% | 28.9% |
| | | | Total (median) | | | 103.3% | | | | | |
| 124000 | MIXER, LIME SLURRY, MUD JACK, TRAILER MOUNTED | 3 | Downtime | 11.1% | 11.1% | 27.3% | 28.6% | 22.3% | 9.7% | 11.0% | 28.6% |
| 124000 | MIXER, LIME SLURRY, MUD JACK, TRAILER MOUNTED | 3 | Trendscore | 27.3% | 27.3% | 33.3% | 42.9% | 34.5% | 7.9% | 8.9% | 42.9% |
| 124000 | MIXER, LIME SLURRY, MUD JACK, TRAILER MOUNTED | 3 | Usage | 14.3% | 14.3% | 18.2% | 33.3% | 21.9% | 10.1% | 11.4% | 33.3% |
| 124000 | MIXER, LIME SLURRY, MUD JACK, TRAILER MOUNTED | 3 | Repair | 14.3% | 14.3% | 22.2% | 27.3% | 21.3% | 6.5% | 7.4% | 27.3% |
| | | | Total (median) | | | 101.0% | | | | | |
| 130010 | MOWER, LIFT OR TRAIL TYPE, FLAIL, 5 TO 7 FT. | 20 | Downtime | 4.2% | 16.3% | 24.2% | 30.4% | 23.4% | 9.4% | 4.1% | 39.0% |
| 130010 | MOWER, LIFT OR TRAIL TYPE, FLAIL, 5 TO 7 FT. | 20 | Trendscore | 10.3% | 17.7% | 29.8% | 34.8% | 28.4% | 12.8% | 5.6% | 60.0% |
| 130010 | MOWER, LIFT OR TRAIL TYPE, FLAIL, 5 TO 7 FT. | 20 | Usage | 4.3% | 14.6% | 23.5% | 31.4% | 24.9% | 14.6% | 6.4% | 66.7% |
| 130010 | MOWER, LIFT OR TRAIL TYPE, FLAIL, 5 TO 7 FT. | 20 | Repair | 4.2% | 17.1% | 23.1% | 31.8% | 23.3% | 9.9% | 4.3% | 40.0% |
| | | | Total (median) | | | 100.5% | | | | | |
| 130020 | MOWER, LIFT OR TRAIL TYPE, FLAIL, 7 TO 9 FT. | 23 | Downtime | 4.3% | 17.3% | 21.1% | 24.1% | 20.2% | 7.6% | 3.1% | 37.5% |
| 130020 | MOWER, LIFT OR TRAIL TYPE, FLAIL, 7 TO 9 FT. | 23 | Trendscore | 22.9% | 26.2% | 33.9% | 52.8% | 39.9% | 15.8% | 6.5% | 82.6% |
| 130020 | MOWER, LIFT OR TRAIL TYPE, FLAIL, 7 TO 9 FT. | 23 | Usage | 3.2% | 15.8% | 22.2% | 25.3% | 20.1% | 7.1% | 2.9% | 29.5% |
| 130020 | MOWER, LIFT OR TRAIL TYPE, FLAIL, 7 TO 9 FT. | 23 | Repair | 4.3% | 16.7% | 21.7% | 24.4% | 19.8% | 6.7% | 2.7% | 27.8% |
| | | | Total (median) | | | 98.9% | | | | | |
| 130030 | MOWER, LIFT OR TRAIL TYPE,COMBFLAIL,14 FT. OR GREATER (TRAC-TOR MTD) | 1 | Downtime | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 130030 | MOWER, LIFT OR TRAIL TYPE,COMBFLAIL,14 FT. OR GREATER (TRAC-TOR MTD) | 1 | Trendscore | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 130030 | MOWER, LIFT OR TRAIL TYPE,COMBFLAIL,14 FT. OR GREATER (TRAC-TOR MTD) | 1 | Usage | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 130030 | MOWER, LIFT OR TRAIL TYPE,COMBFLAIL,14 FT. OR GREATER (TRAC-TOR MTD) | 1 | Repair | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |

| Classcode | Description | Data Points | Attribute | Minimum | 1st Quartile | Median | 3rd Quartile | Mean | St. Dev. | Conf.Int. | Maximum |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 132010 | MOWER, LIFT OR TRAIL TYPE, ROTARY, 5 TO 7 FT. | 65 | Downtime | 6.9% | 15.7% | 22.5% | 27.5% | 22.0% | 7.8% | 1.9% | 43.9% |
| 132010 | MOWER, LIFT OR TRAIL TYPE, ROTARY, 5 TO 7 FT. | 65 | Trendscore | 19.0% | 25.7% | 31.0% | 43.5% | 35.4% | 13.8% | 3.4% | 75.8% |
| 132010 | MOWER, LIFT OR TRAIL TYPE, ROTARY, 5 TO 7 FT. | 65 | Usage | 1.9% | 15.4% | 21.3% | 28.3% | 21.4% | 9.2% | 2.2% | 49.1% |
| 132010 | MOWER, LIFT OR TRAIL TYPE, ROTARY, 5 TO 7 FT. | 65 | Repair | 1.5% | 17.4% | 22.1% | 27.0% | 21.1% | 7.7% | 1.9% | 34.6% |
| | | | Total (median) | | | 96.9% | | | | | |
| 132020 | MOWER, LIFT OR TRAIL TYPE, ROTARY, 7 TO 9 FT. | 33 | Downtime | 2.0% | 14.9% | 21.5% | 26.1% | 21.4% | 9.7% | 3.3% | 47.1% |
| 132020 | MOWER, LIFT OR TRAIL TYPE, ROTARY, 7 TO 9 FT. | 33 | Trendscore | 20.4% | 26.0% | 31.0% | 42.3% | 36.0% | 13.9% | 4.8% | 75.9% |
| 132020 | MOWER, LIFT OR TRAIL TYPE, ROTARY, 7 TO 9 FT. | 33 | Usage | 2.3% | 16.7% | 21.9% | 28.6% | 21.7% | 9.2% | 3.1% | 39.2% |
| 132020 | MOWER, LIFT OR TRAIL TYPE, ROTARY, 7 TO 9 FT. | 33 | Repair | 3.1% | 16.2% | 21.6% | 27.4% | 20.9% | 8.0% | 2.7% | 32.9% |
| | | | Total (median) | | | 96.0% | | | | | |
| 132030 | MOWER, LIFT OR TRAIL TYPE, ROTARY SWING ARM | 3 | Downtime | 16.7% | 16.7% | 22.2% | 30.0% | 23.0% | 6.7% | 7.6% | 30.0% |
| 132030 | MOWER, LIFT OR TRAIL TYPE, ROTARY SWING ARM | 3 | Trendscore | 22.2% | 22.2% | 30.0% | 33.3% | 28.5% | 5.7% | 6.5% | 33.3% |
| 132030 | MOWER, LIFT OR TRAIL TYPE, ROTARY SWING ARM | 3 | Usage | 10.0% | 10.0% | 33.3% | 33.3% | 25.6% | 13.5% | 15.2% | 33.3% |
| 132030 | MOWER, LIFT OR TRAIL TYPE, ROTARY SWING ARM | 3 | Repair | 16.7% | 16.7% | 22.2% | 30.0% | 23.0% | 6.7% | 7.6% | 30.0% |
| | | | Total (median) | | | 107.8% | | | | | |
| 132040 | MOWER, TRAIL TYPE, ROTARY, 9 FT. AND GREATER | 252 | Downtime | 1.0% | 14.6% | 21.6% | 27.3% | 20.7% | 9.2% | 1.1% | 45.6% |
| 132040 | MOWER, TRAIL TYPE, ROTARY, 9 FT. AND GREATER | 252 | Trendscore | 20.3% | 27.3% | 33.7% | 47.0% | 38.4% | 14.6% | 1.8% | 95.4% |
| 132040 | MOWER, TRAIL TYPE, ROTARY, 9 FT. AND GREATER | 252 | Usage | 0.3% | 13.8% | 22.2% | 27.5% | 20.9% | 9.3% | 1.2% | 41.9% |
| 132040 | MOWER, TRAIL TYPE, ROTARY, 9 FT. AND GREATER | 252 | Repair | 0.5% | 14.4% | 22.0% | 26.3% | 20.0% | 7.8% | 1.0% | 33.2% |
| | | | Total (median) | | | 99.4% | | | | | |
| 135010 | MOWER, SELF PROP., RIDING, FORWARD MOUNT, ROTARY, UP TO 60" CUT | 30 | Downtime | 3.2% | 15.6% | 21.5% | 27.2% | 20.8% | 7.6% | 2.7% | 32.9% |
| 135010 | MOWER, SELF PROP., RIDING, FORWARD MOUNT, ROTARY, UP TO 60" CUT | 30 | Trendscore | 21.0% | 26.5% | 32.4% | 48.9% | 38.2% | 15.4% | 5.5% | 73.3% |
| 135010 | MOWER, SELF PROP., RIDING, FORWARD MOUNT, ROTARY, UP TO 60" CUT | 30 | Usage | 3.1% | 16.0% | 21.2% | 26.4% | 20.7% | 8.2% | 2.9% | 38.8% |
| 135010 | MOWER, SELF PROP., RIDING, FORWARD MOUNT, ROTARY, UP TO 60" CUT | 30 | Repair | 3.2% | 14.9% | 22.6% | 25.7% | 20.4% | 7.0% | 2.5% | 29.6% |
| | | | Total (median) | | | 97.7% | | | | | |
| 135020 | MOWER, SELF PROP., RIDING, FORWARD MOUNT, ROTARY, 60" CUT& ABOVE | 47 | Downtime | 2.0% | 14.8% | 21.7% | 25.9% | 20.3% | 8.2% | 2.3% | 33.3% |
| 135020 | MOWER, SELF PROP., RIDING, FORWARD MOUNT, ROTARY, 60" CUT& ABOVE | 47 | Trendscore | 23.0% | 27.7% | 33.3% | 52.1% | 39.9% | 15.6% | 4.5% | 80.9% |
| 135020 | MOWER, SELF PROP., RIDING, FORWARD MOUNT, ROTARY, 60" CUT& ABOVE | 47 | Usage | 2.1% | 13.8% | 20.3% | 25.9% | 20.1% | 8.4% | 2.4% | 40.8% |
| 135020 | MOWER, SELF PROP., RIDING, FORWARD MOUNT, ROTARY, 60" CUT& ABOVE | 47 | Repair | 2.0% | 14.3% | 21.3% | 26.2% | 19.7% | 7.3% | 2.1% | 30.2% |
| | | | Total (median) | | | 96.6% | | | | | |
| 135040 | MOWER, TRACTOR TYPE RIDING, CENTER MOUNT, ROTARY, UP TO 30H.P. | 125 | Downtime | 1.1% | 14.2% | 22.0% | 26.8% | 20.8% | 9.2% | 1.6% | 39.9% |
| 135040 | MOWER, TRACTOR TYPE RIDING, CENTER MOUNT, ROTARY, UP TO 30H.P. | 125 | Trendscore | 19.6% | 27.4% | 32.7% | 41.9% | 37.4% | 15.2% | 2.7% | 95.7% |
| 135040 | MOWER, TRACTOR TYPE RIDING, CENTER MOUNT, ROTARY, UP TO 30H.P. | 125 | Usage | 1.0% | 14.6% | 21.5% | 29.2% | 21.2% | 10.1% | 1.8% | 46.9% |
| 135040 | MOWER, TRACTOR TYPE RIDING, CENTER MOUNT, ROTARY, UP TO 30H.P. | 125 | Repair | 1.1% | 13.7% | 22.4% | 27.5% | 20.6% | 8.7% | 1.5% | 40.2% |
| | | | Total (median) | | | 98.6% | | | | | |
| 135050 | MOWER, TRACTOR TYPE RIDING, CENTER MOUNT, ROTARY, 30 H.P. AND ABOVE | 9 | Downtime | 7.7% | 17.6% | 23.8% | 26.9% | 21.7% | 7.3% | 4.8% | 29.0% |
| 135050 | MOWER, TRACTOR TYPE RIDING, CENTER MOUNT, ROTARY, 30 H.P. AND ABOVE | 9 | Trendscore | 18.8% | 23.1% | 34.6% | 41.2% | 34.4% | 13.8% | 9.0% | 61.5% |
| 135050 | MOWER, TRACTOR TYPE RIDING, CENTER MOUNT, ROTARY, 30 H.P. AND ABOVE | 9 | Usage | 7.1% | 19.0% | 23.1% | 26.9% | 22.0% | 8.2% | 5.4% | 33.3% |
| 135050 | MOWER, TRACTOR TYPE RIDING, CENTER MOUNT, ROTARY, 30 H.P. AND ABOVE | 9 | Repair | 7.7% | 15.4% | 25.8% | 28.1% | 21.9% | 7.9% | 5.2% | 29.4% |
| | | | Total (median) | | | 107.3% | | | | | |

| Classcode | Description | Data Points | Attribute | Minimum | 1st Quartile | Median | 3rd Quartile | Mean | St. Dev. | Conf.Int. | Maximum |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 136010 | MOWER, SLOPE,SIDE BOOM, ROTARYOR FLAIL, TRACTOR MOUNTED(INC.TRACTOR) | 34 | Downtime | 2.8% | 14.6% | 22.8% | 27.6% | 20.9% | 8.9% | 3.0% | 37.8% |
| 136010 | MOWER, SLOPE,SIDE BOOM, ROTARYOR FLAIL, TRACTOR MOUNTED(INC.TRACTOR) | 34 | Trendscore | 20.7% | 27.8% | 32.9% | 45.5% | 37.7% | 15.1% | 5.1% | 80.6% |
| 136010 | MOWER, SLOPE,SIDE BOOM, ROTARYOR FLAIL, TRACTOR MOUNTED(INC.TRACTOR) | 34 | Usage | 3.2% | 14.9% | 20.8% | 28.9% | 21.0% | 9.7% | 3.3% | 43.2% |
| 136010 | MOWER, SLOPE,SIDE BOOM, ROTARYOR FLAIL, TRACTOR MOUNTED(INC.TRACTOR) | 34 | Repair | 2.8% | 16.2% | 19.8% | 26.7% | 20.4% | 8.1% | 2.7% | 34.2% |
| | | | Total (median) | | | 96.2% | | | | | |
| 136020 | MOWER, SLOPE, SELF PROPELLED, ROTARY OR FLAIL | 2 | Downtime | 16.7% | 16.7% | 25.0% | 33.3% | 25.0% | 11.8% | 16.3% | 33.3% |
| 136020 | MOWER, SLOPE, SELF PROPELLED, ROTARY OR FLAIL | 2 | Trendscore | 16.7% | 16.7% | 25.0% | 33.3% | 25.0% | 11.8% | 16.3% | 33.3% |
| 136020 | MOWER, SLOPE, SELF PROPELLED, ROTARY OR FLAIL | 2 | Usage | 16.7% | 16.7% | 25.0% | 33.3% | 25.0% | 11.8% | 16.3% | 33.3% |
| 136020 | MOWER, SLOPE, SELF PROPELLED, ROTARY OR FLAIL | 2 | Repair | 16.7% | 16.7% | 25.0% | 33.3% | 25.0% | 11.8% | 16.3% | 33.3% |
| | | | Total (median) | | | 100.0% | | | | | |
| 139000 | MOWER, SICKLE, TRACTOR MOUNTEDINTEGRAL UNIT (INCLUDES TRACT) | 2 | Downtime | 16.7% | 16.7% | 22.6% | 28.6% | 22.6% | 8.4% | 11.7% | 28.6% |
| 139000 | MOWER, SICKLE, TRACTOR MOUNTEDINTEGRAL UNIT (INCLUDES TRACT) | 2 | Trendscore | 28.6% | 28.6% | 31.0% | 33.3% | 31.0% | 3.4% | 4.7% | 33.3% |
| 139000 | MOWER, SICKLE, TRACTOR MOUNTEDINTEGRAL UNIT (INCLUDES TRACT) | 2 | Usage | 14.3% | 14.3% | 23.8% | 33.3% | 23.8% | 13.5% | 18.7% | 33.3% |
| 139000 | MOWER, SICKLE, TRACTOR MOUNTEDINTEGRAL UNIT (INCLUDES TRACT) | 2 | Repair | 16.7% | 16.7% | 22.6% | 28.6% | 22.6% | 8.4% | 11.7% | 28.6% |
| | | | Total (median) | | | 100.0% | | | | | |
| 140010 | PAINT STRIPE MACHINE, SINGLE LINE, SELF PROPELLED | 13 | Downtime | 5.3% | 18.9% | 22.2% | 25.0% | 20.1% | 7.2% | 3.9% | 29.3% |
| 140010 | PAINT STRIPE MACHINE, SINGLE LINE, SELF PROPELLED | 13 | Trendscore | 24.5% | 29.3% | 38.7% | 52.2% | 40.5% | 13.9% | 7.5% | 63.2% |
| 140010 | PAINT STRIPE MACHINE, SINGLE LINE, SELF PROPELLED | 13 | Usage | 4.5% | 17.1% | 21.7% | 24.5% | 19.8% | 7.2% | 3.9% | 27.7% |
| 140010 | PAINT STRIPE MACHINE, SINGLE LINE, SELF PROPELLED | 13 | Repair | 4.3% | 16.1% | 22.2% | 23.4% | 19.6% | 6.5% | 3.6% | 28.3% |
| | | | Total (median) | | | 104.9% | | | | | |
| 140020 | PAINT STRIPE MACHINE, TWO COLOR, SMALL, SELF PROPELLED | 3 | Downtime | 16.7% | 16.7% | 25.0% | 28.6% | 23.4% | 6.1% | 6.9% | 28.6% |
| 140020 | PAINT STRIPE MACHINE, TWO COLOR, SMALL, SELF PROPELLED | 3 | Trendscore | 25.0% | 25.0% | 28.6% | 33.3% | 29.0% | 4.2% | 4.7% | 33.3% |
| 140020 | PAINT STRIPE MACHINE, TWO COLOR, SMALL, SELF PROPELLED | 3 | Usage | 14.3% | 14.3% | 25.0% | 33.3% | 24.2% | 9.5% | 10.8% | 33.3% |
| 140020 | PAINT STRIPE MACHINE, TWO COLOR, SMALL, SELF PROPELLED | 3 | Repair | 16.7% | 16.7% | 25.0% | 28.6% | 23.4% | 6.1% | 6.9% | 28.6% |
| | | | Total (median) | | | 103.6% | | | | | |
| 140040 | PAINT STRIPE MACHINE, TWO COLOR, MULTI-LINE, TRUCK MOUNTED | 28 | Downtime | 3.4% | 13.1% | 21.3% | 27.4% | 19.9% | 8.8% | 3.3% | 33.3% |
| 140040 | PAINT STRIPE MACHINE, TWO COLOR, MULTI-LINE, TRUCK MOUNTED | 28 | Trendscore | 24.8% | 29.5% | 34.5% | 53.2% | 40.7% | 14.9% | 5.5% | 86.2% |
| 140040 | PAINT STRIPE MACHINE, TWO COLOR, MULTI-LINE, TRUCK MOUNTED | 28 | Usage | 2.5% | 12.8% | 21.0% | 26.6% | 20.0% | 9.2% | 3.4% | 38.1% |
| 140040 | PAINT STRIPE MACHINE, TWO COLOR, MULTI-LINE, TRUCK MOUNTED | 28 | Repair | 3.4% | 15.7% | 20.3% | 25.0% | 19.4% | 7.6% | 2.8% | 32.6% |
| | | | Total (median) | | | 97.2% | | | | | |
| 152000 | PAVEMENT BREAKER, SELF PRO- PELLED | 1 | Downtime | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 152000 | PAVEMENT BREAKER, SELF PRO- PELLED | 1 | Trendscore | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 152000 | PAVEMENT BREAKER, SELF PRO- PELLED | 1 | Usage | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 152000 | PAVEMENT BREAKER, SELF PRO- PELLED | 1 | Repair | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |
| 154000 | PAVEMENT PROFILING MACHINE, SELF PROPELLED | 18 | Downtime | 5.0% | 15.4% | 19.8% | 25.7% | 19.3% | 7.2% | 3.3% | 30.8% |
| 154000 | PAVEMENT PROFILING MACHINE, SELF PROPELLED | 18 | Trendscore | 25.0% | 29.8% | 36.1% | 48.6% | 42.3% | 16.7% | 7.7% | 85.0% |
| 154000 | PAVEMENT PROFILING MACHINE, SELF PROPELLED | 18 | Usage | 5.0% | 14.3% | 21.0% | 22.9% | 19.1% | 6.8% | 3.1% | 28.6% |
| 154000 | PAVEMENT PROFILING MACHINE, SELF PROPELLED | 18 | Repair | 5.0% | 13.9% | 20.5% | 25.0% | 19.3% | 7.2% | 3.3% | 28.8% |
| | | | Total (median) | | | 97.4% | | | | | |

| Classcode | Description | Data Points | Attribute | Minimum | 1st Quartile | Median | 3rd Quartile | Mean | St. Dev. | Conf.Int. | Maximum |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 156010 | PAVER, BITUMINOUS, SELF PROPELLED | 15 | Downtime | 5.9% | 11.1% | 22.5% | 27.3% | 21.1% | 9.4% | 4.8% | 39.4% |
| 156010 | PAVER, BITUMINOUS, SELF PROPELLED | 15 | Trendscore | 20.0% | 28.9% | 31.4% | 44.0% | 36.1% | 13.1% | 6.6% | 64.7% |
| 156010 | PAVER, BITUMINOUS, SELF PROPELLED | 15 | Usage | 5.6% | 11.8% | 22.9% | 28.8% | 21.3% | 9.3% | 4.7% | 34.2% |
| 156010 | PAVER, BITUMINOUS, SELF PROPELLED | 15 | Repair | 3.0% | 17.6% | 22.9% | 27.3% | 21.5% | 8.7% | 4.4% | 34.3% |
| | | | Total (median) | | | 99.6% | | | | | |
| 156020 | PAVER, BITUMINOUS, TOW TYPE | 3 | Downtime | 12.5% | 12.5% | 25.0% | 33.3% | 23.6% | 10.5% | 11.9% | 33.3% |
| 156020 | PAVER, BITUMINOUS, TOW TYPE | 3 | Trendscore | 22.2% | 22.2% | 25.0% | 37.5% | 28.2% | 8.1% | 9.2% | 37.5% |
| 156020 | PAVER, BITUMINOUS, TOW TYPE | 3 | Usage | 11.1% | 11.1% | 25.0% | 37.5% | 24.5% | 13.2% | 14.9% | 37.5% |
| 156020 | PAVER, BITUMINOUS, TOW TYPE | 3 | Repair | 12.5% | 12.5% | 25.0% | 33.3% | 23.6% | 10.5% | 11.9% | 33.3% |
| | | | Total (median) | | | 100.0% | | | | | |
| 160010 | PLATFORM LIFT, PERSONNEL, SELFPROPELLED, SCISSORS TYPE | 2 | Downtime | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | 0.0% | 0.0% | 25.0% |
| 160010 | PLATFORM LIFT, PERSONNEL, SELFPROPELLED, SCISSORS TYPE | 2 | Trendscore | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | 0.0% | 0.0% | 25.0% |
| 160010 | PLATFORM LIFT, PERSONNEL, SELFPROPELLED, SCISSORS TYPE | 2 | Usage | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | 0.0% | 0.0% | 25.0% |
| 160010 | PLATFORM LIFT, PERSONNEL, SELFPROPELLED, SCISSORS TYPE | 2 | Repair | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | 0.0% | 0.0% | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |
| 160020 | PLATFORM LIFT, PERSONNEL, TRUCK MOUNTED (INCLUDES TRUCK) | 6 | Downtime | 12.5% | 16.7% | 22.9% | 26.1% | 22.4% | 7.3% | 5.8% | 33.3% |
| 160020 | PLATFORM LIFT, PERSONNEL, TRUCK MOUNTED (INCLUDES TRUCK) | 6 | Trendscore | 23.5% | 26.1% | 27.2% | 44.4% | 33.1% | 11.2% | 8.9% | 50.0% |
| 160020 | PLATFORM LIFT, PERSONNEL, TRUCK MOUNTED (INCLUDES TRUCK) | 6 | Usage | 12.5% | 20.0% | 22.0% | 23.5% | 22.2% | 6.7% | 5.4% | 33.3% |
| 160020 | PLATFORM LIFT, PERSONNEL, TRUCK MOUNTED (INCLUDES TRUCK) | 6 | Repair | 11.1% | 20.0% | 23.6% | 26.1% | 22.3% | 6.4% | 5.1% | 29.4% |
| | | | Total (median) | | | 95.7% | | | | | |
| 162010 | PULVERIZER-MIXER, EARTH, SELF POWERED, PULL TYPE | 1 | Downtime | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 162010 | PULVERIZER-MIXER, EARTH, SELF POWERED, PULL TYPE | 1 | Trendscore | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 162010 | PULVERIZER-MIXER, EARTH, SELF POWERED, PULL TYPE | 1 | Usage | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 162010 | PULVERIZER-MIXER, EARTH, SELF POWERED, PULL TYPE | 1 | Repair | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |
| 162020 | PULVERIZER-MIXER, EARTH, SELF PROPELLED | 6 | Downtime | 7.7% | 22.2% | 22.5% | 27.3% | 22.9% | 9.0% | 7.2% | 35.3% |
| 162020 | PULVERIZER-MIXER, EARTH, SELF PROPELLED | 6 | Trendscore | 22.2% | 23.5% | 29.0% | 44.4% | 32.3% | 10.3% | 8.2% | 45.5% |
| 162020 | PULVERIZER-MIXER, EARTH, SELF PROPELLED | 6 | Usage | 11.1% | 18.2% | 22.9% | 23.5% | 22.0% | 7.3% | 5.8% | 33.3% |
| 162020 | PULVERIZER-MIXER, EARTH, SELF PROPELLED | 6 | Repair | 9.1% | 17.6% | 22.2% | 27.3% | 22.8% | 9.8% | 7.8% | 38.5% |
| | | | Total (median) | | | 96.6% | | | | | |
| 164000 | PUMP, MUD OR CONCRETE, TRAILERMOUNTED | 4 | Downtime | 16.7% | 17.4% | 21.6% | 31.3% | 24.3% | 9.5% | 9.3% | 37.5% |
| 164000 | PUMP, MUD OR CONCRETE, TRAILERMOUNTED | 4 | Trendscore | 25.0% | 25.0% | 26.1% | 30.3% | 27.7% | 3.9% | 3.9% | 33.3% |
| 164000 | PUMP, MUD OR CONCRETE, TRAILERMOUNTED | 4 | Usage | 16.7% | 20.8% | 25.0% | 26.1% | 23.5% | 4.7% | 4.6% | 27.3% |
| 164000 | PUMP, MUD OR CONCRETE, TRAILERMOUNTED | 4 | Repair | 12.5% | 18.8% | 26.1% | 30.3% | 24.5% | 8.8% | 8.6% | 33.3% |
| | | | Total (median) | | | 98.9% | | | | | |
| 167010 | ROAD ANALYZER VAN, MOBILE WORKSTATION, HOURLY | 2 | Downtime | 16.7% | 16.7% | 22.6% | 28.6% | 22.6% | 8.4% | 11.7% | 28.6% |
| 167010 | ROAD ANALYZER VAN, MOBILE WORKSTATION, HOURLY | 2 | Trendscore | 28.6% | 28.6% | 31.0% | 33.3% | 31.0% | 3.4% | 4.7% | 33.3% |
| 167010 | ROAD ANALYZER VAN, MOBILE WORKSTATION, HOURLY | 2 | Usage | 14.3% | 14.3% | 23.8% | 33.3% | 23.8% | 13.5% | 18.7% | 33.3% |
| 167010 | ROAD ANALYZER VAN, MOBILE WORKSTATION, HOURLY | 2 | Repair | 16.7% | 16.7% | 22.6% | 28.6% | 22.6% | 8.4% | 11.7% | 28.6% |
| | | | Total (median) | | | 100.0% | | | | | |

| Classcode | Description | Data Points | Attribute | Minimum | 1st Quartile | Median | 3rd Quartile | Mean | St. Dev. | Conf.Int. | Maximum |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 170010 | ROLLER, FLATWHEEL, SELF PROP.,4-6 TON W/PNEUMATIC TIRES | 211 | Downtime | 0.5% | 14.8% | 22.0% | 25.7% | 19.9% | 8.2% | 1.1% | 38.3% |
| 170010 | ROLLER, FLATWHEEL, SELF PROP.,4-6 TON W/PNEUMATIC TIRES | 211 | Trendscore | 22.0% | 28.7% | 34.2% | 50.3% | 40.9% | 16.0% | 2.2% | 94.1% |
| 170010 | ROLLER, FLATWHEEL, SELF PROP.,4-6 TON W/PNEUMATIC TIRES | 211 | Usage | 0.3% | 14.8% | 20.9% | 25.8% | 19.8% | 8.1% | 1.1% | 38.8% |
| 170010 | ROLLER, FLATWHEEL, SELF PROP.,4-6 TON W/PNEUMATIC TIRES | 211 | Repair | 0.5% | 15.3% | 21.0% | 25.0% | 19.4% | 7.3% | 1.0% | 32.6% |
| | | | Total (median) | | | 98.0% | | | | | |
| 170020 | ROLLER, FLATWHEEL, SELF PROP.,5-8 TON | 73 | Downtime | 1.5% | 13.5% | 20.8% | 26.3% | 19.4% | 8.1% | 1.9% | 33.3% |
| 170020 | ROLLER, FLATWHEEL, SELF PROP.,5-8 TON | 73 | Trendscore | 24.1% | 29.9% | 36.0% | 49.6% | 42.0% | 17.3% | 4.0% | 95.5% |
| 170020 | ROLLER, FLATWHEEL, SELF PROP.,5-8 TON | 73 | Usage | 1.5% | 14.4% | 20.6% | 25.1% | 19.4% | 8.2% | 1.9% | 34.5% |
| 170020 | ROLLER, FLATWHEEL, SELF PROP.,5-8 TON | 73 | Repair | 1.5% | 13.9% | 20.5% | 25.2% | 19.2% | 7.6% | 1.7% | 32.3% |
| | | | Total (median) | | | 97.9% | | | | | |
| 170030 | ROLLER, FLATWHEEL, SELF PROP.,8-14 TON | 29 | Downtime | 3.4% | 16.2% | 22.2% | 26.0% | 20.6% | 7.5% | 2.7% | 32.4% |
| 170030 | ROLLER, FLATWHEEL, SELF PROP.,8-14 TON | 29 | Trendscore | 22.0% | 27.6% | 30.0% | 52.5% | 38.1% | 15.7% | 5.7% | 80.8% |
| 170030 | ROLLER, FLATWHEEL, SELF PROP.,8-14 TON | 29 | Usage | 3.8% | 16.2% | 21.2% | 26.1% | 20.7% | 8.2% | 3.0% | 38.9% |
| 170030 | ROLLER, FLATWHEEL, SELF PROP.,8-14 TON | 29 | Repair | 2.5% | 17.1% | 23.0% | 25.6% | 20.6% | 6.9% | 2.5% | 30.5% |
| | | | Total (median) | | | 96.4% | | | | | |
| 172000 | ROLLER, GRID, TOW TYPE | 4 | Downtime | 14.3% | 16.2% | 22.7% | 30.3% | 23.3% | 8.6% | 8.5% | 33.3% |
| 172000 | ROLLER, GRID, TOW TYPE | 4 | Trendscore | 18.2% | 18.2% | 25.8% | 38.1% | 28.1% | 12.1% | 11.9% | 42.9% |
| 172000 | ROLLER, GRID, TOW TYPE | 4 | Usage | 8.3% | 17.8% | 27.9% | 32.5% | 25.1% | 11.9% | 11.7% | 36.4% |
| 172000 | ROLLER, GRID, TOW TYPE | 4 | Repair | 14.3% | 16.2% | 21.6% | 30.7% | 23.5% | 9.7% | 9.5% | 36.4% |
| | | | Total (median) | | | 98.0% | | | | | |
| 174010 | ROLLER, PNEUMATIC TIRED, SELF PROPELLED | 268 | Downtime | 0.8% | 15.1% | 21.3% | 25.1% | 19.7% | 7.3% | 0.9% | 33.9% |
| 174010 | ROLLER, PNEUMATIC TIRED, SELF PROPELLED | 268 | Trendscore | 21.0% | 27.5% | 33.4% | 50.0% | 41.0% | 17.8% | 2.1% | 93.8% |
| 174010 | ROLLER, PNEUMATIC TIRED, SELF PROPELLED | 268 | Usage | 0.4% | 15.0% | 20.8% | 25.2% | 19.8% | 7.7% | 0.9% | 39.1% |
| 174010 | ROLLER, PNEUMATIC TIRED, SELF PROPELLED | 268 | Repair | 0.4% | 15.7% | 21.3% | 24.7% | 19.6% | 7.0% | 0.8% | 32.0% |
| | | | Total (median) | | | 96.8% | | | | | |
| 174020 | ROLLER, PNEUMATIC TIRED, TOW TYPE | 31 | Downtime | 9.4% | 16.7% | 24.1% | 28.4% | 23.9% | 8.6% | 3.0% | 48.4% |
| 174020 | ROLLER, PNEUMATIC TIRED, TOW TYPE | 31 | Trendscore | 8.4% | 18.2% | 26.3% | 37.5% | 28.7% | 13.6% | 4.8% | 66.7% |
| 174020 | ROLLER, PNEUMATIC TIRED, TOW TYPE | 31 | Usage | 7.9% | 17.6% | 24.0% | 31.3% | 24.3% | 9.3% | 3.3% | 50.9% |
| 174020 | ROLLER, PNEUMATIC TIRED, TOW TYPE | 31 | Repair | 11.1% | 17.1% | 23.9% | 26.9% | 23.1% | 5.8% | 2.1% | 36.5% |
| | | | Total (median) | | | 98.2% | | | | | |
| 176010 | ROLLER, TAMPING, SELF PROPELLED | 2 | Downtime | 20.0% | 20.0% | 22.5% | 25.0% | 22.5% | 3.5% | 4.9% | 25.0% |
| 176010 | ROLLER, TAMPING, SELF PROPELLED | 2 | Trendscore | 25.0% | 25.0% | 32.5% | 40.0% | 32.5% | 10.6% | 14.7% | 40.0% |
| 176010 | ROLLER, TAMPING, SELF PROPELLED | 2 | Usage | 20.0% | 20.0% | 22.5% | 25.0% | 22.5% | 3.5% | 4.9% | 25.0% |
| 176010 | ROLLER, TAMPING, SELF PROPELLED | 2 | Repair | 20.0% | 20.0% | 22.5% | 25.0% | 22.5% | 3.5% | 4.9% | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |
| 176020 | ROLLER, TAMPING, TOW TYPE | 7 | Downtime | 12.5% | 20.0% | 24.0% | 29.2% | 25.3% | 9.4% | 6.9% | 42.9% |
| 176020 | ROLLER, TAMPING, TOW TYPE | 7 | Trendscore | 14.3% | 16.7% | 25.0% | 31.6% | 25.0% | 8.2% | 6.1% | 37.5% |
| 176020 | ROLLER, TAMPING, TOW TYPE | 7 | Usage | 12.5% | 21.1% | 25.0% | 28.6% | 24.8% | 6.6% | 4.9% | 33.3% |
| 176020 | ROLLER, TAMPING, TOW TYPE | 7 | Repair | 14.3% | 20.0% | 22.2% | 30.0% | 24.9% | 7.8% | 5.8% | 37.5% |
| | | | Total (median) | | | 96.2% | | | | | |

| Classcode | Description | Data Points | Attribute | Minimum | 1st Quartile | Median | 3rd Quartile | Mean | St. Dev. | Conf.Int. | Maximum |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 178010 | ROLLER, VIBRATING, SELF PROPELLED | 2 | Downtime | 20.0% | 20.0% | 22.5% | 25.0% | 22.5% | 3.5% | 4.9% | 25.0% |
| 178010 | ROLLER, VIBRATING, SELF PROPELLED | 2 | Trendscore | 25.0% | 25.0% | 32.5% | 40.0% | 32.5% | 10.6% | 14.7% | 40.0% |
| 178010 | ROLLER, VIBRATING, SELF PROPELLED | 2 | Usage | 20.0% | 20.0% | 22.5% | 25.0% | 22.5% | 3.5% | 4.9% | 25.0% |
| 178010 | ROLLER, VIBRATING, SELF PROPELLED | 2 | Repair | 20.0% | 20.0% | 22.5% | 25.0% | 22.5% | 3.5% | 4.9% | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |
| 178020 | ROLLER, VIBRATING, SELF PROPELLED W/PNEUMATIC TIRES | 25 | Downtime | 3.0% | 13.2% | 21.0% | 24.6% | 19.8% | 8.5% | 3.3% | 40.8% |
| 178020 | ROLLER, VIBRATING, SELF PROPELLED W/PNEUMATIC TIRES | 25 | Trendscore | 24.5% | 28.9% | 38.3% | 50.0% | 41.4% | 14.5% | 5.7% | 71.9% |
| 178020 | ROLLER, VIBRATING, SELF PROPELLED W/PNEUMATIC TIRES | 25 | Usage | 3.1% | 16.4% | 20.5% | 25.0% | 19.5% | 7.7% | 3.0% | 33.3% |
| 178020 | ROLLER, VIBRATING, SELF PROPELLED W/PNEUMATIC TIRES | 25 | Repair | 3.1% | 16.3% | 22.6% | 24.4% | 19.3% | 7.2% | 2.8% | 28.8% |
| | | | Total (median) | | | 102.4% | | | | | |
| 179000 | SAW, CONCRETE, 30-64 H.P. | 9 | Downtime | 7.7% | 15.0% | 22.6% | 27.3% | 20.5% | 8.5% | 5.6% | 30.0% |
| 179000 | SAW, CONCRETE, 30-64 H.P. | 9 | Trendscore | 25.8% | 30.0% | 36.4% | 42.1% | 37.8% | 11.5% | 7.5% | 61.5% |
| 179000 | SAW, CONCRETE, 30-64 H.P. | 9 | Usage | 4.5% | 15.4% | 22.6% | 26.7% | 21.2% | 9.4% | 6.1% | 34.6% |
| 179000 | SAW, CONCRETE, 30-64 H.P. | 9 | Repair | 5.9% | 15.4% | 20.0% | 26.7% | 20.5% | 8.0% | 5.2% | 31.8% |
| | | | Total (median) | | | 101.5% | | | | | |
| 179010 | SAW, CONCRETE, 65 H.P. AND ABOVE | 9 | Downtime | 6.3% | 16.0% | 23.5% | 26.5% | 20.5% | 7.7% | 5.0% | 30.4% |
| 179010 | SAW, CONCRETE, 65 H.P. AND ABOVE | 9 | Trendscore | 23.5% | 32.0% | 36.4% | 38.1% | 38.4% | 13.0% | 8.5% | 66.7% |
| 179010 | SAW, CONCRETE, 65 H.P. AND ABOVE | 9 | Usage | 8.3% | 14.3% | 23.5% | 26.1% | 20.1% | 7.1% | 4.6% | 28.0% |
| 179010 | SAW, CONCRETE, 65 H.P. AND ABOVE | 9 | Repair | 8.3% | 14.3% | 23.5% | 26.5% | 20.9% | 9.1% | 6.0% | 33.3% |
| | | | Total (median) | | | 107.0% | | | | | |
| 180000 | SCRAPER, ELEVATING, W/INTEGRALTRACTOR | 3 | Downtime | 16.7% | 16.7% | 22.2% | 25.0% | 21.3% | 4.2% | 4.8% | 25.0% |
| 180000 | SCRAPER, ELEVATING, W/INTEGRALTRACTOR | 3 | Trendscore | 25.0% | 25.0% | 33.3% | 50.0% | 36.1% | 12.7% | 14.4% | 50.0% |
| 180000 | SCRAPER, ELEVATING, W/INTEGRALTRACTOR | 3 | Usage | 16.7% | 16.7% | 22.2% | 25.0% | 21.3% | 4.2% | 4.8% | 25.0% |
| 180000 | SCRAPER, ELEVATING, W/INTEGRALTRACTOR | 3 | Repair | 16.7% | 16.7% | 22.2% | 25.0% | 21.3% | 4.2% | 4.8% | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |
| 186000 | SIGN, ELECTRONIC CHANGEABLE MESSAGE, TRAILER MOUNTED | 25 | Downtime | 2.0% | 17.0% | 21.6% | 29.1% | 21.8% | 10.1% | 4.0% | 45.3% |
| 186000 | SIGN, ELECTRONIC CHANGEABLE MESSAGE, TRAILER MOUNTED | 25 | Trendscore | 21.5% | 27.9% | 31.5% | 37.7% | 34.8% | 12.0% | 4.7% | 68.0% |
| 186000 | SIGN, ELECTRONIC CHANGEABLE MESSAGE, TRAILER MOUNTED | 25 | Usage | 1.9% | 15.0% | 23.7% | 30.1% | 22.0% | 10.5% | 4.1% | 46.9% |
| 186000 | SIGN, ELECTRONIC CHANGEABLE MESSAGE, TRAILER MOUNTED | 25 | Repair | 3.6% | 13.5% | 18.5% | 30.1% | 21.5% | 10.3% | 4.1% | 39.3% |
| | | | Total (median) | | | 95.3% | | | | | |
| 186010 | SIGN, ELECTRONIC CHANGEABLE MESSAGE, TRAILER MNTD, SOLAR POWERED | 74 | Downtime | 3.3% | 11.0% | 21.8% | 26.4% | 19.4% | 8.9% | 2.0% | 34.4% |
| 186010 | SIGN, ELECTRONIC CHANGEABLE MESSAGE, TRAILER MNTD, SOLAR POWERED | 74 | Trendscore | 25.9% | 31.3% | 39.2% | 48.3% | 40.9% | 11.6% | 2.6% | 76.9% |
| 186010 | SIGN, ELECTRONIC CHANGEABLE MESSAGE, TRAILER MNTD, SOLAR POWERED | 74 | Usage | 6.6% | 14.0% | 21.0% | 27.5% | 20.8% | 8.9% | 2.0% | 47.1% |
| 186010 | SIGN, ELECTRONIC CHANGEABLE MESSAGE, TRAILER MNTD, SOLAR POWERED | 74 | Repair | 1.1% | 14.1% | 19.8% | 25.4% | 18.9% | 8.0% | 1.8% | 32.3% |
| | | | Total (median) | | | 101.8% | | | | | |
| 188000 | SKID TEST TRAILER | 7 | Downtime | 6.3% | 21.1% | 25.0% | 27.3% | 23.6% | 9.1% | 6.8% | 36.8% |
| 188000 | SKID TEST TRAILER | 7 | Trendscore | 21.1% | 21.1% | 25.0% | 43.8% | 31.6% | 11.8% | 8.7% | 50.0% |
| 188000 | SKID TEST TRAILER | 7 | Usage | 12.5% | 15.0% | 25.0% | 28.0% | 22.4% | 7.2% | 5.3% | 31.6% |
| 188000 | SKID TEST TRAILER | 7 | Repair | 12.5% | 15.8% | 24.0% | 26.3% | 22.4% | 7.6% | 5.6% | 35.0% |
| | | | Total (median) | | | 99.0% | | | | | |

| Classcode | Description | Data Points | Attribute | Minimum | 1st Quartile | Median | 3rd Quartile | Mean | St. Dev. | Conf.Int. | Maximum |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 190010 | SNOW PLOW, HIGH SPEED EXPRESS WAY, 10 FT. | 194 | Downtime | 1.6% | 14.4% | 21.3% | 28.8% | 22.1% | 10.4% | 1.5% | 53.4% |
| 190010 | SNOW PLOW, HIGH SPEED EXPRESS WAY, 10 FT. | 194 | Trendscore | 17.5% | 24.6% | 30.6% | 40.5% | 34.8% | 14.6% | 2.1% | 94.0% |
| 190010 | SNOW PLOW, HIGH SPEED EXPRESS WAY, 10 FT. | 194 | Usage | 2.0% | 16.1% | 23.2% | 28.1% | 21.7% | 8.9% | 1.3% | 38.1% |
| 190010 | SNOW PLOW, HIGH SPEED EXPRESS WAY, 10 FT. | 194 | Repair | 1.6% | 15.4% | 22.1% | 27.7% | 21.4% | 8.8% | 1.2% | 44.1% |
| | | | Total (median) | | | 97.3% | | | | | |
| 190020 | SNOW PLOW, STRAIGHT MOLDBOARD,10 FT. | 226 | Downtime | 3.6% | 11.9% | 19.9% | 27.7% | 19.9% | 9.3% | 1.2% | 39.1% |
| 190020 | SNOW PLOW, STRAIGHT MOLDBOARD,10 FT. | 226 | Trendscore | 23.3% | 30.9% | 36.9% | 47.5% | 41.4% | 14.6% | 1.9% | 87.6% |
| 190020 | SNOW PLOW, STRAIGHT MOLDBOARD,10 FT. | 226 | Usage | 0.4% | 13.0% | 21.4% | 25.9% | 19.7% | 9.3% | 1.2% | 43.5% |
| 190020 | SNOW PLOW, STRAIGHT MOLDBOARD,10 FT. | 226 | Repair | 0.4% | 12.4% | 20.5% | 25.9% | 18.9% | 8.3% | 1.1% | 37.8% |
| | | | Total (median) | | | 98.7% | | | | | |
| 190030 | SNOW PLOW, ROTARY TYPE, CARRIER MOUNTED | 2 | Downtime | 16.7% | 16.7% | 25.0% | 33.3% | 25.0% | 11.8% | 16.3% | 33.3% |
| 190030 | SNOW PLOW, ROTARY TYPE, CARRIER MOUNTED | 2 | Trendscore | 16.7% | 16.7% | 25.0% | 33.3% | 25.0% | 11.8% | 16.3% | 33.3% |
| 190030 | SNOW PLOW, ROTARY TYPE, CARRIER MOUNTED | 2 | Usage | 16.7% | 16.7% | 25.0% | 33.3% | 25.0% | 11.8% | 16.3% | 33.3% |
| 190030 | SNOW PLOW, ROTARY TYPE, CARRIER MOUNTED | 2 | Repair | 16.7% | 16.7% | 25.0% | 33.3% | 25.0% | 11.8% | 16.3% | 33.3% |
| | | | Total (median) | | | 100.0% | | | | | |
| 190040 | SNOW BLOWER, FOR MOUNTING ON PNEUMATIC LOADER | 10 | Downtime | 7.7% | 12.5% | 19.9% | 28.6% | 19.6% | 8.2% | 5.1% | 30.0% |
| 190040 | SNOW BLOWER, FOR MOUNTING ON PNEUMATIC LOADER | 10 | Trendscore | 26.3% | 30.3% | 37.7% | 47.6% | 41.3% | 14.7% | 9.1% | 76.9% |
| 190040 | SNOW BLOWER, FOR MOUNTING ON PNEUMATIC LOADER | 10 | Usage | 7.7% | 14.3% | 18.0% | 26.3% | 19.5% | 8.3% | 5.1% | 33.3% |
| 190040 | SNOW BLOWER, FOR MOUNTING ON PNEUMATIC LOADER | 10 | Repair | 7.7% | 11.1% | 18.9% | 28.6% | 19.7% | 8.5% | 5.3% | 30.8% |
| | | | Total (median) | | | 94.6% | | | | | |
| 192010 | SPRAYER, HERBICIDE/INSECTICIDETRUCK MOUNTED (INC. TRUCK) | 246 | Downtime | 2.4% | 14.6% | 21.7% | 26.1% | 20.3% | 8.2% | 1.0% | 39.9% |
| 192010 | SPRAYER, HERBICIDE/INSECTICIDETRUCK MOUNTED (INC. TRUCK) | 246 | Trendscore | 20.4% | 27.3% | 34.1% | 48.0% | 39.5% | 16.9% | 2.1% | 93.4% |
| 192010 | SPRAYER, HERBICIDE/INSECTICIDETRUCK MOUNTED (INC. TRUCK) | 246 | Usage | 2.4% | 14.8% | 21.9% | 25.8% | 20.2% | 7.9% | 1.0% | 38.5% |
| 192010 | SPRAYER, HERBICIDE/INSECTICIDETRUCK MOUNTED (INC. TRUCK) | 246 | Repair | 0.5% | 14.6% | 22.2% | 26.0% | 20.0% | 7.4% | 0.9% | 33.9% |
| | | | Total (median) | | | 100.0% | | | | | |
| 194010 | SPREADER, AGGREGATE, SELF POWERED | 23 | Downtime | 4.5% | 13.3% | 22.7% | 26.5% | 20.2% | 7.3% | 3.0% | 29.2% |
| 194010 | SPREADER, AGGREGATE, SELF POWERED | 23 | Trendscore | 21.7% | 25.7% | 36.7% | 42.6% | 39.3% | 16.9% | 6.9% | 81.8% |
| 194010 | SPREADER, AGGREGATE, SELF POWERED | 23 | Usage | 4.0% | 13.3% | 22.4% | 27.7% | 20.3% | 7.8% | 3.2% | 32.6% |
| 194010 | SPREADER, AGGREGATE, SELF POWERED | 23 | Repair | 4.5% | 13.3% | 22.5% | 26.2% | 20.1% | 7.3% | 3.0% | 30.3% |
| | | | Total (median) | | | 104.3% | | | | | |
| 194020 | SPREADER, AGGREGATE, TOW TYPE | 1 | Downtime | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 194020 | SPREADER, AGGREGATE, TOW TYPE | 1 | Trendscore | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 194020 | SPREADER, AGGREGATE, TOW TYPE | 1 | Usage | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 194020 | SPREADER, AGGREGATE, TOW TYPE | 1 | Repair | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |
| 196000 | SPREADER, MULCH, TRAILER MOUNTSELF POWERED | 1 | Downtime | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 196000 | SPREADER, MULCH, TRAILER MOUNTSELF POWERED | 1 | Trendscore | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 196000 | SPREADER, MULCH, TRAILER MOUNTSELF POWERED | 1 | Usage | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 196000 | SPREADER, MULCH, TRAILER MOUNTSELF POWERED | 1 | Repair | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |

| Classcode | Description | Data Points | Attribute | Minimum | 1st Quartile | Median | 3rd Quartile | Mean | St. Dev. | Conf.Int. | Maximum |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 198000 | STORM & DRAIN PIPE CLEANING UNIT, TRUCK MOUNTED | 1 | Downtime | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 198000 | STORM & DRAIN PIPE CLEANING UNIT, TRUCK MOUNTED | 1 | Trendscore | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 198000 | STORM & DRAIN PIPE CLEANING UNIT, TRUCK MOUNTED | 1 | Usage | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 198000 | STORM & DRAIN PIPE CLEANING UNIT, TRUCK MOUNTED | 1 | Repair | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |
| 200000 | SWEEPER, INDUSTRIAL, SELF PROPELLED | 5 | Downtime | 15.4% | 16.7% | 23.1% | 26.3% | 23.0% | 7.3% | 6.4% | 33.3% |
| 200000 | SWEEPER, INDUSTRIAL, SELF PROPELLED | 5 | Trendscore | 21.1% | 23.1% | 25.0% | 38.5% | 31.5% | 12.4% | 10.9% | 50.0% |
| 200000 | SWEEPER, INDUSTRIAL, SELF PROPELLED | 5 | Usage | 15.4% | 16.7% | 25.0% | 26.3% | 22.8% | 6.6% | 5.8% | 30.8% |
| 200000 | SWEEPER, INDUSTRIAL, SELF PROPELLED | 5 | Repair | 16.7% | 16.7% | 23.1% | 26.3% | 22.7% | 6.1% | 5.4% | 30.8% |
| | | | Total (median) | | | 96.2% | | | | | |
| 202010 | SWEEPER, ROAD, SELF PROPELLED | 282 | Downtime | 0.5% | 15.4% | 21.5% | 26.3% | 20.6% | 7.8% | 0.9% | 41.3% |
| 202010 | SWEEPER, ROAD, SELF PROPELLED | 282 | Trendscore | 18.6% | 25.7% | 31.7% | 46.0% | 38.4% | 17.7% | 2.1% | 98.4% |
| 202010 | SWEEPER, ROAD, SELF PROPELLED | 282 | Usage | 0.5% | 15.6% | 22.0% | 26.3% | 20.7% | 8.2% | 1.0% | 41.5% |
| 202010 | SWEEPER, ROAD, SELF PROPELLED | 282 | Repair | 0.5% | 15.9% | 22.1% | 26.3% | 20.4% | 7.2% | 0.8% | 33.3% |
| | | | Total (median) | | | 97.3% | | | | | |
| 202020 | SWEEPER, ROAD, TOW TYPE | 3 | Downtime | 20.0% | 20.0% | 22.2% | 27.3% | 23.2% | 3.7% | 4.2% | 27.3% |
| 202020 | SWEEPER, ROAD, TOW TYPE | 3 | Trendscore | 18.2% | 18.2% | 33.3% | 40.0% | 30.5% | 11.2% | 12.7% | 40.0% |
| 202020 | SWEEPER, ROAD, TOW TYPE | 3 | Usage | 20.0% | 20.0% | 22.2% | 27.3% | 23.2% | 3.7% | 4.2% | 27.3% |
| 202020 | SWEEPER, ROAD, TOW TYPE | 3 | Repair | 20.0% | 20.0% | 22.2% | 27.3% | 23.2% | 3.7% | 4.2% | 27.3% |
| | | | Total (median) | | | 100.0% | | | | | |
| 204010 | SWEEPER, STREET, TRICYCLE DESIGN | 1 | Downtime | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 204010 | SWEEPER, STREET, TRICYCLE DESIGN | 1 | Trendscore | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 204010 | SWEEPER, STREET, TRICYCLE DESIGN | 1 | Usage | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 204010 | SWEEPER, STREET, TRICYCLE DESIGN | 1 | Repair | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |
| 204020 | SWEEPER, STREET, TRUCK MOUNTED | 68 | Downtime | 1.3% | 12.9% | 19.5% | 25.2% | 19.3% | 8.5% | 2.0% | 41.7% |
| 204020 | SWEEPER, STREET, TRUCK MOUNTED | 68 | Trendscore | 23.6% | 29.9% | 37.0% | 48.8% | 42.8% | 17.5% | 4.2% | 86.1% |
| 204020 | SWEEPER, STREET, TRUCK MOUNTED | 68 | Usage | 1.2% | 13.9% | 19.7% | 24.5% | 19.0% | 7.6% | 1.8% | 32.2% |
| 204020 | SWEEPER, STREET, TRUCK MOUNTED | 68 | Repair | 1.4% | 12.7% | 20.1% | 24.2% | 18.9% | 7.2% | 1.7% | 30.2% |
| | | | Total (median) | | | 96.3% | | | | | |
| 204030 | SWEEPER, STREET, TRUCK MOUNTEDREGENERATIVE AIR, UP TO 6 CU. YD. | 7 | Downtime | 9.1% | 21.7% | 22.2% | 25.9% | 21.8% | 6.1% | 4.6% | 28.6% |
| 204030 | SWEEPER, STREET, TRUCK MOUNTEDREGENERATIVE AIR, UP TO 6 CU. YD. | 7 | Trendscore | 21.7% | 25.9% | 28.6% | 45.5% | 34.8% | 12.2% | 9.0% | 55.6% |
| 204030 | SWEEPER, STREET, TRUCK MOUNTEDREGENERATIVE AIR, UP TO 6 CU. YD. | 7 | Usage | 11.1% | 15.4% | 22.2% | 27.8% | 21.9% | 7.1% | 5.3% | 30.4% |
| 204030 | SWEEPER, STREET, TRUCK MOUNTEDREGENERATIVE AIR, UP TO 6 CU. YD. | 7 | Repair | 11.1% | 18.2% | 23.1% | 25.9% | 21.5% | 5.3% | 3.9% | 26.1% |
| | | | Total (median) | | | 96.1% | | | | | |
| 204040 | SWEEPER, STREET, TRUCK MOUNTEDREGENERATIVE AIR, 6 CU.YD. ANDGREATER | 14 | Downtime | 5.3% | 13.5% | 21.7% | 24.1% | 19.1% | 7.0% | 3.7% | 28.6% |
| 204040 | SWEEPER, STREET, TRUCK MOUNTEDREGENERATIVE AIR, 6 CU.YD. ANDGREATER | 14 | Trendscore | 25.9% | 31.8% | 36.9% | 51.9% | 43.1% | 16.7% | 8.7% | 77.8% |
| 204040 | SWEEPER, STREET, TRUCK MOUNTEDREGENERATIVE AIR, 6 CU.YD. ANDGREATER | 14 | Usage | 5.6% | 14.8% | 18.6% | 24.1% | 18.9% | 6.8% | 3.6% | 29.7% |
| 204040 | SWEEPER, STREET, TRUCK MOUNTEDREGENERATIVE AIR, 6 CU.YD. ANDGREATER | 14 | Repair | 5.6% | 15.2% | 20.2% | 24.0% | 18.9% | 6.3% | 3.3% | 25.9% |
| | | | Total (median) | | | 97.4% | | | | | |

| Classcode | Description | Data Points | Attribute | Minimum | 1st Quartile | Median | 3rd Quartile | Mean | St. Dev. | Conf.Int. | Maximum |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 210020 | TANK, FUEL, TRAILER MOUNTED | 57 | Downtime | 2.7% | 17.0% | 24.6% | 31.1% | 24.0% | 10.2% | 2.6% | 46.4% |
| 210020 | TANK, FUEL, TRAILER MOUNTED | 57 | Trendscore | 2.1% | 18.0% | 25.2% | 33.8% | 26.4% | 14.4% | 3.7% | 71.4% |
| 210020 | TANK, FUEL, TRAILER MOUNTED | 57 | Usage | 2.9% | 16.1% | 26.2% | 33.1% | 25.9% | 14.5% | 3.8% | 70.3% |
| 210020 | TANK, FUEL, TRAILER MOUNTED | 57 | Repair | 2.7% | 16.1% | 26.1% | 30.1% | 23.7% | 9.3% | 2.4% | 42.0% |
| | | | Total (median) | | | 102.1% | | | | | |
| 212000 | TANK, STORAGE, PORTABLE | 11 | Downtime | 9.1% | 13.0% | 23.5% | 33.3% | 24.2% | 12.2% | 7.2% | 45.0% |
| 212000 | TANK, STORAGE, PORTABLE | 11 | Trendscore | 5.0% | 11.1% | 25.0% | 43.5% | 28.3% | 20.8% | 12.3% | 72.7% |
| 212000 | TANK, STORAGE, PORTABLE | 11 | Usage | 9.1% | 14.3% | 23.5% | 30.6% | 23.5% | 10.0% | 5.9% | 41.7% |
| 212000 | TANK, STORAGE, PORTABLE | 11 | Repair | 8.3% | 16.7% | 21.7% | 34.6% | 24.0% | 11.1% | 6.5% | 40.7% |
| | | | Total (median) | | | 93.8% | | | | | |
| 214000 | TANK, WATER, TRUCK MOUNTED, INCLUDES TRUCK | 14 | Downtime | 3.6% | 15.8% | 22.2% | 25.0% | 20.3% | 6.9% | 3.6% | 28.9% |
| 214000 | TANK, WATER, TRUCK MOUNTED, INCLUDES TRUCK | 14 | Trendscore | 22.6% | 26.7% | 36.4% | 42.9% | 39.4% | 14.4% | 7.6% | 66.7% |
| 214000 | TANK, WATER, TRUCK MOUNTED, INCLUDES TRUCK | 14 | Usage | 5.6% | 15.0% | 21.8% | 25.0% | 19.9% | 6.9% | 3.6% | 28.0% |
| 214000 | TANK, WATER, TRUCK MOUNTED, INCLUDES TRUCK | 14 | Repair | 5.0% | 15.0% | 22.0% | 24.0% | 20.3% | 8.4% | 4.4% | 39.3% |
| | | | Total (median) | | | 102.4% | | | | | |
| 214010 | TANK, WATER, TRUCK MOUNTED, INCLUDES TRUCK | 34 | Downtime | 3.7% | 16.9% | 20.2% | 25.7% | 20.5% | 7.4% | 2.5% | 34.8% |
| 214010 | TANK, WATER, TRUCK MOUNTED, INCLUDES TRUCK | 34 | Trendscore | 20.2% | 26.3% | 31.9% | 48.0% | 38.4% | 17.2% | 5.8% | 88.9% |
| 214010 | TANK, WATER, TRUCK MOUNTED, INCLUDES TRUCK | 34 | Usage | 3.7% | 16.7% | 21.1% | 25.9% | 20.7% | 7.5% | 2.5% | 34.7% |
| 214010 | TANK, WATER, TRUCK MOUNTED, INCLUDES TRUCK | 34 | Repair | 3.7% | 17.2% | 21.1% | 25.9% | 20.3% | 6.5% | 2.2% | 28.6% |
| | | | Total (median) | | | 94.3% | | | | | |
| 214020 | TANK, WATER, TRAILER MOUNTED | 41 | Downtime | 1.5% | 12.4% | 22.8% | 31.2% | 22.5% | 11.1% | 3.4% | 43.5% |
| 214020 | TANK, WATER, TRAILER MOUNTED | 41 | Trendscore | 16.8% | 25.3% | 31.6% | 40.0% | 33.1% | 11.2% | 3.4% | 63.3% |
| 214020 | TANK, WATER, TRAILER MOUNTED | 41 | Usage | 2.1% | 13.9% | 20.5% | 30.0% | 22.6% | 12.4% | 3.8% | 60.0% |
| 214020 | TANK, WATER, TRAILER MOUNTED | 41 | Repair | 1.5% | 16.7% | 24.2% | 27.7% | 21.8% | 9.2% | 2.8% | 38.0% |
| | | | Total (median) | | | 99.1% | | | | | |
| 216040 | THERMOPLASTIC STRIPING MACHINESYSTEM, TRAILER MOUNTED | 1 | Downtime | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 216040 | THERMOPLASTIC STRIPING MACHINESYSTEM, TRAILER MOUNTED | 1 | Trendscore | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 216040 | THERMOPLASTIC STRIPING MACHINESYSTEM, TRAILER MOUNTED | 1 | Usage | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 216040 | THERMOPLASTIC STRIPING MACHINESYSTEM, TRAILER MOUNTED | 1 | Repair | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |
| 220010 | TRACTOR, CRAWLER TYPE (W/ OR W/O DOZER), UP TO 100 H.P. | 25 | Downtime | 3.3% | 16.7% | 21.8% | 24.4% | 19.5% | 7.4% | 2.9% | 30.0% |
| 220010 | TRACTOR, CRAWLER TYPE (W/ OR W/O DOZER), UP TO 100 H.P. | 25 | Trendscore | 24.2% | 28.8% | 37.1% | 47.9% | 42.0% | 16.0% | 6.3% | 76.7% |
| 220010 | TRACTOR, CRAWLER TYPE (W/ OR W/O DOZER), UP TO 100 H.P. | 25 | Usage | 3.2% | 13.8% | 19.4% | 25.4% | 19.4% | 8.0% | 3.1% | 35.3% |
| 220010 | TRACTOR, CRAWLER TYPE (W/ OR W/O DOZER), UP TO 100 H.P. | 25 | Repair | 3.2% | 16.0% | 21.9% | 24.2% | 19.1% | 6.8% | 2.6% | 27.5% |
| | | | Total (median) | | | 100.2% | | | | | |
| 220020 | TRACTOR, CRAWLER TYPE (W/ OR W/O DOZER) 100 TO 129 H.P. | 9 | Downtime | 10.0% | 16.7% | 24.2% | 25.7% | 21.0% | 6.7% | 4.4% | 27.3% |
| 220020 | TRACTOR, CRAWLER TYPE (W/ OR W/O DOZER) 100 TO 129 H.P. | 9 | Trendscore | 24.2% | 25.7% | 31.8% | 38.9% | 37.0% | 14.5% | 9.5% | 70.0% |
| 220020 | TRACTOR, CRAWLER TYPE (W/ OR W/O DOZER) 100 TO 129 H.P. | 9 | Usage | 10.0% | 16.7% | 22.7% | 25.0% | 21.0% | 7.2% | 4.7% | 33.3% |
| 220020 | TRACTOR, CRAWLER TYPE (W/ OR W/O DOZER) 100 TO 129 H.P. | 9 | Repair | 10.0% | 16.7% | 24.2% | 25.7% | 20.9% | 6.5% | 4.3% | 27.8% |
| | | | Total (median) | | | 103.0% | | | | | |

| Classcode | Description | Data Points | Attribute | Minimum | 1st Quartile | Median | 3rd Quartile | Mean | St. Dev. | Conf.Int. | Maximum |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 220030 | TRACTOR, CRAWLER TYPE (W/ OR W/O DOZER) 130 TO 179 H.P. | 17 | Downtime | 5.3% | 16.7% | 22.2% | 24.6% | 19.9% | 6.2% | 2.9% | 26.4% |
| 220030 | TRACTOR, CRAWLER TYPE (W/ OR W/O DOZER) 130 TO 179 H.P. | 17 | Trendscore | 22.2% | 28.0% | 34.1% | 45.2% | 40.0% | 16.8% | 8.0% | 77.8% |
| 220030 | TRACTOR, CRAWLER TYPE (W/ OR W/O DOZER) 130 TO 179 H.P. | 17 | Usage | 5.6% | 18.2% | 22.2% | 25.5% | 20.1% | 6.6% | 3.1% | 27.3% |
| 220030 | TRACTOR, CRAWLER TYPE (W/ OR W/O DOZER) 130 TO 179 H.P. | 17 | Repair | 5.6% | 16.1% | 21.2% | 25.4% | 20.0% | 6.4% | 3.0% | 27.0% |
| | | | Total (median) | | | 99.8% | | | | | |
| 220040 | TRACTOR, CRAWLER TYPE (W/ OR W/O DOZER) 180 H.P. & GREATER | 2 | Downtime | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | 0.0% | 0.0% | 25.0% |
| 220040 | TRACTOR, CRAWLER TYPE (W/ OR W/O DOZER) 180 H.P. & GREATER | 2 | Trendscore | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | 0.0% | 0.0% | 25.0% |
| 220040 | TRACTOR, CRAWLER TYPE (W/ OR W/O DOZER) 180 H.P. & GREATER | 2 | Usage | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | 0.0% | 0.0% | 25.0% |
| 220040 | TRACTOR, CRAWLER TYPE (W/ OR W/O DOZER) 180 H.P. & GREATER | 2 | Repair | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | 0.0% | 0.0% | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |
| 230010 | TRACTOR, PNEUMATIC TIRED, UP TO 49 H.P. (TRACTOR ONLY) | 75 | Downtime | 0.9% | 16.5% | 23.6% | 26.8% | 21.8% | 8.6% | 1.9% | 42.9% |
| 230010 | TRACTOR, PNEUMATIC TIRED, UP TO 49 H.P. (TRACTOR ONLY) | 75 | Trendscore | 18.2% | 25.1% | 31.8% | 42.6% | 35.5% | 13.6% | 3.1% | 76.7% |
| 230010 | TRACTOR, PNEUMATIC TIRED, UP TO 49 H.P. (TRACTOR ONLY) | 75 | Usage | 1.3% | 16.7% | 23.0% | 28.5% | 21.7% | 8.9% | 2.0% | 37.4% |
| 230010 | TRACTOR, PNEUMATIC TIRED, UP TO 49 H.P. (TRACTOR ONLY) | 75 | Repair | 1.7% | 16.7% | 22.7% | 26.6% | 21.0% | 7.7% | 1.7% | 31.5% |
| | | | Total (median) | | | 101.1% | | | | | |
| 230020 | TRACTOR, PNEUMATIC TIRED, 50 TO 64 H.P. (TRACTOR ONLY) | 136 | Downtime | 0.6% | 14.8% | 21.7% | 29.0% | 21.7% | 9.6% | 1.6% | 46.2% |
| 230020 | TRACTOR, PNEUMATIC TIRED, 50 TO 64 H.P. (TRACTOR ONLY) | 136 | Trendscore | 18.4% | 23.0% | 30.9% | 43.3% | 35.6% | 15.8% | 2.7% | 93.0% |
| 230020 | TRACTOR, PNEUMATIC TIRED, 50 TO 64 H.P. (TRACTOR ONLY) | 136 | Usage | 1.1% | 16.6% | 22.5% | 27.6% | 21.6% | 9.1% | 1.5% | 40.5% |
| 230020 | TRACTOR, PNEUMATIC TIRED, 50 TO 64 H.P. (TRACTOR ONLY) | 136 | Repair | 1.2% | 16.0% | 22.5% | 27.1% | 21.0% | 8.1% | 1.4% | 35.9% |
| | | | Total (median) | | | 97.5% | | | | | |
| 230030 | TRACTOR, PNEUMATIC TIRED, 65 H.P. AND ABOVE (TRACTOR ONLY) | 338 | Downtime | 0.2% | 14.3% | 21.7% | 27.4% | 20.9% | 9.5% | 1.0% | 44.9% |
| 230030 | TRACTOR, PNEUMATIC TIRED, 65 H.P. AND ABOVE (TRACTOR ONLY) | 338 | Trendscore | 19.4% | 26.9% | 33.5% | 45.4% | 37.5% | 14.4% | 1.5% | 91.5% |
| 230030 | TRACTOR, PNEUMATIC TIRED, 65 H.P. AND ABOVE (TRACTOR ONLY) | 338 | Usage | 0.3% | 13.9% | 22.2% | 28.2% | 21.2% | 9.8% | 1.0% | 47.6% |
| 230030 | TRACTOR, PNEUMATIC TIRED, 65 H.P. AND ABOVE (TRACTOR ONLY) | 338 | Repair | 0.3% | 14.7% | 22.6% | 26.8% | 20.3% | 8.0% | 0.9% | 33.6% |
| | | | Total (median) | | | 100.0% | | | | | |
| 240010 | TRACTOR, PNEUMATIC TIRED, W/ FRONT END LOADER | 4 | Downtime | 16.7% | 18.3% | 20.7% | 26.1% | 22.2% | 6.0% | 5.9% | 30.8% |
| 240010 | TRACTOR, PNEUMATIC TIRED, W/ FRONT END LOADER | 4 | Trendscore | 23.1% | 25.8% | 29.3% | 40.0% | 32.9% | 11.8% | 11.5% | 50.0% |
| 240010 | TRACTOR, PNEUMATIC TIRED, W/ FRONT END LOADER | 4 | Usage | 15.4% | 16.0% | 22.6% | 29.3% | 22.7% | 7.7% | 7.5% | 30.0% |
| 240010 | TRACTOR, PNEUMATIC TIRED, W/ FRONT END LOADER | 4 | Repair | 16.7% | 18.3% | 20.7% | 26.1% | 22.2% | 6.0% | 5.9% | 30.8% |
| | | | Total (median) | | | 93.3% | | | | | |
| 240020 | TRACTOR, PNEUMATIC TIRED, W/ LOADER AND BACKHOE, UP TO 60 H.P. | 17 | Downtime | 5.6% | 17.6% | 22.0% | 25.9% | 21.6% | 6.9% | 3.3% | 34.8% |
| 240020 | TRACTOR, PNEUMATIC TIRED, W/ LOADER AND BACKHOE, UP TO 60 H.P. | 17 | Trendscore | 17.2% | 25.6% | 31.7% | 37.8% | 34.7% | 14.6% | 6.9% | 71.4% |
| 240020 | TRACTOR, PNEUMATIC TIRED, W/ LOADER AND BACKHOE, UP TO 60 H.P. | 17 | Usage | 6.7% | 19.5% | 23.3% | 27.8% | 22.1% | 7.7% | 3.7% | 33.3% |
| 240020 | TRACTOR, PNEUMATIC TIRED, W/ LOADER AND BACKHOE, UP TO 60 H.P. | 17 | Repair | 7.1% | 16.7% | 21.7% | 26.8% | 21.5% | 6.8% | 3.2% | 30.4% |
| | | | Total (median) | | | 98.7% | | | | | |
| 240030 | TRACTOR, PNEUMATIC TIRED, W/ LOADER AND BACKHOE, 60 H.P. AND ABOVE | 135 | Downtime | 0.8% | 12.9% | 20.9% | 25.4% | 19.0% | 8.0% | 1.3% | 34.0% |
| 240030 | TRACTOR, PNEUMATIC TIRED, W/ LOADER AND BACKHOE, 60 H.P. AND ABOVE | 135 | Trendscore | 24.5% | 29.3% | 39.3% | 52.5% | 43.0% | 16.1% | 2.7% | 92.6% |
| 240030 | TRACTOR, PNEUMATIC TIRED, W/ LOADER AND BACKHOE, 60 H.P. AND ABOVE | 135 | Usage | 0.3% | 13.1% | 20.3% | 25.7% | 19.1% | 7.8% | 1.3% | 34.0% |
| 240030 | TRACTOR, PNEUMATIC TIRED, W/ LOADER AND BACKHOE, 60 H.P. AND ABOVE | 135 | Repair | 0.7% | 14.7% | 21.0% | 25.1% | 18.9% | 7.7% | 1.3% | 38.6% |
| | | | Total (median) | | | 101.5% | | | | | |

| Classcode | Description | Data Points | Attribute | Minimum | 1st Quartile | Median | 3rd Quartile | Mean | St. Dev. | Conf.Int. | Maximum |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 250010 | TRAILER, BUNKHOUSE OR DINING | 5 | Downtime | 11.8% | 16.7% | 27.3% | 33.3% | 25.1% | 10.6% | 9.3% | 36.4% |
| 250010 | TRAILER, BUNKHOUSE OR DINING | 5 | Trendscore | 9.1% | 20.0% | 29.4% | 33.3% | 25.6% | 11.1% | 9.7% | 36.4% |
| 250010 | TRAILER, BUNKHOUSE OR DINING | 5 | Usage | 16.7% | 18.2% | 26.7% | 27.3% | 23.6% | 5.8% | 5.1% | 29.4% |
| 250010 | TRAILER, BUNKHOUSE OR DINING | 5 | Repair | 9.1% | 20.0% | 29.4% | 33.3% | 25.6% | 11.1% | 9.7% | 36.4% |
| | | | Total (median) | | | 112.8% | | | | | |
| 250020 | TRAILER, FIELD LABORATORY OR OFFICE | 13 | Downtime | 8.7% | 13.3% | 25.9% | 27.8% | 22.0% | 8.1% | 4.4% | 30.0% |
| 250020 | TRAILER, FIELD LABORATORY OR OFFICE | 13 | Trendscore | 20.0% | 25.0% | 30.0% | 45.0% | 34.5% | 11.4% | 6.2% | 52.2% |
| 250020 | TRAILER, FIELD LABORATORY OR OFFICE | 13 | Usage | 5.0% | 16.7% | 23.1% | 27.8% | 22.2% | 10.6% | 5.8% | 40.0% |
| 250020 | TRAILER, FIELD LABORATORY OR OFFICE | 13 | Repair | 4.3% | 17.2% | 23.3% | 26.5% | 21.3% | 8.1% | 4.4% | 33.3% |
| | | | Total (median) | | | 102.3% | | | | | |
| 250030 | TRAILER, INSTRUMENTATION, MLS | 1 | Downtime | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 250030 | TRAILER, INSTRUMENTATION, MLS | 1 | Trendscore | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 250030 | TRAILER, INSTRUMENTATION, MLS | 1 | Usage | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 250030 | TRAILER, INSTRUMENTATION, MLS | 1 | Repair | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |
| 260010 | TRAILER, EQUIPMENT, TILT BED OR UTILITY, UP TO 24,000# CAPACITY | 62 | Downtime | 1.7% | 14.8% | 20.2% | 28.1% | 21.4% | 10.6% | 2.6% | 42.7% |
| 260010 | TRAILER, EQUIPMENT, TILT BED OR UTILITY, UP TO 24,000# CAPACITY | 62 | Trendscore | 20.8% | 26.9% | 33.1% | 42.7% | 36.7% | 13.0% | 3.2% | 78.6% |
| 260010 | TRAILER, EQUIPMENT, TILT BED OR UTILITY, UP TO 24,000# CAPACITY | 62 | Usage | 0.9% | 15.2% | 22.0% | 27.5% | 21.5% | 10.0% | 2.5% | 45.9% |
| 260010 | TRAILER, EQUIPMENT, TILT BED OR UTILITY, UP TO 24,000# CAPACITY | 62 | Repair | 1.5% | 15.2% | 22.0% | 26.8% | 20.4% | 8.0% | 2.0% | 33.3% |
| | | | Total (median) | | | 97.2% | | | | | |
| 260020 | TRAILER, EQUIPMENT, TILT BED OR UTILITY, 24,000# CAP. AND GREATER | 332 | Downtime | 0.5% | 15.1% | 22.1% | 28.0% | 21.4% | 9.4% | 1.0% | 49.0% |
| 260020 | TRAILER, EQUIPMENT, TILT BED OR UTILITY, 24,000# CAP. AND GREATER | 332 | Trendscore | 18.6% | 25.6% | 31.4% | 43.3% | 36.0% | 14.3% | 1.5% | 95.4% |
| 260020 | TRAILER, EQUIPMENT, TILT BED OR UTILITY, 24,000# CAP. AND GREATER | 332 | Usage | 0.2% | 15.8% | 23.1% | 28.4% | 21.6% | 9.4% | 1.0% | 53.4% |
| 260020 | TRAILER, EQUIPMENT, TILT BED OR UTILITY, 24,000# CAP. AND GREATER | 332 | Repair | 0.5% | 15.9% | 22.3% | 27.4% | 21.0% | 8.4% | 0.9% | 43.3% |
| | | | Total (median) | | | 98.9% | | | | | |
| 260030 | TRAILER, EQUIPMENT, GOOSENECK | 97 | Downtime | 1.4% | 15.4% | 22.2% | 27.4% | 21.2% | 8.5% | 1.7% | 40.6% |
| 260030 | TRAILER, EQUIPMENT, GOOSENECK | 97 | Trendscore | 18.3% | 24.7% | 31.2% | 44.6% | 37.0% | 16.0% | 3.2% | 91.2% |
| 260030 | TRAILER, EQUIPMENT, GOOSENECK | 97 | Usage | 1.5% | 15.7% | 21.5% | 27.4% | 21.2% | 8.4% | 1.7% | 38.9% |
| 260030 | TRAILER, EQUIPMENT, GOOSENECK | 97 | Repair | 1.4% | 16.7% | 22.4% | 25.5% | 20.7% | 7.4% | 1.5% | 34.4% |
| | | | Total (median) | | | 97.2% | | | | | |
| 270010 | TRAILER, MATERIAL, HYDRAULIC DUMP | 2 | Downtime | 16.7% | 16.7% | 22.6% | 28.6% | 22.6% | 8.4% | 11.7% | 28.6% |
| 270010 | TRAILER, MATERIAL, HYDRAULIC DUMP | 2 | Trendscore | 28.6% | 28.6% | 31.0% | 33.3% | 31.0% | 3.4% | 4.7% | 33.3% |
| 270010 | TRAILER, MATERIAL, HYDRAULIC DUMP | 2 | Usage | 14.3% | 14.3% | 23.8% | 33.3% | 23.8% | 13.5% | 18.7% | 33.3% |
| 270010 | TRAILER, MATERIAL, HYDRAULIC DUMP | 2 | Repair | 16.7% | 16.7% | 22.6% | 28.6% | 22.6% | 8.4% | 11.7% | 28.6% |
| | | | Total (median) | | | 100.0% | | | | | |
| 270030 | TRAILER, BULK PRESSURE | 1 | Downtime | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 270030 | TRAILER, BULK PRESSURE | 1 | Trendscore | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 270030 | TRAILER, BULK PRESSURE | 1 | Usage | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 270030 | TRAILER, BULK PRESSURE | 1 | Repair | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |

| Classcode | Description | Data Points | Attribute | Minimum | 1st Quartile | Median | 3rd Quartile | Mean | St. Dev. | Conf.Int. | Maximum |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 280010 | TRAILER, TRANSPORT, PLATFORM | 110 | Downtime | 0.8% | 12.7% | 21.6% | 25.9% | 20.0% | 9.4% | 1.7% | 39.4% |
| 280010 | TRAILER, TRANSPORT, PLATFORM | 110 | Trendscore | 23.8% | 30.2% | 38.7% | 47.6% | 40.9% | 13.1% | 2.5% | 82.4% |
| 280010 | TRAILER, TRANSPORT, PLATFORM | 110 | Usage | 0.7% | 12.9% | 22.1% | 26.3% | 19.8% | 9.2% | 1.7% | 40.7% |
| 280010 | TRAILER, TRANSPORT, PLATFORM | 110 | Repair | 0.7% | 13.3% | 21.3% | 26.1% | 19.3% | 8.0% | 1.5% | 30.7% |
| | | | Total (median) | | | 103.7% | | | | | |
| 280020 | TRAILER, TRANSPORT, SIGN | 150 | Downtime | 1.1% | 18.1% | 24.3% | 29.4% | 23.7% | 10.3% | 1.6% | 60.9% |
| 280020 | TRAILER, TRANSPORT, SIGN | 150 | Trendscore | 3.7% | 13.8% | 27.0% | 34.3% | 27.2% | 16.1% | 2.6% | 85.1% |
| 280020 | TRAILER, TRANSPORT, SIGN | 150 | Usage | 0.3% | 17.3% | 24.4% | 32.7% | 25.3% | 13.5% | 2.2% | 69.5% |
| 280020 | TRAILER, TRANSPORT, SIGN | 150 | Repair | 0.5% | 16.1% | 24.6% | 31.6% | 23.8% | 10.6% | 1.7% | 54.2% |
| | | | Total (median) | | | 100.3% | | | | | |
| 280030 | TRAILER, TRANSPORT, VAN | 22 | Downtime | 4.5% | 15.9% | 21.7% | 28.3% | 21.4% | 9.9% | 4.2% | 40.7% |
| 280030 | TRAILER, TRANSPORT, VAN | 22 | Trendscore | 23.2% | 26.7% | 33.0% | 43.2% | 37.0% | 14.2% | 5.9% | 72.7% |
| 280030 | TRAILER, TRANSPORT, VAN | 22 | Usage | 4.5% | 13.5% | 23.8% | 27.1% | 20.8% | 8.0% | 3.3% | 31.9% |
| 280030 | TRAILER, TRANSPORT, VAN | 22 | Repair | 4.5% | 14.3% | 23.0% | 27.6% | 20.8% | 8.0% | 3.3% | 31.4% |
| | | | Total (median) | | | 101.5% | | | | | |
| 292000 | TRAILER, POLE | 13 | Downtime | 5.6% | 20.6% | 25.0% | 28.1% | 23.9% | 9.7% | 5.3% | 40.0% |
| 292000 | TRAILER, POLE | 13 | Trendscore | 16.2% | 22.9% | 26.1% | 40.0% | 30.8% | 12.2% | 6.6% | 55.6% |
| 292000 | TRAILER, POLE | 13 | Usage | 3.8% | 23.1% | 25.0% | 26.5% | 22.8% | 6.8% | 3.7% | 27.3% |
| 292000 | TRAILER, POLE | 13 | Repair | 6.7% | 17.9% | 21.6% | 26.1% | 22.5% | 8.2% | 4.4% | 38.5% |
| | | | Total (median) | | | 97.7% | | | | | |
| 300000 | TREE SPADE, TRAILER MOUNTED | 1 | Downtime | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 300000 | TREE SPADE, TRAILER MOUNTED | 1 | Trendscore | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 300000 | TREE SPADE, TRAILER MOUNTED | 1 | Usage | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 300000 | TREE SPADE, TRAILER MOUNTED | 1 | Repair | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |
| 302000 | TRENCHING MACHINE | 21 | Downtime | 4.5% | 16.3% | 21.6% | 25.6% | 19.8% | 7.2% | 3.1% | 28.8% |
| 302000 | TRENCHING MACHINE | 21 | Trendscore | 23.1% | 26.9% | 35.6% | 48.6% | 40.6% | 15.9% | 6.8% | 81.8% |
| 302000 | TRENCHING MACHINE | 21 | Usage | 3.7% | 14.0% | 23.5% | 25.6% | 20.0% | 7.4% | 3.2% | 29.0% |
| 302000 | TRENCHING MACHINE | 21 | Repair | 4.5% | 14.7% | 21.3% | 24.4% | 19.6% | 6.8% | 2.9% | 28.8% |
| | | | Total (median) | | | 102.1% | | | | | |
| 302010 | TRENCHER, WALK BEHIND | 1 | Downtime | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 302010 | TRENCHER, WALK BEHIND | 1 | Trendscore | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 302010 | TRENCHER, WALK BEHIND | 1 | Usage | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 302010 | TRENCHER, WALK BEHIND | 1 | Repair | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |
| 305000 | ROCK/CONCRETE CUTTER, CRAWLER MOUNTED | 1 | Downtime | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 305000 | ROCK/CONCRETE CUTTER, CRAWLER MOUNTED | 1 | Trendscore | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 305000 | ROCK/CONCRETE CUTTER, CRAWLER MOUNTED | 1 | Usage | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 305000 | ROCK/CONCRETE CUTTER, CRAWLER MOUNTED | 1 | Repair | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |

| Classcode | Description | Data Points | Attribute | Minimum | 1st Quartile | Median | 3rd Quartile | Mean | St. Dev. | Conf.Int. | Maximum |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 400010 | TRUCK, 4-WD UTILITY AND CARRYALL | 56 | Downtime | 1.8% | 13.1% | 19.6% | 28.5% | 20.4% | 10.2% | 2.7% | 39.4% |
| 400010 | TRUCK, 4-WD UTILITY AND CARRYALL | 56 | Trendscore | 23.6% | 29.3% | 34.7% | 47.8% | 39.7% | 14.6% | 3.8% | 83.9% |
| 400010 | TRUCK, 4-WD UTILITY AND CARRYALL | 56 | Usage | 1.8% | 13.2% | 21.2% | 26.4% | 20.3% | 9.7% | 2.5% | 43.2% |
| 400010 | TRUCK, 4-WD UTILITY AND CARRYALL | 56 | Repair | 1.8% | 13.1% | 20.9% | 27.0% | 19.6% | 8.2% | 2.2% | 30.5% |
| | | | Total (median) | | | 96.4% | | | | | |
| 400020 | TRUCK, 4-WD PICKUP (ALL SIZES) | 4 | Downtime | 10.0% | 14.1% | 19.8% | 28.9% | 21.5% | 11.0% | 10.8% | 36.4% |
| 400020 | TRUCK, 4-WD PICKUP (ALL SIZES) | 4 | Trendscore | 28.6% | 32.5% | 36.4% | 38.2% | 35.3% | 4.8% | 4.7% | 40.0% |
| 400020 | TRUCK, 4-WD PICKUP (ALL SIZES) | 4 | Usage | 9.1% | 13.6% | 19.8% | 30.7% | 22.2% | 13.0% | 12.7% | 40.0% |
| 400020 | TRUCK, 4-WD PICKUP (ALL SIZES) | 4 | Repair | 10.0% | 14.1% | 22.7% | 27.9% | 21.0% | 8.7% | 8.5% | 28.6% |
| | | | Total (median) | | | 98.7% | | | | | |
| 400030 | TRUCK, 2-WD UTILITY VEHICLE, 3961 TO 5000 GVWR | 288 | Downtime | 0.4% | 13.0% | 20.6% | 26.9% | 20.4% | 9.5% | 1.1% | 47.2% |
| 400030 | TRUCK, 2-WD UTILITY VEHICLE, 3961 TO 5000 GVWR | 288 | Trendscore | 21.3% | 28.2% | 34.8% | 45.6% | 39.5% | 15.9% | 1.8% | 96.6% |
| 400030 | TRUCK, 2-WD UTILITY VEHICLE, 3961 TO 5000 GVWR | 288 | Usage | 0.4% | 14.1% | 22.0% | 26.9% | 20.3% | 8.9% | 1.0% | 43.4% |
| 400030 | TRUCK, 2-WD UTILITY VEHICLE, 3961 TO 5000 GVWR | 288 | Repair | 0.3% | 14.5% | 20.6% | 26.6% | 19.8% | 7.9% | 0.9% | 32.3% |
| | | | Total (median) | | | 98.0% | | | | | |
| 410010 | TRUCK, CARRYALL, UP TO 6950 LBGVWR | 41 | Downtime | 1.6% | 12.9% | 19.8% | 25.7% | 19.8% | 9.2% | 2.8% | 42.1% |
| 410010 | TRUCK, CARRYALL, UP TO 6950 LBGVWR | 41 | Trendscore | 24.3% | 29.8% | 36.3% | 50.7% | 41.6% | 15.7% | 4.8% | 86.0% |
| 410010 | TRUCK, CARRYALL, UP TO 6950 LBGVWR | 41 | Usage | 2.3% | 13.7% | 19.8% | 25.0% | 19.4% | 8.1% | 2.5% | 34.8% |
| 410010 | TRUCK, CARRYALL, UP TO 6950 LBGVWR | 41 | Repair | 2.3% | 14.6% | 22.1% | 23.7% | 19.2% | 7.5% | 2.3% | 32.8% |
| | | | Total (median) | | | 98.0% | | | | | |
| 410020 | TRUCK, CARRYALL, 7000 LB GVWR AND GREATER | 60 | Downtime | 1.6% | 12.7% | 20.9% | 28.0% | 20.8% | 10.0% | 2.5% | 42.6% |
| 410020 | TRUCK, CARRYALL, 7000 LB GVWR AND GREATER | 60 | Trendscore | 23.5% | 27.8% | 33.2% | 46.5% | 38.6% | 14.3% | 3.6% | 88.7% |
| 410020 | TRUCK, CARRYALL, 7000 LB GVWR AND GREATER | 60 | Usage | 1.9% | 13.9% | 20.1% | 27.4% | 20.3% | 8.9% | 2.3% | 40.2% |
| 410020 | TRUCK, CARRYALL, 7000 LB GVWR AND GREATER | 60 | Repair | 1.9% | 13.8% | 20.6% | 26.9% | 20.2% | 8.7% | 2.2% | 36.6% |
| | | | Total (median) | | | 94.8% | | | | | |
| 420010 | TRUCK, CARGO OR WINDOW VAN, UPTO 6200 LB GVWR | 110 | Downtime | 1.0% | 14.6% | 22.1% | 27.4% | 20.7% | 8.8% | 1.6% | 41.7% |
| 420010 | TRUCK, CARGO OR WINDOW VAN, UPTO 6200 LB GVWR | 110 | Trendscore | 20.7% | 27.1% | 32.4% | 44.6% | 38.4% | 16.2% | 3.0% | 89.8% |
| 420010 | TRUCK, CARGO OR WINDOW VAN, UPTO 6200 LB GVWR | 110 | Usage | 1.1% | 15.5% | 20.5% | 27.0% | 20.6% | 8.7% | 1.6% | 37.6% |
| 420010 | TRUCK, CARGO OR WINDOW VAN, UPTO 6200 LB GVWR | 110 | Repair | 1.0% | 13.7% | 21.8% | 26.2% | 20.2% | 7.9% | 1.5% | 35.7% |
| | | | Total (median) | | | 96.8% | | | | | |
| 420020 | TRUCK, CARGO OR WINDOW VAN, 6200 LB GVWR AND GREATER | 89 | Downtime | 1.3% | 13.8% | 21.2% | 27.6% | 20.5% | 8.8% | 1.8% | 39.2% |
| 420020 | TRUCK, CARGO OR WINDOW VAN, 6200 LB GVWR AND GREATER | 89 | Trendscore | 21.5% | 27.5% | 34.3% | 47.9% | 39.3% | 15.7% | 3.3% | 87.2% |
| 420020 | TRUCK, CARGO OR WINDOW VAN, 6200 LB GVWR AND GREATER | 89 | Usage | 0.8% | 15.4% | 22.0% | 26.0% | 20.2% | 7.6% | 1.6% | 31.3% |
| 420020 | TRUCK, CARGO OR WINDOW VAN, 6200 LB GVWR AND GREATER | 89 | Repair | 1.3% | 16.5% | 22.2% | 25.2% | 20.1% | 7.6% | 1.6% | 32.7% |
| | | | Total (median) | | | 99.8% | | | | | |
| 430010 | TRUCK, LIGHT DUTY, PICKUP, UP TO 4600 LB GVWR | 6 | Downtime | 12.5% | 14.3% | 25.0% | 30.0% | 23.8% | 9.2% | 7.4% | 35.7% |
| 430010 | TRUCK, LIGHT DUTY, PICKUP, UP TO 4600 LB GVWR | 6 | Trendscore | 12.5% | 14.3% | 25.0% | 30.0% | 23.8% | 9.2% | 7.4% | 35.7% |
| 430010 | TRUCK, LIGHT DUTY, PICKUP, UP TO 4600 LB GVWR | 6 | Usage | 7.1% | 10.0% | 25.0% | 42.9% | 28.8% | 21.0% | 16.8% | 62.5% |
| 430010 | TRUCK, LIGHT DUTY, PICKUP, UP TO 4600 LB GVWR | 6 | Repair | 12.5% | 14.3% | 25.0% | 30.0% | 23.8% | 9.2% | 7.4% | 35.7% |
| | | | Total (median) | | | 100.0% | | | | | |

| Classcode | Description | Data Points | Attribute | Minimum | 1st Quartile | Median | 3rd Quartile | Mean | St. Dev. | Conf.Int. | Maximum |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 430020 | TRUCK, LIGHT DUTY, PICKUP,4600TO 6199 LB GVWR | 1842 | Downtime | 0.1% | 14.0% | 22.1% | 27.4% | 21.0% | 9.8% | 0.4% | 51.8% |
| 430020 | TRUCK, LIGHT DUTY, PICKUP,4600TO 6199 LB GVWR | 1842 | Trendscore | 19.5% | 26.7% | 32.8% | 44.0% | 37.9% | 15.7% | 0.7% | 98.5% |
| 430020 | TRUCK, LIGHT DUTY, PICKUP,4600TO 6199 LB GVWR | 1842 | Usage | 0.1% | 14.3% | 22.0% | 27.4% | 20.8% | 9.1% | 0.4% | 42.5% |
| 430020 | TRUCK, LIGHT DUTY, PICKUP,4600TO 6199 LB GVWR | 1842 | Repair | 0.1% | 14.7% | 22.4% | 26.5% | 20.3% | 8.0% | 0.4% | 40.4% |
| | | | Total (median) | | | 99.3% | | | | | |
| 430030 | TRUCK, LIGHT DUTY, OTHER BODY STYLES, 4600 TO 6199 LB GVWR | 5 | Downtime | 7.1% | 16.7% | 23.1% | 26.7% | 23.0% | 12.8% | 11.2% | 41.7% |
| 430030 | TRUCK, LIGHT DUTY, OTHER BODY STYLES, 4600 TO 6199 LB GVWR | 5 | Trendscore | 26.7% | 28.6% | 30.8% | 33.3% | 32.2% | 5.8% | 5.1% | 41.7% |
| 430030 | TRUCK, LIGHT DUTY, OTHER BODY STYLES, 4600 TO 6199 LB GVWR | 5 | Usage | 8.3% | 13.3% | 23.1% | 33.3% | 22.8% | 12.0% | 10.5% | 35.7% |
| 430030 | TRUCK, LIGHT DUTY, OTHER BODY STYLES, 4600 TO 6199 LB GVWR | 5 | Repair | 8.3% | 16.7% | 23.1% | 28.6% | 22.0% | 9.8% | 8.6% | 33.3% |
| | | | Total (median) | | | 100.0% | | | | | |
| 430040 | TRUCK, HEAVY DUTY COMPACT, 4320 TO 5600 GVWR | 53 | Downtime | 2.1% | 13.8% | 23.6% | 29.6% | 22.6% | 11.1% | 3.0% | 62.4% |
| 430040 | TRUCK, HEAVY DUTY COMPACT, 4320 TO 5600 GVWR | 53 | Trendscore | 14.7% | 22.7% | 29.8% | 37.0% | 32.6% | 12.6% | 3.4% | 73.2% |
| 430040 | TRUCK, HEAVY DUTY COMPACT, 4320 TO 5600 GVWR | 53 | Usage | 1.2% | 15.7% | 23.7% | 31.5% | 23.0% | 10.2% | 2.8% | 39.6% |
| 430040 | TRUCK, HEAVY DUTY COMPACT, 4320 TO 5600 GVWR | 53 | Repair | 2.1% | 16.3% | 23.3% | 27.0% | 21.8% | 8.9% | 2.4% | 40.7% |
| | | | Total (median) | | | 100.4% | | | | | |
| 430050 | TRUCK, EXTENDED CAB COMPACT, 4245 TO 5034 GVWR | 100 | Downtime | 1.1% | 15.7% | 21.3% | 26.1% | 20.3% | 7.8% | 1.5% | 35.9% |
| 430050 | TRUCK, EXTENDED CAB COMPACT, 4245 TO 5034 GVWR | 100 | Trendscore | 21.4% | 26.8% | 31.9% | 48.2% | 39.4% | 16.3% | 3.2% | 83.3% |
| 430050 | TRUCK, EXTENDED CAB COMPACT, 4245 TO 5034 GVWR | 100 | Usage | 1.1% | 15.6% | 21.0% | 26.3% | 20.3% | 8.3% | 1.6% | 38.8% |
| 430050 | TRUCK, EXTENDED CAB COMPACT, 4245 TO 5034 GVWR | 100 | Repair | 1.0% | 15.2% | 21.6% | 25.5% | 20.0% | 7.3% | 1.4% | 30.5% |
| | | | Total (median) | | | 95.7% | | | | | |
| 430070 | TRUCK, EXTENDED CAB 1/2 TON, 6000 TO 6250 GVWR | 1225 | Downtime | 0.1% | 13.2% | 21.0% | 26.7% | 20.4% | 9.9% | 0.6% | 51.6% |
| 430070 | TRUCK, EXTENDED CAB 1/2 TON, 6000 TO 6250 GVWR | 1225 | Trendscore | 21.4% | 28.2% | 35.0% | 48.3% | 40.0% | 15.1% | 0.8% | 96.5% |
| 430070 | TRUCK, EXTENDED CAB 1/2 TON, 6000 TO 6250 GVWR | 1225 | Usage | 0.1% | 14.4% | 21.3% | 26.3% | 19.9% | 8.2% | 0.5% | 37.0% |
| 430070 | TRUCK, EXTENDED CAB 1/2 TON, 6000 TO 6250 GVWR | 1225 | Repair | 0.1% | 15.1% | 21.5% | 25.9% | 19.7% | 7.8% | 0.4% | 33.5% |
| | | | Total (median) | | | 98.8% | | | | | |
| 440010 | TRUCK, LIGHT DUTY, PICKUP, 6200 TO 7999 LB. GVWR | 242 | Downtime | 0.5% | 13.9% | 21.9% | 27.6% | 20.7% | 9.3% | 1.2% | 44.5% |
| 440010 | TRUCK, LIGHT DUTY, PICKUP, 6200 TO 7999 LB. GVWR | 242 | Trendscore | 19.8% | 27.2% | 32.8% | 45.0% | 38.7% | 16.4% | 2.1% | 93.1% |
| 440010 | TRUCK, LIGHT DUTY, PICKUP, 6200 TO 7999 LB. GVWR | 242 | Usage | 0.5% | 14.9% | 21.6% | 26.4% | 20.4% | 8.3% | 1.0% | 38.2% |
| 440010 | TRUCK, LIGHT DUTY, PICKUP, 6200 TO 7999 LB. GVWR | 242 | Repair | 0.5% | 14.9% | 21.1% | 26.2% | 20.1% | 7.7% | 1.0% | 34.0% |
| | | | Total (median) | | | 97.4% | | | | | |
| 440020 | TRUCK, LIGHT DUTY, OTHER BODY STYLES, 6200 TO 7999 LB. GVWR | 15 | Downtime | 3.6% | 11.1% | 21.2% | 28.6% | 21.0% | 10.2% | 5.2% | 43.3% |
| 440020 | TRUCK, LIGHT DUTY, OTHER BODY STYLES, 6200 TO 7999 LB. GVWR | 15 | Trendscore | 23.2% | 28.0% | 36.1% | 46.4% | 38.5% | 11.7% | 5.9% | 68.4% |
| 440020 | TRUCK, LIGHT DUTY, OTHER BODY STYLES, 6200 TO 7999 LB. GVWR | 15 | Usage | 3.6% | 12.9% | 21.1% | 27.3% | 20.3% | 8.1% | 4.1% | 31.6% |
| 440020 | TRUCK, LIGHT DUTY, OTHER BODY STYLES, 6200 TO 7999 LB. GVWR | 15 | Repair | 3.3% | 12.1% | 22.2% | 26.0% | 20.2% | 7.7% | 3.9% | 28.9% |
| | | | Total (median) | | | 100.6% | | | | | |
| 440030 | TRUCK, EXTENDED CAB 3/4 TON, 6800 TO 8800 GVWR | 191 | Downtime | 0.7% | 13.1% | 20.3% | 25.9% | 19.8% | 8.8% | 1.3% | 44.0% |
| 440030 | TRUCK, EXTENDED CAB 3/4 TON, 6800 TO 8800 GVWR | 191 | Trendscore | 23.5% | 28.8% | 36.9% | 50.2% | 41.4% | 15.8% | 2.2% | 89.1% |
| 440030 | TRUCK, EXTENDED CAB 3/4 TON, 6800 TO 8800 GVWR | 191 | Usage | 0.3% | 15.0% | 20.8% | 25.5% | 19.5% | 7.8% | 1.1% | 32.4% |
| 440030 | TRUCK, EXTENDED CAB 3/4 TON, 6800 TO 8800 GVWR | 191 | Repair | 0.5% | 13.3% | 21.1% | 25.4% | 19.4% | 7.7% | 1.1% | 32.9% |
| | | | Total (median) | | | 99.0% | | | | | |

| Classcode | Description | Data Points | Attribute | Minimum | 1st Quartile | Median | 3rd Quartile | Mean | St. Dev. | Conf.Int. | Maximum |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 450010 | TRUCK, LIGHT DUTY,8000 TO 8999GVWR, PICKUP BODY | 91 | Downtime | 0.7% | 14.4% | 22.0% | 25.1% | 19.8% | 7.8% | 1.6% | 33.7% |
| 450010 | TRUCK, LIGHT DUTY,8000 TO 8999GVWR, PICKUP BODY | 91 | Trendscore | 23.5% | 27.5% | 37.4% | 51.3% | 41.2% | 15.6% | 3.2% | 84.6% |
| 450010 | TRUCK, LIGHT DUTY,8000 TO 8999GVWR, PICKUP BODY | 91 | Usage | 0.8% | 15.4% | 22.4% | 25.1% | 19.6% | 7.7% | 1.6% | 34.0% |
| 450010 | TRUCK, LIGHT DUTY,8000 TO 8999GVWR, PICKUP BODY | 91 | Repair | 0.8% | 15.0% | 21.8% | 24.8% | 19.4% | 7.0% | 1.4% | 28.3% |
| | | | Total (median) | | | 103.5% | | | | | |
| 450020 | TRUCK, LIGHT DUTY,8000 TO 8999GVWR, OTHER BODY STYLES | 90 | Downtime | 0.9% | 13.7% | 20.1% | 27.4% | 20.3% | 9.5% | 2.0% | 41.7% |
| 450020 | TRUCK, LIGHT DUTY,8000 TO 8999GVWR, OTHER BODY STYLES | 90 | Trendscore | 22.7% | 28.9% | 34.0% | 45.1% | 39.8% | 15.2% | 3.1% | 90.1% |
| 450020 | TRUCK, LIGHT DUTY,8000 TO 8999GVWR, OTHER BODY STYLES | 90 | Usage | 1.2% | 14.0% | 21.4% | 26.2% | 20.0% | 8.7% | 1.8% | 40.4% |
| 450020 | TRUCK, LIGHT DUTY,8000 TO 8999GVWR, OTHER BODY STYLES | 90 | Repair | 1.1% | 13.7% | 20.7% | 26.5% | 19.9% | 8.3% | 1.7% | 34.5% |
| | | | Total (median) | | | 96.3% | | | | | |
| 460010 | TRUCK, LIGHT DUTY, 9000 GVWR AND GREATER, PICKUP BODY | 19 | Downtime | 3.6% | 15.9% | 22.8% | 26.1% | 20.5% | 7.6% | 3.4% | 32.7% |
| 460010 | TRUCK, LIGHT DUTY, 9000 GVWR AND GREATER, PICKUP BODY | 19 | Trendscore | 22.4% | 26.8% | 33.3% | 50.0% | 38.6% | 14.7% | 6.6% | 71.4% |
| 460010 | TRUCK, LIGHT DUTY, 9000 GVWR AND GREATER, PICKUP BODY | 19 | Usage | 4.3% | 14.3% | 22.4% | 25.5% | 20.4% | 7.6% | 3.4% | 31.6% |
| 460010 | TRUCK, LIGHT DUTY, 9000 GVWR AND GREATER, PICKUP BODY | 19 | Repair | 4.3% | 13.6% | 23.3% | 26.9% | 20.5% | 8.0% | 3.6% | 34.1% |
| | | | Total (median) | | | 101.9% | | | | | |
| 460020 | TRUCK, LIGHT DUTY, 9000 GVWR AND GREATER, OTHER BODY STYLES | 139 | Downtime | 0.9% | 15.1% | 20.7% | 25.6% | 19.9% | 8.0% | 1.3% | 34.8% |
| 460020 | TRUCK, LIGHT DUTY, 9000 GVWR AND GREATER, OTHER BODY STYLES | 139 | Trendscore | 22.3% | 27.7% | 35.0% | 50.9% | 40.5% | 16.1% | 2.7% | 97.4% |
| 460020 | TRUCK, LIGHT DUTY, 9000 GVWR AND GREATER, OTHER BODY STYLES | 139 | Usage | 0.9% | 14.8% | 20.6% | 26.6% | 19.9% | 8.4% | 1.4% | 35.6% |
| 460020 | TRUCK, LIGHT DUTY, 9000 GVWR AND GREATER, OTHER BODY STYLES | 139 | Repair | 0.9% | 15.2% | 21.1% | 25.7% | 19.7% | 7.8% | 1.3% | 36.3% |
| | | | Total (median) | | | 97.4% | | | | | |
| 460060 | TRUCK, LIGHT DUTY, 9000 GVWR AND GREATER, ALL BODY STYLES, HRLY RATE | 3 | Downtime | 14.3% | 14.3% | 22.2% | 37.5% | 24.7% | 11.8% | 13.4% | 37.5% |
| 460060 | TRUCK, LIGHT DUTY, 9000 GVWR AND GREATER, ALL BODY STYLES, HRLY RATE | 3 | Trendscore | 11.1% | 11.1% | 25.0% | 42.9% | 26.3% | 15.9% | 18.0% | 42.9% |
| 460060 | TRUCK, LIGHT DUTY, 9000 GVWR AND GREATER, ALL BODY STYLES, HRLY RATE | 3 | Usage | 12.5% | 12.5% | 28.6% | 33.3% | 24.8% | 10.9% | 12.4% | 33.3% |
| 460060 | TRUCK, LIGHT DUTY, 9000 GVWR AND GREATER, ALL BODY STYLES, HRLY RATE | 3 | Repair | 14.3% | 14.3% | 25.0% | 33.3% | 24.2% | 9.5% | 10.8% | 33.3% |
| | | | Total (median) | | | 100.8% | | | | | |
| 470010 | TRUCK, LIGHT DUTY, CREW CAB, UP TO 7900 GVWR, ALL BODY STYLES | 2 | Downtime | 16.7% | 16.7% | 22.6% | 28.6% | 22.6% | 8.4% | 11.7% | 28.6% |
| 470010 | TRUCK, LIGHT DUTY, CREW CAB, UP TO 7900 GVWR, ALL BODY STYLES | 2 | Trendscore | 28.6% | 28.6% | 31.0% | 33.3% | 31.0% | 3.4% | 4.7% | 33.3% |
| 470010 | TRUCK, LIGHT DUTY, CREW CAB, UP TO 7900 GVWR, ALL BODY STYLES | 2 | Usage | 14.3% | 14.3% | 23.8% | 33.3% | 23.8% | 13.5% | 18.7% | 33.3% |
| 470010 | TRUCK, LIGHT DUTY, CREW CAB, UP TO 7900 GVWR, ALL BODY STYLES | 2 | Repair | 16.7% | 16.7% | 22.6% | 28.6% | 22.6% | 8.4% | 11.7% | 28.6% |
| | | | Total (median) | | | 100.0% | | | | | |
| 470020 | TRUCK, LIGHT DUTY, CREW CAB, 7901 TO 8999 GVWR, ALL BODY STYLES | 12 | Downtime | 7.7% | 12.5% | 18.1% | 29.6% | 22.0% | 12.4% | 7.0% | 44.0% |
| 470020 | TRUCK, LIGHT DUTY, CREW CAB, 7901 TO 8999 GVWR, ALL BODY STYLES | 12 | Trendscore | 23.7% | 28.2% | 33.3% | 37.6% | 35.4% | 12.1% | 6.9% | 69.2% |
| 470020 | TRUCK, LIGHT DUTY, CREW CAB, 7901 TO 8999 GVWR, ALL BODY STYLES | 12 | Usage | 4.3% | 15.6% | 21.1% | 26.0% | 21.4% | 9.6% | 5.4% | 39.3% |
| 470020 | TRUCK, LIGHT DUTY, CREW CAB, 7901 TO 8999 GVWR, ALL BODY STYLES | 12 | Repair | 7.7% | 13.4% | 21.5% | 28.8% | 21.2% | 9.3% | 5.3% | 35.7% |
| | | | Total (median) | | | 94.0% | | | | | |
| 470030 | TRUCK, LIGHT DUTY, CREW CAB, 9000 TO 14900 GVWR, ALL BODY STYLES | 193 | Downtime | 0.5% | 14.5% | 21.5% | 25.6% | 19.8% | 8.2% | 1.2% | 37.6% |
| 470030 | TRUCK, LIGHT DUTY, CREW CAB, 9000 TO 14900 GVWR, ALL BODY STYLES | 193 | Trendscore | 21.7% | 28.4% | 33.9% | 49.9% | 40.8% | 16.8% | 2.4% | 95.2% |
| 470030 | TRUCK, LIGHT DUTY, CREW CAB, 9000 TO 14900 GVWR, ALL BODY STYLES | 193 | Usage | 0.4% | 14.6% | 21.1% | 25.7% | 19.8% | 8.1% | 1.1% | 34.9% |
| 470030 | TRUCK, LIGHT DUTY, CREW CAB, 9000 TO 14900 GVWR, ALL BODY STYLES | 193 | Repair | 0.5% | 14.4% | 20.8% | 25.4% | 19.6% | 7.6% | 1.1% | 37.6% |
| | | | Total (median) | | | 97.2% | | | | | |

| Classcode | Description | Data Points | Attribute | Minimum | 1st Quartile | Median | 3rd Quartile | Mean | St. Dev. | Conf.Int. | Maximum |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 480010 | TRUCK,PLATFORM, PLATFORM DUMP,STAKE, 9000 TO 14900 GVWR | 172 | Downtime | 0.7% | 14.6% | 21.5% | 26.6% | 20.5% | 9.0% | 1.3% | 48.0% |
| 480010 | TRUCK,PLATFORM, PLATFORM DUMP,STAKE, 9000 TO 14900 GVWR | 172 | Trendscore | 20.3% | 26.9% | 33.2% | 46.7% | 38.8% | 15.5% | 2.3% | 98.0% |
| 480010 | TRUCK,PLATFORM, PLATFORM DUMP,STAKE, 9000 TO 14900 GVWR | 172 | Usage | 0.6% | 15.3% | 21.2% | 26.7% | 20.5% | 8.7% | 1.3% | 38.6% |
| 480010 | TRUCK,PLATFORM, PLATFORM DUMP,STAKE, 9000 TO 14900 GVWR | 172 | Repair | 0.7% | 14.8% | 21.7% | 26.4% | 20.2% | 8.2% | 1.2% | 38.2% |
| | | | Total (median) | | | 97.6% | | | | | |
| 480060 | TRUCK,PLATFORM, PLATFORM DUMP,STAKE, 9000 TO 14900 GVWR,HRLYRATE | 2 | Downtime | 16.7% | 16.7% | 25.0% | 33.3% | 25.0% | 11.8% | 16.3% | 33.3% |
| 480060 | TRUCK,PLATFORM, PLATFORM DUMP,STAKE, 9000 TO 14900 GVWR,HRLYRATE | 2 | Trendscore | 16.7% | 16.7% | 25.0% | 33.3% | 25.0% | 11.8% | 16.3% | 33.3% |
| 480060 | TRUCK,PLATFORM, PLATFORM DUMP,STAKE, 9000 TO 14900 GVWR,HRLYRATE | 2 | Usage | 16.7% | 16.7% | 25.0% | 33.3% | 25.0% | 11.8% | 16.3% | 33.3% |
| 480060 | TRUCK,PLATFORM, PLATFORM DUMP,STAKE, 9000 TO 14900 GVWR,HRLYRATE | 2 | Repair | 16.7% | 16.7% | 25.0% | 33.3% | 25.0% | 11.8% | 16.3% | 33.3% |
| | | | Total (median) | | | 100.0% | | | | | |
| 490010 | TRUCK, LIGHT/MEDIUM, 14,500 TO17,340 GVWR | 239 | Downtime | 0.5% | 13.7% | 20.8% | 27.0% | 20.2% | 9.2% | 1.2% | 43.2% |
| 490010 | TRUCK, LIGHT/MEDIUM, 14,500 TO17,340 GVWR | 239 | Trendscore | 21.6% | 28.2% | 34.0% | 46.1% | 39.9% | 16.0% | 2.0% | 93.1% |
| 490010 | TRUCK, LIGHT/MEDIUM, 14,500 TO17,340 GVWR | 239 | Usage | 0.4% | 14.1% | 21.7% | 26.4% | 20.2% | 8.8% | 1.1% | 42.1% |
| 490010 | TRUCK, LIGHT/MEDIUM, 14,500 TO17,340 GVWR | 239 | Repair | 0.5% | 14.1% | 21.2% | 25.7% | 19.8% | 8.0% | 1.0% | 34.7% |
| | | | Total (median) | | | 97.7% | | | | | |
| 500010 | TRUCK, ALL BODY STYLES, 15000 TO 18900 GVWR | 6 | Downtime | 7.7% | 15.4% | 20.5% | 26.3% | 20.1% | 7.9% | 6.3% | 30.0% |
| 500010 | TRUCK, ALL BODY STYLES, 15000 TO 18900 GVWR | 6 | Trendscore | 30.0% | 31.6% | 35.8% | 46.2% | 37.6% | 7.5% | 6.0% | 46.2% |
| 500010 | TRUCK, ALL BODY STYLES, 15000 TO 18900 GVWR | 6 | Usage | 6.7% | 10.0% | 22.1% | 31.6% | 21.8% | 12.2% | 9.8% | 38.5% |
| 500010 | TRUCK, ALL BODY STYLES, 15000 TO 18900 GVWR | 6 | Repair | 7.7% | 15.4% | 18.4% | 30.0% | 20.5% | 9.7% | 7.7% | 33.3% |
| | | | Total (median) | | | 96.8% | | | | | |
| 510010 | TRUCK, ALL BODY STYLES, 19000 TO 20900 GVWR | 29 | Downtime | 2.8% | 12.7% | 18.8% | 27.2% | 20.4% | 10.2% | 3.7% | 38.3% |
| 510010 | TRUCK, ALL BODY STYLES, 19000 TO 20900 GVWR | 29 | Trendscore | 23.8% | 29.4% | 35.2% | 47.5% | 39.3% | 12.6% | 4.6% | 69.4% |
| 510010 | TRUCK, ALL BODY STYLES, 19000 TO 20900 GVWR | 29 | Usage | 2.1% | 16.0% | 21.6% | 26.7% | 20.4% | 9.2% | 3.3% | 33.3% |
| 510010 | TRUCK, ALL BODY STYLES, 19000 TO 20900 GVWR | 29 | Repair | 2.6% | 13.2% | 22.7% | 25.6% | 19.8% | 8.4% | 3.0% | 35.2% |
| | | | Total (median) | | | 98.3% | | | | | |
| 520010 | TRUCK, ALL BODY STYLES EXCEPT CONV. DUMP, 21000 TO 25400 GVWR | 52 | Downtime | 1.7% | 14.7% | 20.5% | 27.3% | 20.1% | 8.4% | 2.3% | 34.0% |
| 520010 | TRUCK, ALL BODY STYLES EXCEPT CONV. DUMP, 21000 TO 25400 GVWR | 52 | Trendscore | 22.3% | 28.2% | 34.4% | 46.4% | 39.7% | 15.2% | 4.1% | 75.0% |
| 520010 | TRUCK, ALL BODY STYLES EXCEPT CONV. DUMP, 21000 TO 25400 GVWR | 52 | Usage | 1.7% | 14.4% | 20.7% | 26.9% | 20.3% | 8.7% | 2.4% | 40.0% |
| 520010 | TRUCK, ALL BODY STYLES EXCEPT CONV. DUMP, 21000 TO 25400 GVWR | 52 | Repair | 1.5% | 13.9% | 21.5% | 26.0% | 19.8% | 7.7% | 2.1% | 32.9% |
| | | | Total (median) | | | 97.1% | | | | | |
| 520020 | TRUCK, CONVENTIONAL DUMP, 21000 TO 25400 GVWR | 7 | Downtime | 16.7% | 17.6% | 23.8% | 28.0% | 23.3% | 4.7% | 3.5% | 28.6% |
| 520020 | TRUCK, CONVENTIONAL DUMP, 21000 TO 25400 GVWR | 7 | Trendscore | 19.0% | 21.4% | 29.4% | 33.3% | 29.7% | 10.3% | 7.7% | 50.0% |
| 520020 | TRUCK, CONVENTIONAL DUMP, 21000 TO 25400 GVWR | 7 | Usage | 13.0% | 16.7% | 24.0% | 29.4% | 23.9% | 7.2% | 5.4% | 33.3% |
| 520020 | TRUCK, CONVENTIONAL DUMP, 21000 TO 25400 GVWR | 7 | Repair | 16.7% | 21.4% | 23.5% | 24.0% | 23.2% | 4.1% | 3.0% | 30.4% |
| | | | Total (median) | | | 100.8% | | | | | |
| 520030 | TRUCK, EJECTION TYPE MATERIAL BODY, 21000 TO 25400 GVWR | 19 | Downtime | 5.0% | 12.5% | 24.6% | 27.0% | 20.2% | 9.2% | 4.1% | 33.3% |
| 520030 | TRUCK, EJECTION TYPE MATERIAL BODY, 21000 TO 25400 GVWR | 19 | Trendscore | 26.1% | 29.3% | 34.7% | 45.9% | 40.0% | 14.2% | 6.4% | 85.0% |
| 520030 | TRUCK, EJECTION TYPE MATERIAL BODY, 21000 TO 25400 GVWR | 19 | Usage | 5.0% | 13.5% | 19.7% | 28.1% | 20.3% | 9.6% | 4.3% | 35.9% |
| 520030 | TRUCK, EJECTION TYPE MATERIAL BODY, 21000 TO 25400 GVWR | 19 | Repair | 5.0% | 13.5% | 19.5% | 26.5% | 19.5% | 7.6% | 3.4% | 28.9% |
| | | | Total (median) | | | 98.5% | | | | | |

| Classcode | Description | Data Points | Attribute | Minimum | 1st Quartile | Median | 3rd Quartile | Mean | St. Dev. | Conf.Int. | Maximum |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 520040 | TRUCK, CREW CAB, ALL BODY STYLES, 21000 TO 25400 GVWR | 1 | Downtime | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 520040 | TRUCK, CREW CAB, ALL BODY STYLES, 21000 TO 25400 GVWR | 1 | Trendscore | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 520040 | TRUCK, CREW CAB, ALL BODY STYLES, 21000 TO 25400 GVWR | 1 | Usage | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 520040 | TRUCK, CREW CAB, ALL BODY STYLES, 21000 TO 25400 GVWR | 1 | Repair | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |
| 520050 | TRUCK, CONV. DUMP W/FRONT END LOADER, 21000 TO 25400 GVWR, HRLY RATE | 1 | Downtime | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 520050 | TRUCK, CONV. DUMP W/FRONT END LOADER, 21000 TO 25400 GVWR, HRLY RATE | 1 | Trendscore | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 520050 | TRUCK, CONV. DUMP W/FRONT END LOADER, 21000 TO 25400 GVWR, HRLY RATE | 1 | Usage | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 520050 | TRUCK, CONV. DUMP W/FRONT END LOADER, 21000 TO 25400 GVWR, HRLY RATE | 1 | Repair | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |
| 520060 | TRUCK, ALL STYLES, 21000 TO 25400 GVWR, HOURLY RATE | 1 | Downtime | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 520060 | TRUCK, ALL STYLES, 21000 TO 25400 GVWR, HOURLY RATE | 1 | Trendscore | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 520060 | TRUCK, ALL STYLES, 21000 TO 25400 GVWR, HOURLY RATE | 1 | Usage | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 520060 | TRUCK, ALL STYLES, 21000 TO 25400 GVWR, HOURLY RATE | 1 | Repair | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |
| 530010 | TRUCK, ALL BODY STYLES EXCEPT CONV. DUMP/WRECKER,25500-28900GVWR | 52 | Downtime | 2.0% | 13.1% | 20.0% | 26.5% | 19.6% | 9.2% | 2.5% | 45.3% |
| 530010 | TRUCK, ALL BODY STYLES EXCEPT CONV. DUMP/WRECKER,25500-28900GVWR | 52 | Trendscore | 23.1% | 30.6% | 35.5% | 48.1% | 40.8% | 15.0% | 4.1% | 93.9% |
| 530010 | TRUCK, ALL BODY STYLES EXCEPT CONV. DUMP/WRECKER,25500-28900GVWR | 52 | Usage | 2.0% | 13.7% | 20.8% | 25.7% | 19.8% | 9.1% | 2.5% | 41.9% |
| 530010 | TRUCK, ALL BODY STYLES EXCEPT CONV. DUMP/WRECKER,25500-28900GVWR | 52 | Repair | 2.0% | 14.0% | 20.4% | 26.1% | 19.7% | 8.9% | 2.4% | 35.2% |
| | | | Total (median) | | | 96.7% | | | | | |
| 530020 | TRUCK, CONVENTIONAL DUMP, 25500 TO 28900 GVWR | 3 | Downtime | 16.7% | 16.7% | 25.0% | 30.0% | 23.9% | 6.7% | 7.6% | 30.0% |
| 530020 | TRUCK, CONVENTIONAL DUMP, 25500 TO 28900 GVWR | 3 | Trendscore | 12.5% | 12.5% | 30.0% | 33.3% | 25.3% | 11.2% | 12.7% | 33.3% |
| 530020 | TRUCK, CONVENTIONAL DUMP, 25500 TO 28900 GVWR | 3 | Usage | 10.0% | 10.0% | 33.3% | 37.5% | 26.9% | 14.8% | 16.8% | 37.5% |
| 530020 | TRUCK, CONVENTIONAL DUMP, 25500 TO 28900 GVWR | 3 | Repair | 16.7% | 16.7% | 25.0% | 30.0% | 23.9% | 6.7% | 7.6% | 30.0% |
| | | | Total (median) | | | 113.3% | | | | | |
| 530030 | TRUCK, EJECTION TYPE MATERIAL BODY, 25500 TO 38900 GVWR | 19 | Downtime | 4.0% | 12.3% | 20.9% | 26.6% | 19.0% | 7.8% | 3.5% | 28.9% |
| 530030 | TRUCK, EJECTION TYPE MATERIAL BODY, 25500 TO 38900 GVWR | 19 | Trendscore | 26.0% | 29.7% | 40.4% | 50.0% | 43.2% | 16.2% | 7.3% | 79.2% |
| 530030 | TRUCK, EJECTION TYPE MATERIAL BODY, 25500 TO 38900 GVWR | 19 | Usage | 3.7% | 12.0% | 18.4% | 26.1% | 18.9% | 7.7% | 3.5% | 31.6% |
| 530030 | TRUCK, EJECTION TYPE MATERIAL BODY, 25500 TO 38900 GVWR | 19 | Repair | 4.2% | 11.1% | 22.8% | 24.2% | 18.8% | 7.2% | 3.3% | 28.1% |
| | | | Total (median) | | | 102.6% | | | | | |
| 530040 | TRUCK, WRECKER, 25500 TO 28900GVWR | 1 | Downtime | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 530040 | TRUCK, WRECKER, 25500 TO 28900GVWR | 1 | Trendscore | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 530040 | TRUCK, WRECKER, 25500 TO 28900GVWR | 1 | Usage | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 530040 | TRUCK, WRECKER, 25500 TO 28900GVWR | 1 | Repair | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |
| 530050 | TRUCK, CREW CAB, ALL BODY STYLES, 25500 TO 28900 GVWR | 1 | Downtime | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 530050 | TRUCK, CREW CAB, ALL BODY STYLES, 25500 TO 28900 GVWR | 1 | Trendscore | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 530050 | TRUCK, CREW CAB, ALL BODY STYLES, 25500 TO 28900 GVWR | 1 | Usage | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 530050 | TRUCK, CREW CAB, ALL BODY STYLES, 25500 TO 28900 GVWR | 1 | Repair | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |

| Classcode | Description | Data Points | Attribute | Minimum | 1st Quartile | Median | 3rd Quartile | Mean | St. Dev. | Conf.Int. | Maximum |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 530060 | TRUCK, 25500 TO 28900 GVWR, ALL STYLES, HOURLY RATE | 2 | Downtime | 20.0% | 20.0% | 22.5% | 25.0% | 22.5% | 3.5% | 4.9% | 25.0% |
| 530060 | TRUCK, 25500 TO 28900 GVWR, ALL STYLES, HOURLY RATE | 2 | Trendscore | 25.0% | 25.0% | 32.5% | 40.0% | 32.5% | 10.6% | 14.7% | 40.0% |
| 530060 | TRUCK, 25500 TO 28900 GVWR, ALL STYLES, HOURLY RATE | 2 | Usage | 20.0% | 20.0% | 22.5% | 25.0% | 22.5% | 3.5% | 4.9% | 25.0% |
| 530060 | TRUCK, 25500 TO 28900 GVWR, ALL STYLES, HOURLY RATE | 2 | Repair | 20.0% | 20.0% | 22.5% | 25.0% | 22.5% | 3.5% | 4.9% | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |
| 540010 | TRUCK, DUMP, SINGLE REAR AXLE,29000 TO 42900 GVWR (6 YARD) | 1314 | Downtime | 2.9% | 13.7% | 20.3% | 24.8% | 19.1% | 7.7% | 0.4% | 46.2% |
| 540010 | TRUCK, DUMP, SINGLE REAR AXLE,29000 TO 42900 GVWR (6 YARD) | 1314 | Trendscore | 23.0% | 29.0% | 36.1% | 51.9% | 42.8% | 18.0% | 1.0% | 92.0% |
| 540010 | TRUCK, DUMP, SINGLE REAR AXLE,29000 TO 42900 GVWR (6 YARD) | 1314 | Usage | 1.8% | 13.9% | 20.2% | 25.2% | 19.2% | 7.7% | 0.4% | 38.5% |
| 540010 | TRUCK, DUMP, SINGLE REAR AXLE,29000 TO 42900 GVWR (6 YARD) | 1314 | Repair | 2.1% | 14.3% | 20.3% | 24.7% | 18.9% | 7.1% | 0.4% | 36.1% |
| | | | Total (median) | | | 97.0% | | | | | |
| 540020 | TRUCK, DUMP, TANDEM REAR AXLE,43000 GVWR AND GREATER (10 YARD) | 631 | Downtime | 0.2% | 13.9% | 20.8% | 24.3% | 18.7% | 7.4% | 0.6% | 34.2% |
| 540020 | TRUCK, DUMP, TANDEM REAR AXLE,43000 GVWR AND GREATER (10 YARD) | 631 | Trendscore | 24.1% | 30.0% | 38.5% | 54.0% | 44.3% | 17.8% | 1.4% | 99.2% |
| 540020 | TRUCK, DUMP, TANDEM REAR AXLE,43000 GVWR AND GREATER (10 YARD) | 631 | Usage | 0.1% | 13.5% | 20.6% | 24.3% | 18.6% | 7.1% | 0.6% | 30.2% |
| 540020 | TRUCK, DUMP, TANDEM REAR AXLE,43000 GVWR AND GREATER (10 YARD) | 631 | Repair | 0.2% | 14.4% | 20.6% | 24.0% | 18.5% | 6.8% | 0.5% | 29.3% |
| | | | Total (median) | | | 100.5% | | | | | |
| 550010 | TRUCK, ALL STYLES EXCEPT DUMP,SINGLE REAR AXLE, 29000-38900 GVWR | 67 | Downtime | 1.1% | 13.7% | 20.4% | 25.4% | 19.3% | 8.2% | 2.0% | 33.7% |
| 550010 | TRUCK, ALL STYLES EXCEPT DUMP,SINGLE REAR AXLE, 29000-38900 GVWR | 67 | Trendscore | 24.9% | 29.7% | 38.5% | 52.1% | 42.6% | 15.8% | 3.8% | 88.6% |
| 550010 | TRUCK, ALL STYLES EXCEPT DUMP,SINGLE REAR AXLE, 29000-38900 GVWR | 67 | Usage | 1.4% | 12.7% | 20.0% | 25.5% | 19.2% | 8.2% | 2.0% | 40.5% |
| 550010 | TRUCK, ALL STYLES EXCEPT DUMP,SINGLE REAR AXLE, 29000-38900 GVWR | 67 | Repair | 1.0% | 13.3% | 20.9% | 24.9% | 18.9% | 7.3% | 1.8% | 30.0% |
| | | | Total (median) | | | 99.8% | | | | | |
| 550020 | TRUCK, ALL STYLES EXCEPT DUMP,TANDEM REAR AXLE, 39000 GVWR AND UP | 17 | Downtime | 4.5% | 12.2% | 22.6% | 26.3% | 20.4% | 10.1% | 4.8% | 40.5% |
| 550020 | TRUCK, ALL STYLES EXCEPT DUMP,TANDEM REAR AXLE, 39000 GVWR AND UP | 17 | Trendscore | 25.8% | 32.0% | 35.6% | 43.2% | 40.5% | 13.7% | 6.5% | 72.7% |
| 550020 | TRUCK, ALL STYLES EXCEPT DUMP,TANDEM REAR AXLE, 39000 GVWR AND UP | 17 | Usage | 2.7% | 15.9% | 20.0% | 23.9% | 19.6% | 7.9% | 3.7% | 32.7% |
| 550020 | TRUCK, ALL STYLES EXCEPT DUMP,TANDEM REAR AXLE, 39000 GVWR AND UP | 17 | Repair | 4.5% | 13.5% | 20.0% | 25.8% | 19.5% | 8.9% | 4.2% | 37.8% |
| | | | Total (median) | | | 98.1% | | | | | |
| 550030 | TRUCK, ALL STYLES EXCEPT DUMP,SINGLE REAR AXLE, 29000-38900 GVWR HRLY | 1 | Downtime | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 550030 | TRUCK, ALL STYLES EXCEPT DUMP,SINGLE REAR AXLE, 29000-38900 GVWR HRLY | 1 | Trendscore | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 550030 | TRUCK, ALL STYLES EXCEPT DUMP,SINGLE REAR AXLE, 29000-38900 GVWR HRLY | 1 | Usage | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 550030 | TRUCK, ALL STYLES EXCEPT DUMP,SINGLE REAR AXLE, 29000-38900 GVWR HRLY | 1 | Repair | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |
| 550040 | TRUCK, ALL STYLES EXCEPT DUMP,TANDEM REAR AXLE, 39000 GVWR AND UP | 3 | Downtime | 20.0% | 20.0% | 25.0% | 25.0% | 23.3% | 2.9% | 3.3% | 25.0% |
| 550040 | TRUCK, ALL STYLES EXCEPT DUMP,TANDEM REAR AXLE, 39000 GVWR AND UP | 3 | Trendscore | 25.0% | 25.0% | 25.0% | 40.0% | 30.0% | 8.7% | 9.8% | 40.0% |
| 550040 | TRUCK, ALL STYLES EXCEPT DUMP,TANDEM REAR AXLE, 39000 GVWR AND UP | 3 | Usage | 20.0% | 20.0% | 25.0% | 25.0% | 23.3% | 2.9% | 3.3% | 25.0% |
| 550040 | TRUCK, ALL STYLES EXCEPT DUMP,TANDEM REAR AXLE, 39000 GVWR AND UP | 3 | Repair | 20.0% | 20.0% | 25.0% | 25.0% | 23.3% | 2.9% | 3.3% | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |
| 600010 | TRUCK TRACTOR, SINGLE REAR AXLE UP TO 60000 GCWR | 16 | Downtime | 5.7% | 16.5% | 24.3% | 29.3% | 24.2% | 11.1% | 5.4% | 50.0% |
| 600010 | TRUCK TRACTOR, SINGLE REAR AXLE UP TO 60000 GCWR | 16 | Trendscore | 16.7% | 21.9% | 27.9% | 34.8% | 29.8% | 12.4% | 6.1% | 66.7% |
| 600010 | TRUCK TRACTOR, SINGLE REAR AXLE UP TO 60000 GCWR | 16 | Usage | 8.3% | 17.8% | 21.6% | 30.7% | 23.4% | 9.4% | 4.6% | 42.4% |
| 600010 | TRUCK TRACTOR, SINGLE REAR AXLE UP TO 60000 GCWR | 16 | Repair | 11.1% | 18.3% | 22.3% | 28.4% | 22.6% | 7.1% | 3.5% | 35.0% |
| | | | Total (median) | | | 96.1% | | | | | |

| Classcode | Description | Data Points | Attribute | Minimum | 1st Quartile | Median | 3rd Quartile | Mean | St. Dev. | Conf.Int. | Maximum |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 600020 | TRUCK TRACTOR, SINGLE REAR AXLE, 60000 GCWR AND GREATER | 36 | Downtime | 2.5% | 14.4% | 21.2% | 25.3% | 19.4% | 7.7% | 2.5% | 37.3% |
| 600020 | TRUCK TRACTOR, SINGLE REAR AXLE, 60000 GCWR AND GREATER | 36 | Trendscore | 22.9% | 28.8% | 36.2% | 52.0% | 41.4% | 15.2% | 5.0% | 80.0% |
| 600020 | TRUCK TRACTOR, SINGLE REAR AXLE, 60000 GCWR AND GREATER | 36 | Usage | 1.5% | 14.7% | 20.5% | 26.2% | 19.8% | 7.8% | 2.5% | 33.7% |
| 600020 | TRUCK TRACTOR, SINGLE REAR AXLE, 60000 GCWR AND GREATER | 36 | Repair | 2.5% | 15.4% | 21.4% | 24.9% | 19.3% | 7.1% | 2.3% | 27.1% |
| | | | Total (median) | | | 99.3% | | | | | |
| 600030 | TRUCK TRACTOR, TANDEM REAR AXLE, ALL GCWR | 78 | Downtime | 1.3% | 13.3% | 19.9% | 25.1% | 18.9% | 7.9% | 1.8% | 36.2% |
| 600030 | TRUCK TRACTOR, TANDEM REAR AXLE, ALL GCWR | 78 | Trendscore | 24.4% | 30.5% | 37.7% | 51.0% | 43.7% | 17.4% | 3.9% | 94.9% |
| 600030 | TRUCK TRACTOR, TANDEM REAR AXLE, ALL GCWR | 78 | Usage | 1.3% | 13.4% | 20.4% | 24.4% | 18.8% | 7.7% | 1.7% | 35.3% |
| 600030 | TRUCK TRACTOR, TANDEM REAR AXLE, ALL GCWR | 78 | Repair | 1.3% | 14.9% | 19.7% | 24.4% | 18.6% | 7.1% | 1.6% | 30.8% |
| | | | Total (median) | | | 97.7% | | | | | |
| 710010 | VEHICLE, ALL TERRAIN | 28 | Downtime | 2.9% | 16.1% | 21.7% | 26.4% | 20.4% | 8.9% | 3.3% | 35.7% |
| 710010 | VEHICLE, ALL TERRAIN | 28 | Trendscore | 25.5% | 30.1% | 34.9% | 39.3% | 37.6% | 11.0% | 4.1% | 69.7% |
| 710010 | VEHICLE, ALL TERRAIN | 28 | Usage | 4.8% | 12.9% | 21.5% | 27.8% | 21.2% | 10.0% | 3.7% | 43.8% |
| 710010 | VEHICLE, ALL TERRAIN | 28 | Repair | 3.0% | 11.5% | 23.5% | 29.2% | 20.8% | 10.2% | 3.8% | 34.9% |
| | | | Total (median) | | | 101.6% | | | | | |
| 710020 | VEHICLE, PERSONNEL, 3 WHEEL, ENGINE DRIVEN | 4 | Downtime | 21.4% | 21.8% | 23.6% | 27.9% | 24.9% | 4.2% | 4.1% | 30.8% |
| 710020 | VEHICLE, PERSONNEL, 3 WHEEL, ENGINE DRIVEN | 4 | Trendscore | 22.2% | 22.6% | 24.0% | 26.8% | 24.7% | 2.8% | 2.8% | 28.6% |
| 710020 | VEHICLE, PERSONNEL, 3 WHEEL, ENGINE DRIVEN | 4 | Usage | 21.4% | 21.8% | 23.6% | 27.9% | 24.9% | 4.2% | 4.1% | 30.8% |
| 710020 | VEHICLE, PERSONNEL, 3 WHEEL, ENGINE DRIVEN | 4 | Repair | 15.4% | 20.2% | 26.8% | 31.0% | 25.6% | 7.6% | 7.4% | 33.3% |
| | | | Total (median) | | | 98.0% | | | | | |
| 901010 | CORE DRILL, SPECIMEN, SKID MOUNTED | 2 | Downtime | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | 0.0% | 0.0% | 25.0% |
| 901010 | CORE DRILL, SPECIMEN, SKID MOUNTED | 2 | Trendscore | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | 0.0% | 0.0% | 25.0% |
| 901010 | CORE DRILL, SPECIMEN, SKID MOUNTED | 2 | Usage | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | 0.0% | 0.0% | 25.0% |
| 901010 | CORE DRILL, SPECIMEN, SKID MOUNTED | 2 | Repair | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | 0.0% | 0.0% | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |
| 901020 | CORE DRILL, SPECIMEN, TRAILER MOUNTED | 6 | Downtime | 14.3% | 18.8% | 22.5% | 26.7% | 22.0% | 5.2% | 4.1% | 27.3% |
| 901020 | CORE DRILL, SPECIMEN, TRAILER MOUNTED | 6 | Trendscore | 18.2% | 25.0% | 31.7% | 40.0% | 33.9% | 13.6% | 10.8% | 57.1% |
| 901020 | CORE DRILL, SPECIMEN, TRAILER MOUNTED | 6 | Usage | 14.3% | 20.0% | 22.5% | 25.0% | 21.9% | 4.8% | 3.8% | 27.3% |
| 901020 | CORE DRILL, SPECIMEN, TRAILER MOUNTED | 6 | Repair | 14.3% | 20.0% | 20.0% | 27.3% | 22.1% | 6.1% | 4.9% | 31.3% |
| | | | Total (median) | | | 96.7% | | | | | |
| 902000 | CURB LAYING MACHINE | 7 | Downtime | 11.1% | 17.6% | 22.2% | 25.0% | 24.3% | 12.3% | 9.1% | 50.0% |
| 902000 | CURB LAYING MACHINE | 7 | Trendscore | 21.4% | 24.0% | 28.0% | 33.3% | 27.8% | 4.6% | 3.4% | 33.3% |
| 902000 | CURB LAYING MACHINE | 7 | Usage | 7.1% | 18.8% | 24.0% | 29.4% | 24.9% | 11.4% | 8.4% | 44.4% |
| 902000 | CURB LAYING MACHINE | 7 | Repair | 11.1% | 21.4% | 23.5% | 28.0% | 23.1% | 6.3% | 4.7% | 31.3% |
| | | | Total (median) | | | 97.8% | | | | | |
| 905000 | DISC HARROW | 20 | Downtime | 10.0% | 19.1% | 24.4% | 28.2% | 23.4% | 7.1% | 3.1% | 34.5% |
| 905000 | DISC HARROW | 20 | Trendscore | 12.1% | 17.1% | 30.1% | 37.5% | 29.8% | 12.3% | 5.4% | 60.0% |
| 905000 | DISC HARROW | 20 | Usage | 10.0% | 17.4% | 23.5% | 28.5% | 23.6% | 8.3% | 3.6% | 40.8% |
| 905000 | DISC HARROW | 20 | Repair | 7.1% | 19.3% | 22.5% | 28.7% | 23.2% | 6.2% | 2.7% | 32.3% |
| | | | Total (median) | | | 100.4% | | | | | |

| Classcode | Description | Data Points | Attribute | Minimum | 1st Quartile | Median | 3rd Quartile | Mean | St. Dev. | Conf.Int. | Maximum |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 906000 | GRADER, PULL TYPE | 69 | Downtime | 3.1% | 17.9% | 24.8% | 31.3% | 23.9% | 9.4% | 2.2% | 42.7% |
| 906000 | GRADER, PULL TYPE | 69 | Trendscore | 1.1% | 15.4% | 26.3% | 35.1% | 27.6% | 18.1% | 4.3% | 81.9% |
| 906000 | GRADER, PULL TYPE | 69 | Usage | 0.8% | 14.8% | 25.8% | 33.7% | 25.1% | 13.3% | 3.1% | 51.9% |
| 906000 | GRADER, PULL TYPE | 69 | Repair | 1.4% | 16.8% | 24.8% | 30.3% | 23.3% | 10.0% | 2.4% | 40.9% |
| | | | Total (median) | | | 101.8% | | | | | |
| 910000 | JOINT ROUTING MACHINE, CONCRETE | 1 | Downtime | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 910000 | JOINT ROUTING MACHINE, CONCRETE | 1 | Trendscore | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 910000 | JOINT ROUTING MACHINE, CONCRETE | 1 | Usage | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 910000 | JOINT ROUTING MACHINE, CONCRETE | 1 | Repair | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |
| 912000 | PAINT STRIPE MACHINE, SINGLE LINE PUSH TYPE | 1 | Downtime | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 912000 | PAINT STRIPE MACHINE, SINGLE LINE PUSH TYPE | 1 | Trendscore | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 912000 | PAINT STRIPE MACHINE, SINGLE LINE PUSH TYPE | 1 | Usage | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 912000 | PAINT STRIPE MACHINE, SINGLE LINE PUSH TYPE | 1 | Repair | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |
| 913000 | PAINT SPRAY OUTFIT, TRAILER MOUNTED | 4 | Downtime | 12.5% | 17.0% | 25.0% | 32.5% | 24.7% | 10.2% | 10.0% | 36.4% |
| 913000 | PAINT SPRAY OUTFIT, TRAILER MOUNTED | 4 | Trendscore | 9.1% | 17.0% | 26.8% | 35.7% | 26.4% | 13.9% | 13.6% | 42.9% |
| 913000 | PAINT SPRAY OUTFIT, TRAILER MOUNTED | 4 | Usage | 14.3% | 16.2% | 23.4% | 33.0% | 24.6% | 10.5% | 10.3% | 37.5% |
| 913000 | PAINT SPRAY OUTFIT, TRAILER MOUNTED | 4 | Repair | 14.3% | 17.9% | 23.2% | 30.7% | 24.3% | 9.2% | 9.0% | 36.4% |
| | | | Total (median) | | | 98.4% | | | | | |
| 914000 | PAINT STRIPE REMOVER | 16 | Downtime | 3.1% | 13.9% | 23.2% | 29.6% | 21.2% | 9.6% | 4.7% | 34.0% |
| 914000 | PAINT STRIPE REMOVER | 16 | Trendscore | 25.0% | 27.3% | 35.0% | 44.4% | 37.7% | 12.4% | 6.1% | 61.9% |
| 914000 | PAINT STRIPE REMOVER | 16 | Usage | 4.0% | 15.4% | 19.1% | 27.5% | 20.6% | 8.6% | 4.2% | 35.1% |
| 914000 | PAINT STRIPE REMOVER | 16 | Repair | 4.8% | 14.0% | 21.1% | 25.0% | 20.5% | 8.9% | 4.4% | 40.6% |
| | | | Total (median) | | | 98.4% | | | | | |
| 915000 | PLATFORM LIFT, INDUSTRIAL | 1 | Downtime | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 915000 | PLATFORM LIFT, INDUSTRIAL | 1 | Trendscore | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 915000 | PLATFORM LIFT, INDUSTRIAL | 1 | Usage | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 915000 | PLATFORM LIFT, INDUSTRIAL | 1 | Repair | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |
| 916010 | PUMP AND ENGINE, PORTABLE, 3" | 29 | Downtime | 3.7% | 18.8% | 24.1% | 28.1% | 22.8% | 9.6% | 3.5% | 40.6% |
| 916010 | PUMP AND ENGINE, PORTABLE, 3" | 29 | Trendscore | 18.4% | 22.6% | 28.6% | 38.9% | 31.8% | 10.7% | 3.9% | 56.0% |
| 916010 | PUMP AND ENGINE, PORTABLE, 3" | 29 | Usage | 2.6% | 18.2% | 21.6% | 29.8% | 23.2% | 10.4% | 3.8% | 45.3% |
| 916010 | PUMP AND ENGINE, PORTABLE, 3" | 29 | Repair | 4.0% | 19.4% | 23.6% | 27.8% | 22.2% | 7.8% | 2.8% | 31.7% |
| | | | Total (median) | | | 97.9% | | | | | |
| 916020 | PUMP AND ENGINE, PORTABLE, 4" | 10 | Downtime | 7.7% | 15.4% | 22.4% | 27.6% | 23.6% | 11.8% | 7.3% | 43.5% |
| 916020 | PUMP AND ENGINE, PORTABLE, 4" | 10 | Trendscore | 10.3% | 18.2% | 24.6% | 36.0% | 26.9% | 11.8% | 7.3% | 47.6% |
| 916020 | PUMP AND ENGINE, PORTABLE, 4" | 10 | Usage | 4.8% | 13.8% | 26.8% | 36.4% | 25.5% | 13.7% | 8.5% | 46.2% |
| 916020 | PUMP AND ENGINE, PORTABLE, 4" | 10 | Repair | 4.8% | 15.4% | 27.9% | 31.8% | 23.9% | 10.0% | 6.2% | 34.5% |
| | | | Total (median) | | | 101.6% | | | | | |

| Classcode | Description | Data Points | Attribute | Minimum | 1st Quartile | Median | 3rd Quartile | Mean | St. Dev. | Conf.Int. | Maximum |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 916030 | PUMP AND ENGINE, PORTABLE, OVER 4" | 4 | Downtime | 20.0% | 20.7% | 23.2% | 29.2% | 24.9% | 6.0% | 5.9% | 33.3% |
| 916030 | PUMP AND ENGINE, PORTABLE, OVER 4" | 4 | Trendscore | 20.0% | 22.5% | 25.0% | 26.8% | 24.6% | 3.5% | 3.5% | 28.6% |
| 916030 | PUMP AND ENGINE, PORTABLE, OVER 4" | 4 | Usage | 16.7% | 19.0% | 23.2% | 32.5% | 25.8% | 10.1% | 9.9% | 40.0% |
| 916030 | PUMP AND ENGINE, PORTABLE, OVER 4" | 4 | Repair | 20.0% | 22.5% | 25.0% | 26.8% | 24.6% | 3.5% | 3.5% | 28.6% |
| | | | Total (median) | | | 96.4% | | | | | |
| 917000 | PUMP, PTO DRIVEN, 4" | 3 | Downtime | 12.5% | 12.5% | 22.2% | 33.3% | 22.7% | 10.4% | 11.8% | 33.3% |
| 917000 | PUMP, PTO DRIVEN, 4" | 3 | Trendscore | 22.2% | 22.2% | 22.2% | 37.5% | 27.3% | 8.8% | 10.0% | 37.5% |
| 917000 | PUMP, PTO DRIVEN, 4" | 3 | Usage | 22.2% | 22.2% | 22.2% | 37.5% | 27.3% | 8.8% | 10.0% | 37.5% |
| 917000 | PUMP, PTO DRIVEN, 4" | 3 | Repair | 12.5% | 12.5% | 22.2% | 33.3% | 22.7% | 10.4% | 11.8% | 33.3% |
| | | | Total (median) | | | 88.9% | | | | | |
| 918000 | ROLLER, FLAT WHEEL, SINGLE DRUM, TOW TYPE | 1 | Downtime | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 918000 | ROLLER, FLAT WHEEL, SINGLE DRUM, TOW TYPE | 1 | Trendscore | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 918000 | ROLLER, FLAT WHEEL, SINGLE DRUM, TOW TYPE | 1 | Usage | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 918000 | ROLLER, FLAT WHEEL, SINGLE DRUM, TOW TYPE | 1 | Repair | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |
| 921000 | SNOW PLOW, V-TYPE | 4 | Downtime | 18.2% | 19.1% | 28.2% | 38.2% | 28.6% | 11.1% | 10.9% | 40.0% |
| 921000 | SNOW PLOW, V-TYPE | 4 | Trendscore | 10.0% | 14.1% | 24.1% | 33.2% | 23.6% | 11.8% | 11.6% | 36.4% |
| 921000 | SNOW PLOW, V-TYPE | 4 | Usage | 9.1% | 14.5% | 23.6% | 33.6% | 24.1% | 13.0% | 12.7% | 40.0% |
| 921000 | SNOW PLOW, V-TYPE | 4 | Repair | 10.0% | 14.1% | 24.1% | 33.2% | 23.6% | 11.8% | 11.6% | 36.4% |
| | | | Total (median) | | | 100.0% | | | | | |
| 923000 | SPREADER, FERTILIZER, TOW TYPE | 1 | Downtime | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 923000 | SPREADER, FERTILIZER, TOW TYPE | 1 | Trendscore | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 923000 | SPREADER, FERTILIZER, TOW TYPE | 1 | Usage | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 923000 | SPREADER, FERTILIZER, TOW TYPE | 1 | Repair | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |
| 926000 | TILLER, ROTARY, TRACTOR MOUNTDPULVIMIXER, PTO DRIVEN | 6 | Downtime | 12.5% | 15.4% | 23.4% | 33.3% | 24.7% | 10.8% | 8.7% | 40.0% |
| 926000 | TILLER, ROTARY, TRACTOR MOUNTDPULVIMIXER, PTO DRIVEN | 6 | Trendscore | 7.7% | 23.8% | 25.8% | 33.3% | 25.0% | 9.4% | 7.5% | 33.3% |
| 926000 | TILLER, ROTARY, TRACTOR MOUNTDPULVIMIXER, PTO DRIVEN | 6 | Usage | 11.1% | 13.3% | 22.6% | 38.5% | 26.4% | 15.5% | 12.4% | 50.0% |
| 926000 | TILLER, ROTARY, TRACTOR MOUNTDPULVIMIXER, PTO DRIVEN | 6 | Repair | 12.5% | 20.0% | 22.2% | 28.6% | 24.0% | 8.8% | 7.0% | 38.5% |
| | | | Total (median) | | | 94.1% | | | | | |
| 927000 | TRAILER, EQUIPMENT, 1-1/2 THRU3 TON | 12 | Downtime | 6.7% | 17.4% | 21.8% | 23.8% | 23.7% | 12.9% | 7.3% | 52.6% |
| 927000 | TRAILER, EQUIPMENT, 1-1/2 THRU3 TON | 12 | Trendscore | 18.4% | 22.2% | 30.5% | 33.1% | 31.0% | 11.9% | 6.7% | 60.0% |
| 927000 | TRAILER, EQUIPMENT, 1-1/2 THRU3 TON | 12 | Usage | 7.7% | 14.6% | 23.8% | 31.1% | 22.9% | 9.6% | 5.4% | 36.8% |
| 927000 | TRAILER, EQUIPMENT, 1-1/2 THRU3 TON | 12 | Repair | 5.3% | 19.8% | 24.1% | 27.5% | 22.4% | 7.1% | 4.0% | 29.6% |
| | | | Total (median) | | | 100.1% | | | | | |
| 928000 | TRAFFIC ALERTING & CHANNELING DEVICE, ARROW, TRAILER MOUNTED | 158 | Downtime | 0.7% | 14.3% | 22.3% | 26.8% | 21.1% | 9.2% | 1.4% | 41.2% |
| 928000 | TRAFFIC ALERTING & CHANNELING DEVICE, ARROW, TRAILER MOUNTED | 158 | Trendscore | 18.7% | 25.6% | 31.3% | 43.7% | 36.9% | 14.7% | 2.3% | 82.7% |
| 928000 | TRAFFIC ALERTING & CHANNELING DEVICE, ARROW, TRAILER MOUNTED | 158 | Usage | 0.5% | 13.8% | 23.0% | 28.4% | 21.3% | 9.8% | 1.5% | 55.5% |
| 928000 | TRAFFIC ALERTING & CHANNELING DEVICE, ARROW, TRAILER MOUNTED | 158 | Repair | 0.7% | 17.1% | 22.6% | 26.8% | 20.7% | 7.8% | 1.2% | 35.7% |
| | | | Total (median) | | | 99.3% | | | | | |

| Classcode | Description | Data Points | Attribute | Minimum | 1st Quartile | Median | 3rd Quartile | Mean | St. Dev. | Conf.Int. | Maximum |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 928010 | TRAFFIC ALERTING & CHANNELING DEVICE, ARROW, TRLR MTD, SOLARPOWERED | 300 | Downtime | 2.9% | 12.2% | 21.0% | 25.8% | 19.9% | 9.3% | 1.0% | 47.0% |
| 928010 | TRAFFIC ALERTING & CHANNELING DEVICE, ARROW, TRLR MTD, SOLARPOWERED | 300 | Trendscore | 23.5% | 29.7% | 37.6% | 48.2% | 40.7% | 13.4% | 1.5% | 81.2% |
| 928010 | TRAFFIC ALERTING & CHANNELING DEVICE, ARROW, TRLR MTD, SOLARPOWERED | 300 | Usage | 1.3% | 13.1% | 21.6% | 26.1% | 19.9% | 9.2% | 1.0% | 41.4% |
| 928010 | TRAFFIC ALERTING & CHANNELING DEVICE, ARROW, TRLR MTD, SOLARPOWERED | 300 | Repair | 0.2% | 14.4% | 21.9% | 25.3% | 19.4% | 7.9% | 0.9% | 35.5% |
| | | | Total (median) | | | 102.1% | | | | | |
| 930000 | PUMP, ASPHALT TRANSFER, PORT. | 36 | Downtime | 5.5% | 16.3% | 24.0% | 30.3% | 23.5% | 10.8% | 3.5% | 48.1% |
| 930000 | PUMP, ASPHALT TRANSFER, PORT. | 36 | Trendscore | 17.0% | 24.0% | 27.3% | 35.2% | 31.3% | 12.4% | 4.1% | 76.2% |
| 930000 | PUMP, ASPHALT TRANSFER, PORT. | 36 | Usage | 2.6% | 19.0% | 24.7% | 28.5% | 23.0% | 9.2% | 3.0% | 45.7% |
| 930000 | PUMP, ASPHALT TRANSFER, PORT. | 36 | Repair | 4.2% | 17.4% | 24.8% | 27.3% | 22.2% | 8.0% | 2.6% | 37.1% |
| | | | Total (median) | | | 100.9% | | | | | |
| 930010 | PUMP, ASPHALT TRANSFER, SKID MOUNTED | 1 | Downtime | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 930010 | PUMP, ASPHALT TRANSFER, SKID MOUNTED | 1 | Trendscore | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 930010 | PUMP, ASPHALT TRANSFER, SKID MOUNTED | 1 | Usage | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| 930010 | PUMP, ASPHALT TRANSFER, SKID MOUNTED | 1 | Repair | 25.0% | 25.0% | 25.0% | 25.0% | 25.0% | | | 25.0% |
| | | | Total (median) | | | 100.0% | | | | | |