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16. 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 improve 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.

The research objectives were to develop, test and implement a computerized system capable of updating the analysis data sets, processing and comparing the life cycle cost profiles for all equipment units in TxDOT's inventory, supporting equipment replacement decisions with life cycle cost based replacement criteria, and generating reports in tabular and graphical formats in order to simplify the analysis of the results by TxDOT decision makers. 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.

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DEVELOPMENT OF AN AUTOMATED FLEET-LEVEL EQUIPMENT REPLACEMENT METHODOLOGY

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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

ACKNOWLEDGEMENTS

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.

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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

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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	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, year-

round 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. <u>Equipment units that changed classcodes when the voucher was processed</u>, 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. <u>Equipment units that changed to a different size/power category</u>. 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. <u>Truck or trailer mounted devices previously classified as trucks or trailers, and vice-versa</u>. 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. <u>IDs from retired equipment being assigned to newer equipment</u>. 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

<u>Do retired units remain in databases subsequent to retirement?</u>

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.

<u>Can retired equipment IDs be absent from previous databases (instead of appearing as not retired)?</u>

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

<u>Equipment status, retirement code, and fuel consumption</u>

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

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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

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

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

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.

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

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

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

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

(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.
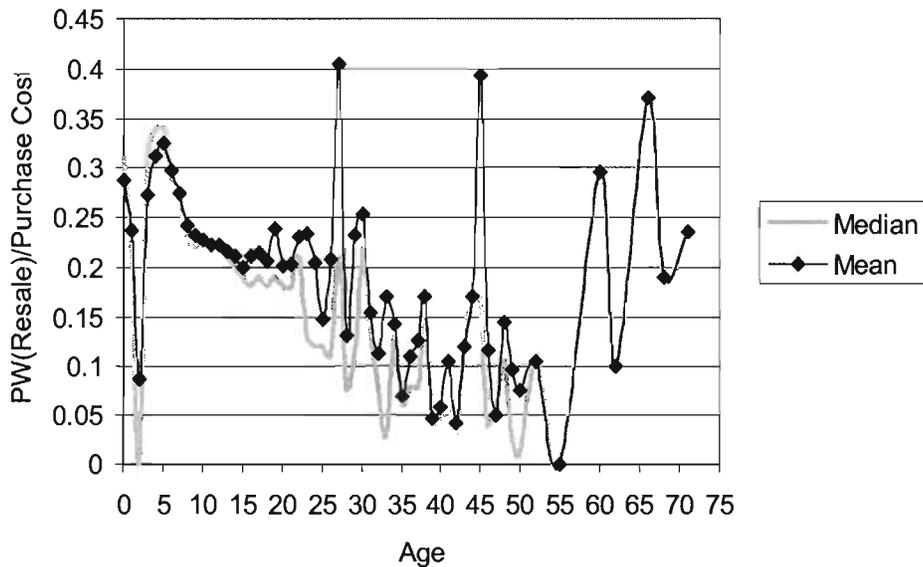
Figure 4.1 Observed Mean and Median Depreciation Factor by Age

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.

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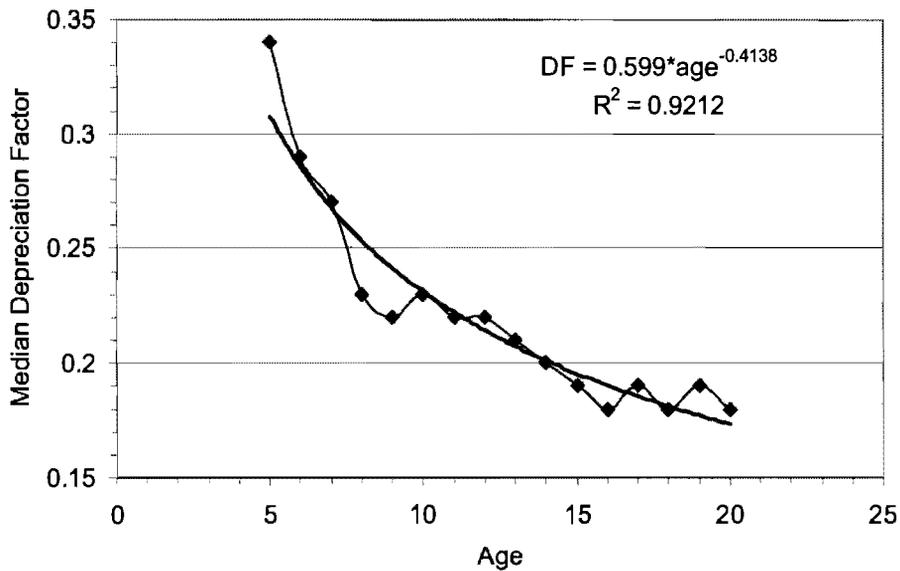
Figure 4.2 Observed Median Depreciation Factor, Ages Between 5 and 20

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:	$DF = 0.8 - 0.1 * [age]$	(4.6)
Ages between 5 and 20 years:	$DF = 0.599 * [age]^{-0.42}$	(4.7)

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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

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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).
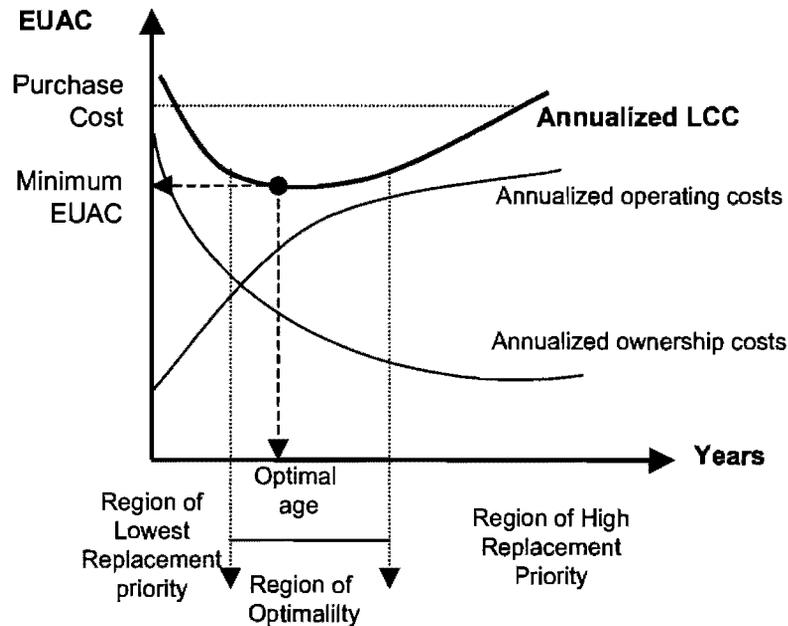
Figure 4.3 Theoretical EUACs of Owning and Operating an Equipment Unit

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 5th 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

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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.
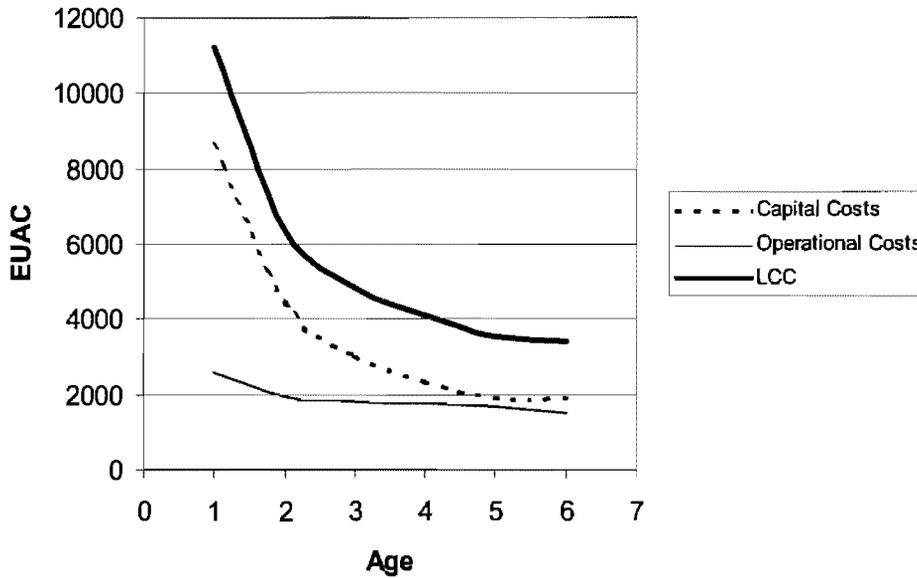
Figure 4.4 EUALCC of Equipment ID=00161C (Automobile)
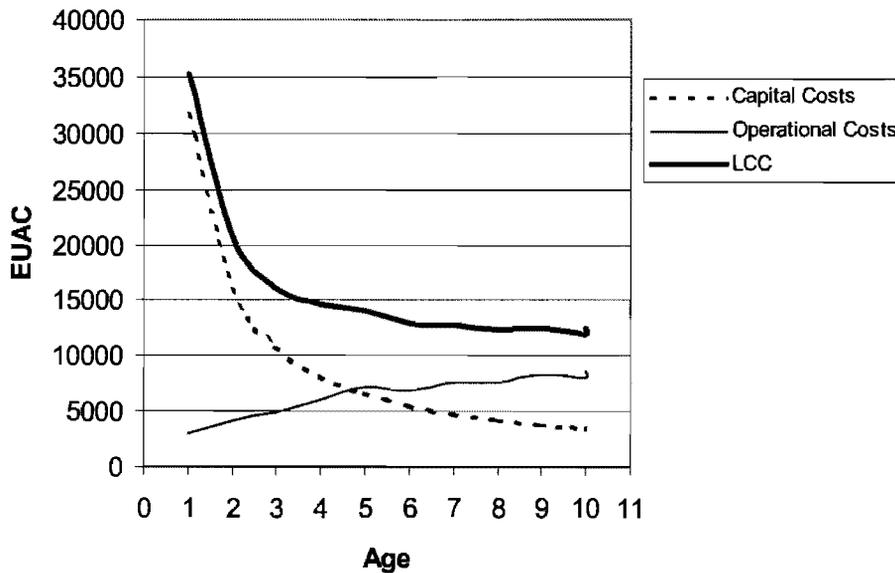
Figure 4.5 EUALCC of Equipment ID= 04113E (Dump Truck)
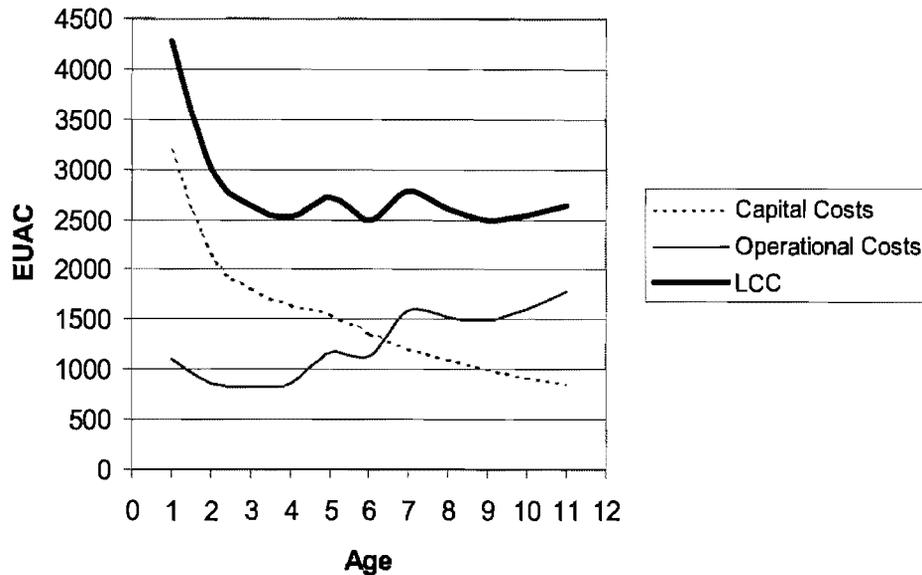
Figure 4.6 EUALCC of Equipment ID= 00137C (Automobile)

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:

$$Y_t = T_t + S_t + \varepsilon_t \qquad (4.8)$$

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);

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ϵ_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.
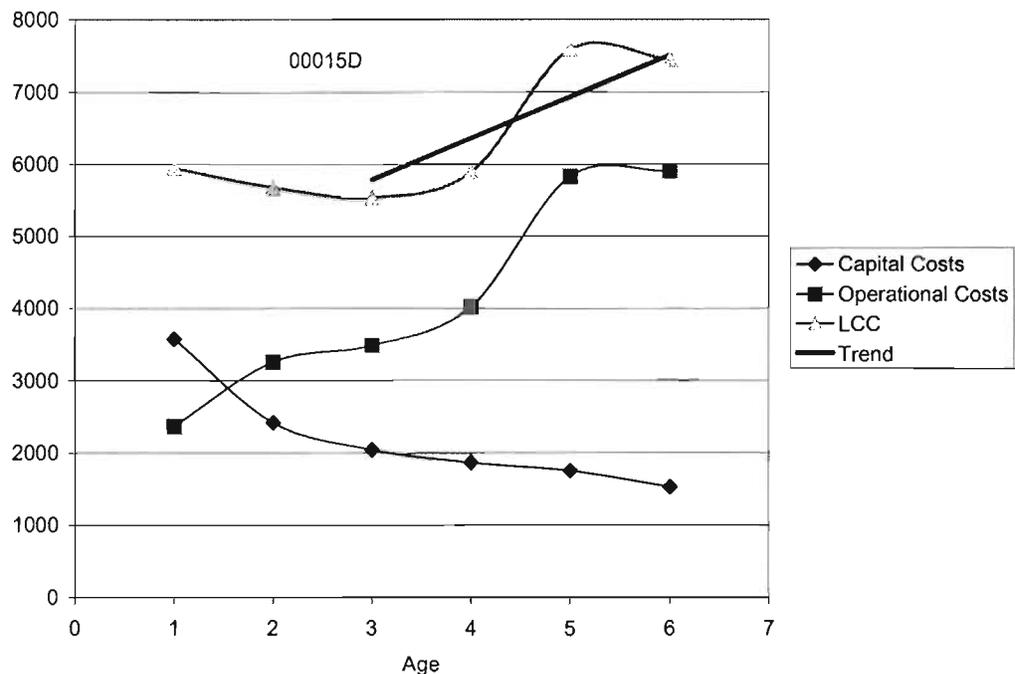
Figure 4.7 EUALCC with Increasing Trend

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.

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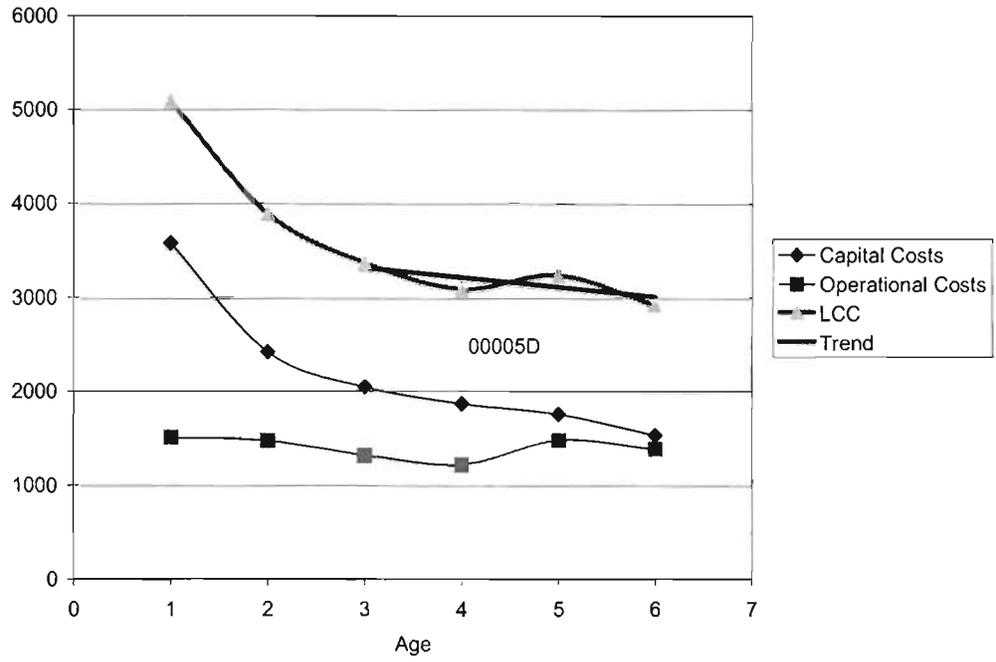
Figure 4.8 EUALCC with Decreasing Trend.
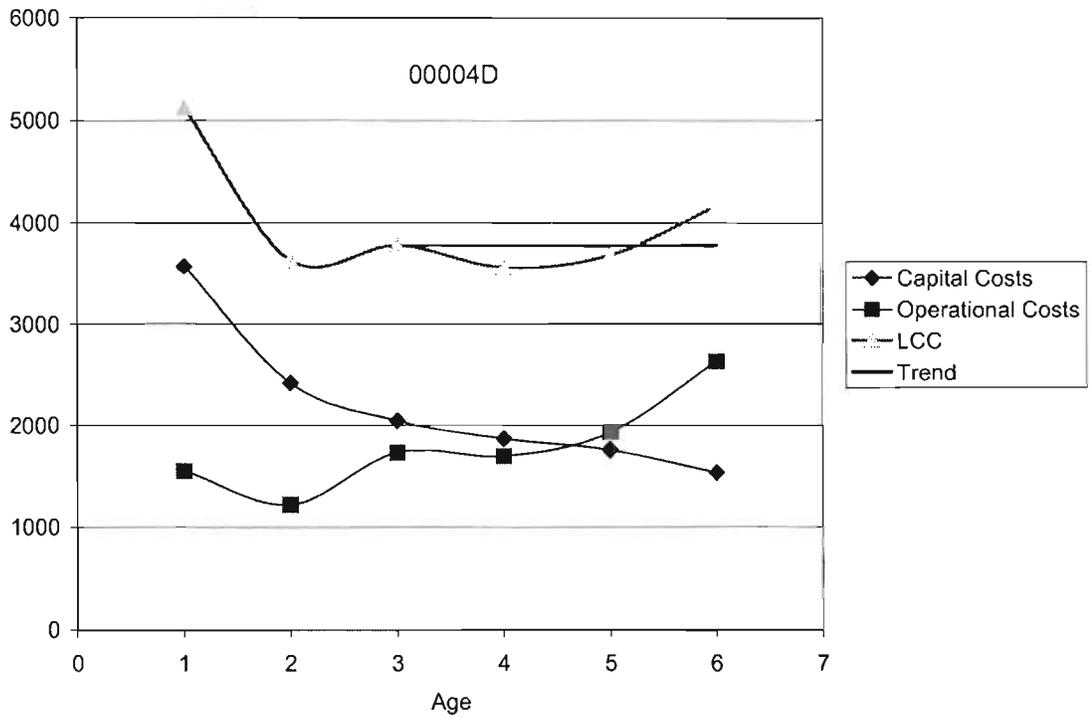
Figure 4.9 EUALCC with Stable Trend.
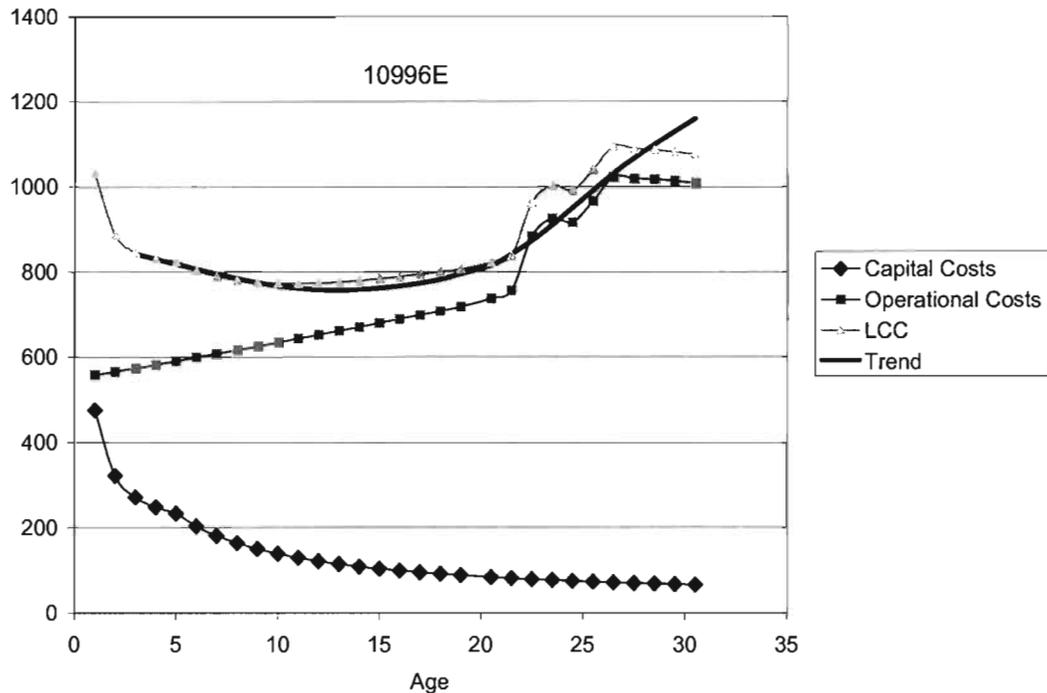
Figure 4.10 EUALCC with Combination Trend

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.

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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

Unit	Trendscore	Replacement Priority Based on	
		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.
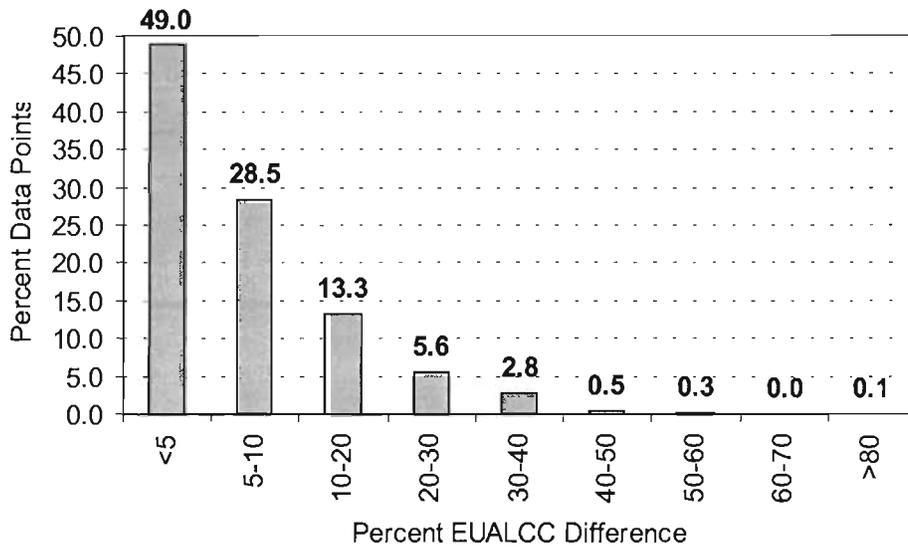
Figure 4.11 EUALCC Variation for Discount Rates Between 2% and 6%
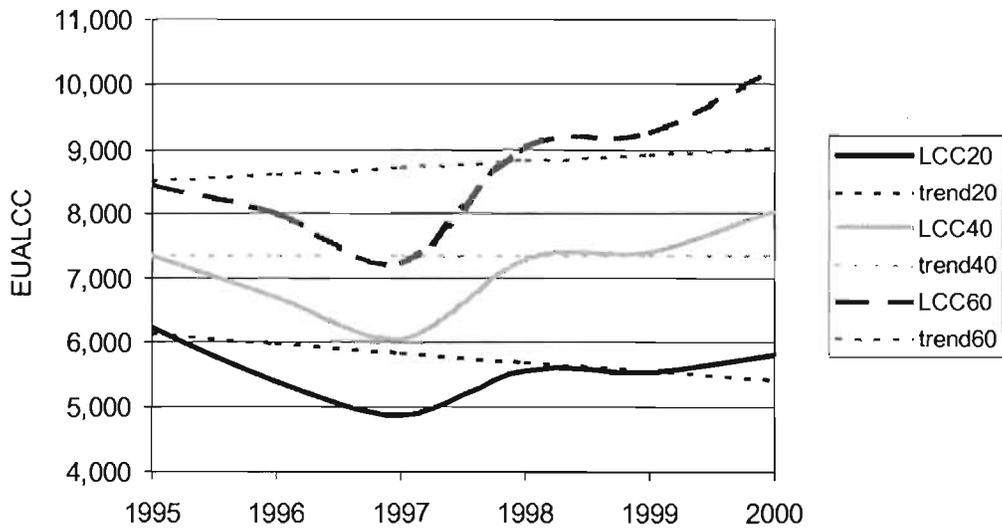
Figure 4.12 Sensitivity of Trendscore to Downtime Cost Variations.

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.)

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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).

Classcode = 1030
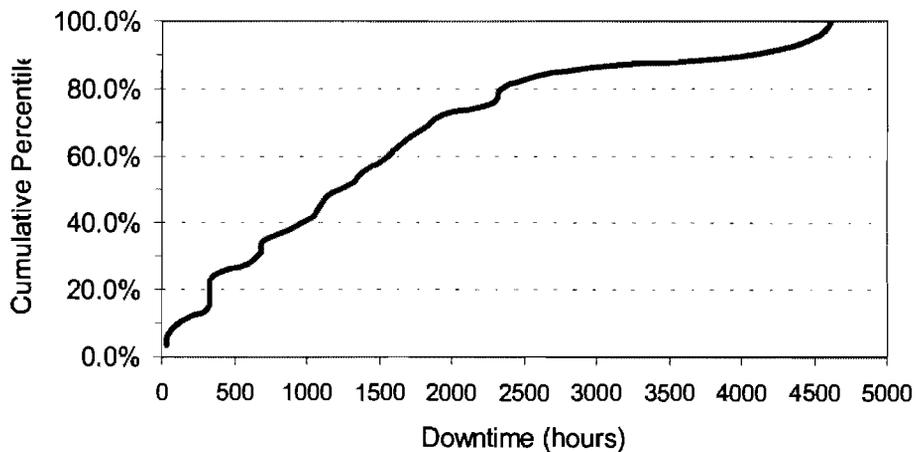
Figure 5.1 Example of Attribute Percentiles

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

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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 3rd quartile (75th percentile) and the 1st quartile (25th percentile), respectively, and the size of the box is the interquartile range (difference between 3rd and 1st 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 3rd 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%			

Percent Contribution to the Priority Rank
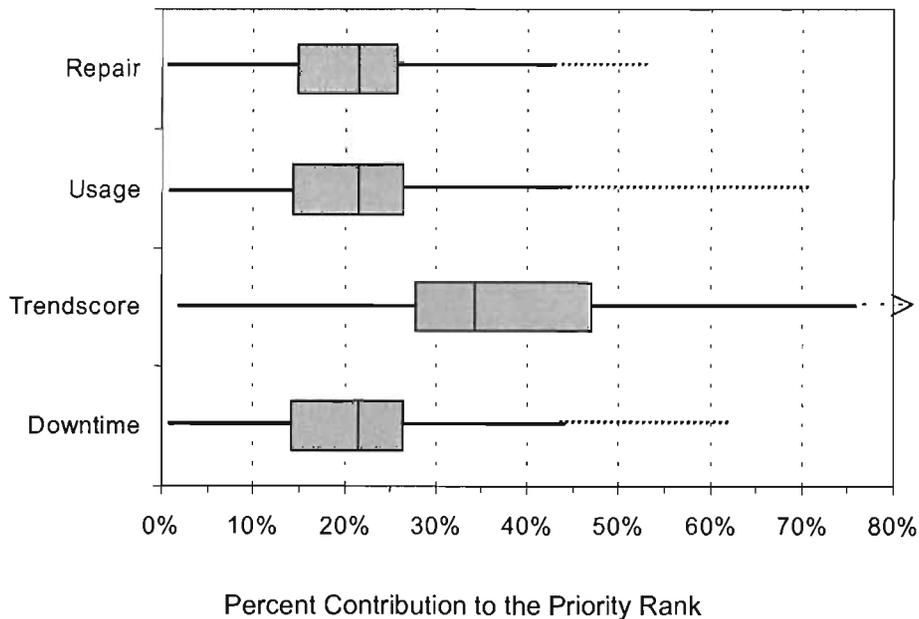
Figure 5.2 Attribute Contributions to Replacement Priority: All Classcodes

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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.
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.
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).
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.
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 asphalt maintenance unit, truck mounted	Downtime	0.7%	13.1%	20.9%	24.8%	19.0%	7.5%	1.2%	34.6%
	Trendscore	23.9%	29.5%	38.3%	52.7%	43.2%	17.4%	2.8%	96.5%
	Usage	0.6%	14.0%	21.1%	25.1%	19.0%	7.6%	1.2%	32.3%
	Repair	0.6%	14.3%	20.4%	24.7%	18.8%	7.2%	1.2%	29.8%
	Total			100.8%					
212000 portable storage tank	Downtime	9.1%	13.0%	23.5%	33.3%	24.2%	12.2%	7.2%	45.0%
	Trendscore	5.0%	11.1%	25.0%	43.5%	28.3%	20.8%	12.3%	72.7%
	Usage	9.1%	14.3%	23.5%	30.6%	23.5%	10.0%	5.9%	41.7%
	Repair	8.3%	16.7%	21.7%	34.6%	24.0%	11.1%	6.5%	40.7%
	Total			93.8%					
214000 water tank truck mounted includes truck	Downtime	3.6%	15.8%	22.2%	25.0%	20.3%	6.9%	3.6%	28.9%
	Trendscore	22.6%	26.7%	36.4%	42.9%	39.4%	14.4%	7.6%	66.7%
	Usage	5.6%	15.0%	21.8%	25.0%	19.9%	6.9%	3.6%	28.0%
	Repair	5.0%	15.0%	22.0%	24.0%	20.3%	8.4%	4.4%	39.3%
	Total			102.4%					
20020 automobiles sedan 100 - 112.9 in wheelbase	Downtime	0.8%	12.6%	20.5%	28.6%	20.6%	10.2%	1.1%	42.4%
	Trendscore	22.1%	28.3%	33.9%	43.6%	39.7%	16.2%	1.8%	98.4%
	Usage	0.4%	13.3%	21.1%	27.0%	20.1%	8.9%	1.0%	39.3%
	Repair	0.4%	13.7%	20.6%	26.2%	19.7%	8.1%	0.9%	38.1%
	Total			96.1%					
20030 automobiles sedan >=113 in wheelbase	Downtime	0.6%	13.5%	20.7%	27.7%	20.9%	10.2%	1.4%	44.4%
	Trendscore	22.0%	27.7%	32.8%	46.0%	38.8%	15.2%	2.1%	92.0%
	Usage	0.5%	14.5%	21.1%	26.9%	20.3%	8.7%	1.2%	38.0%
	Repair	0.5%	15.4%	21.4%	26.3%	20.0%	7.9%	1.1%	33.4%
	Total			96.0%					
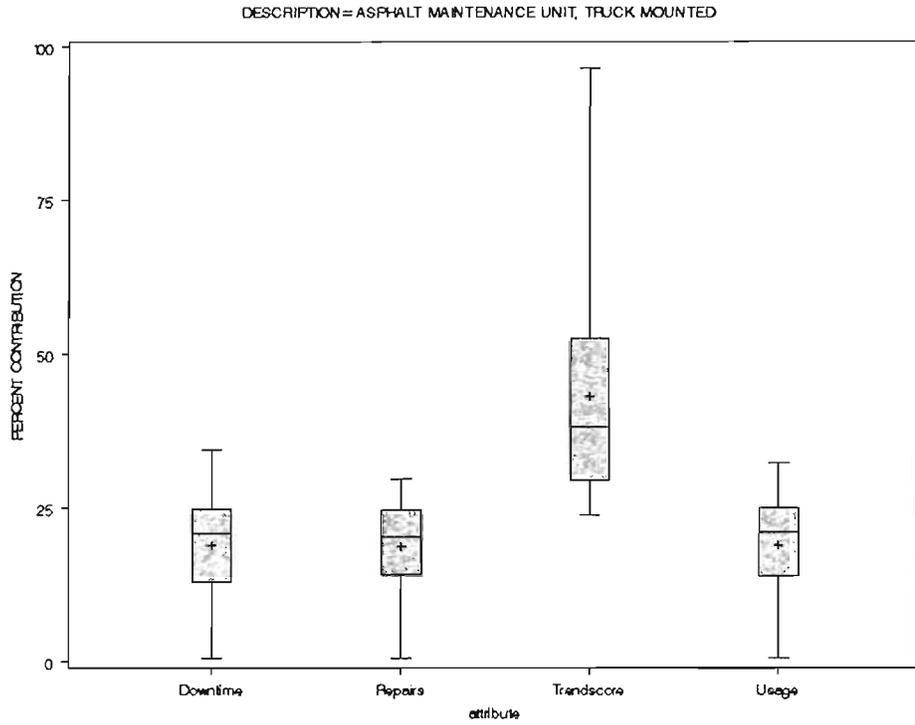
Figure 5.3 Attribute Contributions to Replacement Priority: Classcode 12030
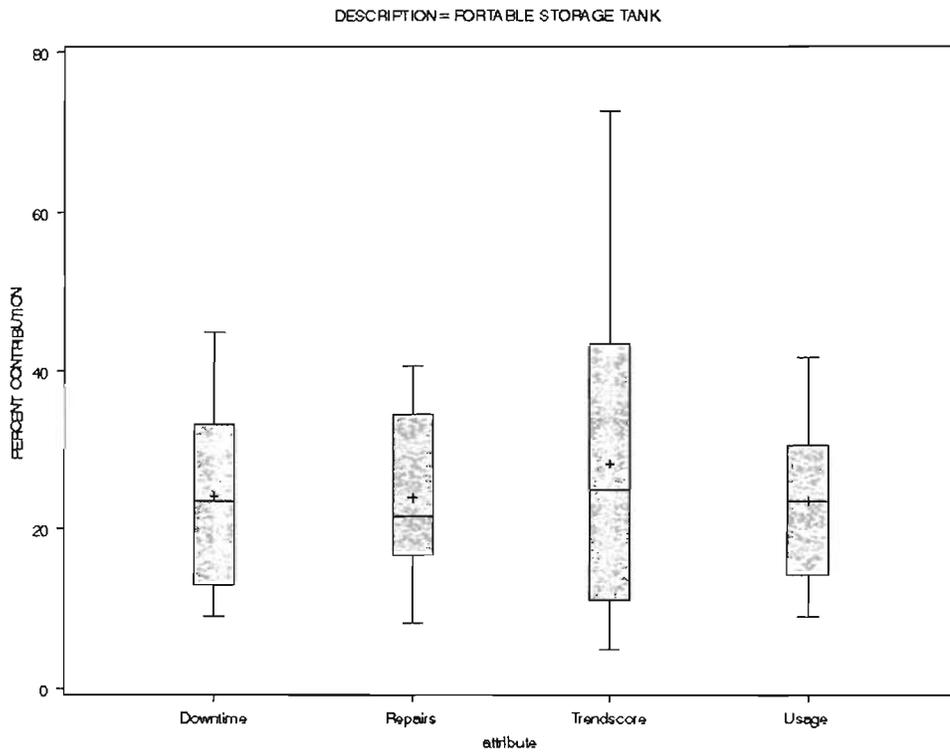
Figure 5.4 Attribute Contributions to Replacement Priority: Classcode 212000
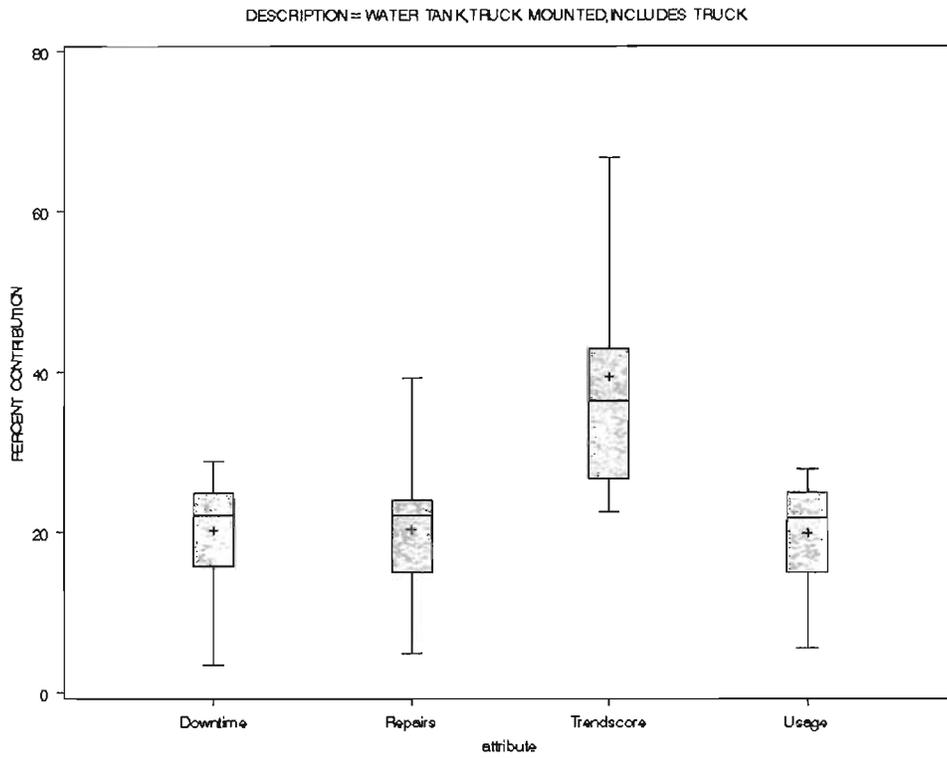
Figure 5.5 Attribute Contributions to Replacement Priority: Classcode 214000
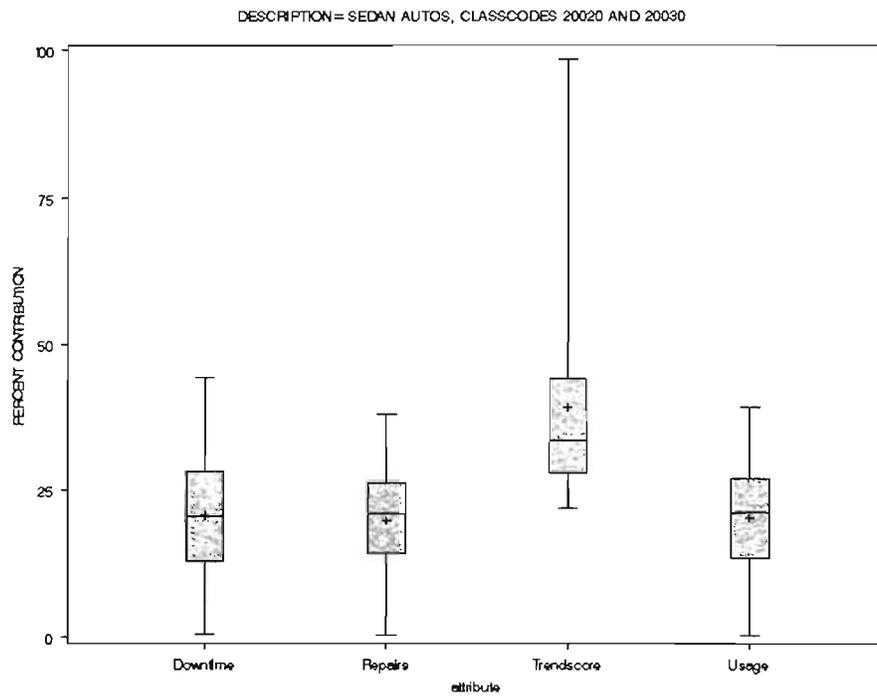
Figure 5.6 Attribute Contributions to Replacement Priority: Classcodes 20020 and 20030 (Aggregated)

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.

System Update
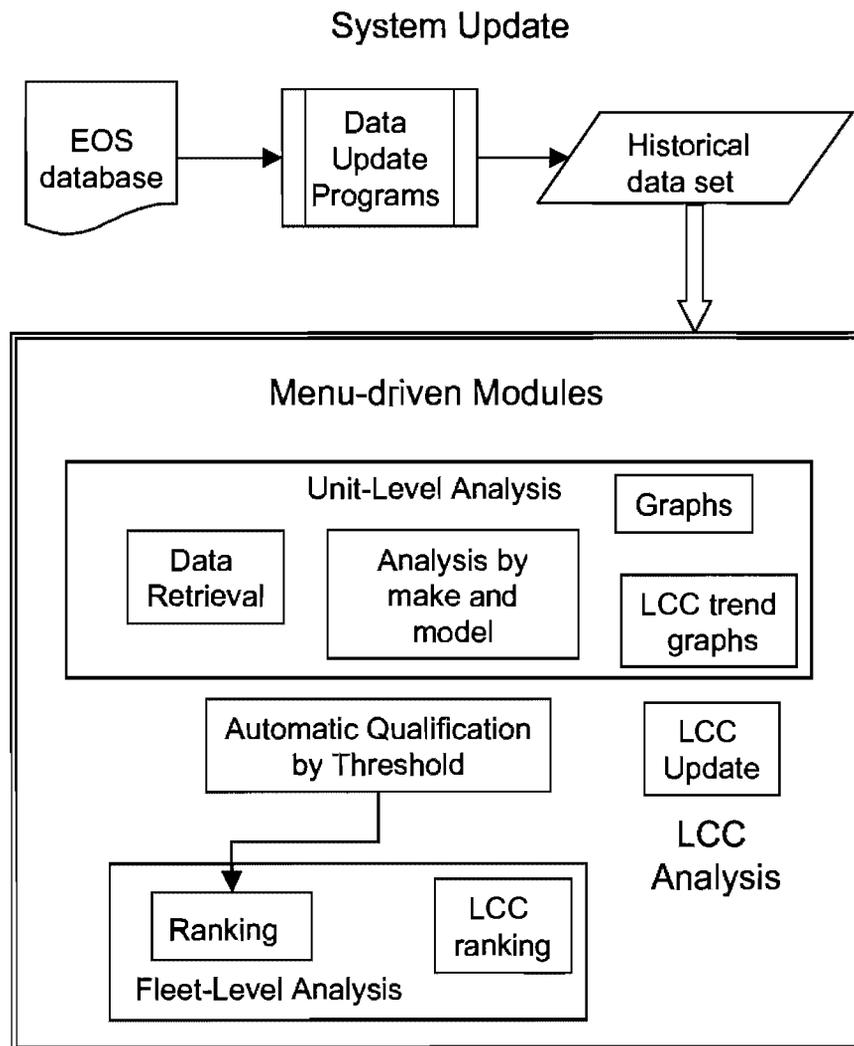
Figure 5.7 System Framework

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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.
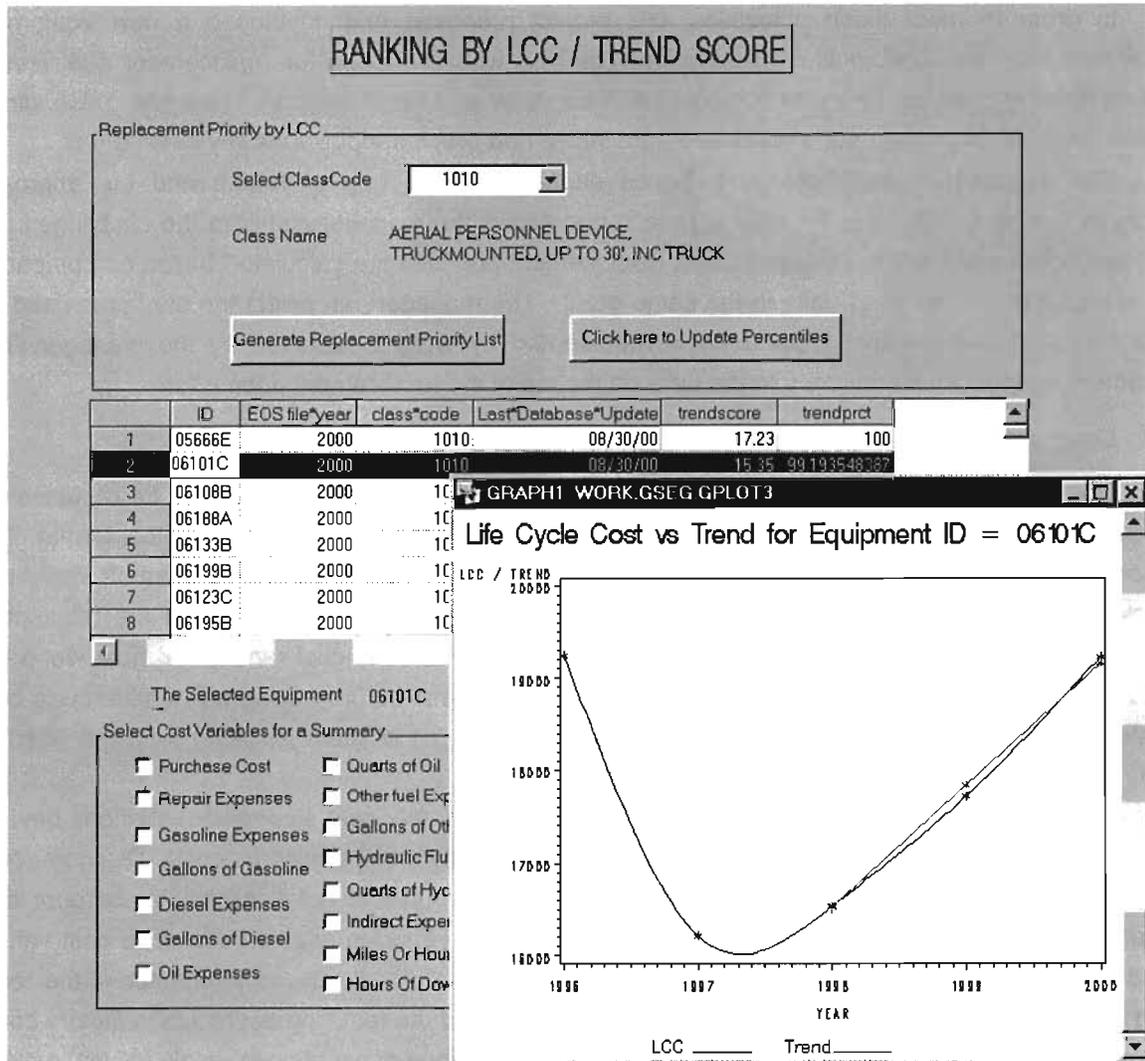
Figure 5.9 Life-Cycle Cost Module

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 3rd 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 embedde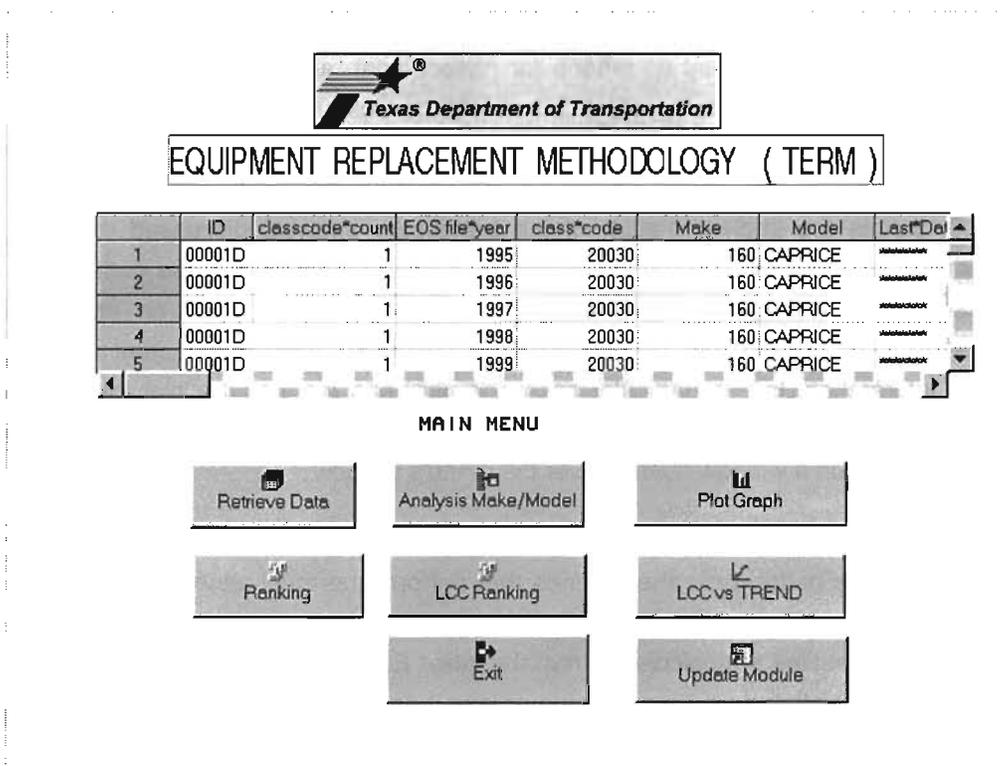d in the program and recalculate the LCC for the new values. The ranking module performs the multi-attribute ranking procedure, with or without thresholds for automatic qualification threshold.

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 3rd 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.

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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 TO 3999 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 TO 3999 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 TO 3999 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 TO 3999 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 TO 124 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 TO 124 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 TO 124 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 TO 124 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%			.		

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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 TO 3000 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 TO 3000 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 TO 3000 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 TO 3000 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/INTEGRAL TRACTOR	3	Downtime	16.7%	16.7%	22.2%	25.0%	21.3%	4.2%	4.8%	25.0%
180000	SCRAPER, ELEVATING, W/INTEGRAL TRACTOR	3	Trendscore	25.0%	25.0%	33.3%	50.0%	36.1%	12.7%	14.4%	50.0%
180000	SCRAPER, ELEVATING, W/INTEGRAL TRACTOR	3	Usage	16.7%	16.7%	22.2%	25.0%	21.3%	4.2%	4.8%	25.0%
180000	SCRAPER, ELEVATING, W/INTEGRAL TRACTOR	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%					

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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%					

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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,4600 TO 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,4600 TO 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,4600 TO 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,4600 TO 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%					