Fleet Management Performance Monitoring

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by

Paul Kauffmann, Ph.D., P.E.
Professor

Richard Williams, Ph.D., P.E.
Associate Professor

Department of Engineering
East Carolina University
Greenville, NC 27858

and

John Hildreth, Ph.D.
Assistant Professor

Department of Engineering Technology and Construction Management
UNC Charlotte
Charlotte, NC 28223

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16. Abstract

The principle goal of this project was to enhance and expand the analytical modeling methodology previously developed as part of the "Fleet Management Criteria: Disposal Points and Utilization Rates" project completed in 2010. The enhanced and expanded methods were focused on the management and analysis of equipment, usage, costs, and optimal life cycle for equipment in the NCDOT equipment fleet. Most important, a strategic goal was to develop, test, and refine a flexible and capable analytical model which can serve the long term management needs of the Fleet and Material Management Unit.

A second approach to economic life modeling, based on dividing the present value of the life-to-date cost by usage (cost/mile or cost/hour) was integrated into the analytical capability, in addition to the equipment analysis model employing equivalent uniform annual cost. This rate model provides a second economic measure which presents an alternative perspective for the optimal life of some classes with high data variability in the fleet. The sum of years' digits method of depreciation was selected to model the decline in equipment value as the machine ages. Equipment which have no measured usage data (odometer or hour meter), such as various equipment attachments, were analyzed on an annual cost basis. The developed modeling application automates basic steps such as development of utilization and fleet age histograms and also automates calculations of economic life based on both the EUAC and rate models. Most importantly, it provides management with the capability to examine "what if" scenarios based on various levels of fleet reduction. Utilization, while an important metric, is limited in ability to reflect the actual wear and tear experienced by equipment. Consequently, model options were provided which reflect both utilization and equipment usage (hours or miles per year) since this parameter more directly reflects operating costs (fuel, maintenance and repairs) and cost related trends. In the long term, it is likely utilization will become a less important measurement tool and more emphasis will be given to actual equipment usage.

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Mr. John Amstutz – URA, ECU
Ms. Sarah Brady – URA, ECU
Mr. Paul Cox – URA, ECU
Mr. Praveen Gali – GRA, ECU
Ms. Christine Gurganus – URA, ECU
Ms. Martha Hahn – GRA, UNC Charlotte
Mr. Tyler Johnson – GRA, UNC Charlotte
Ms. Shannon Keifer – URA, UNC Charlotte
Ms. Arinc Demir Leishear – URA, ECU
Mr. Joe Royer – URA, UNC Charlotte
Ms. Barbara Sage – URA, ECU

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Executive Summary

The principle goal of this project was to enhance and expand the analytical modeling methodology previously developed as part of the "Fleet Management Criteria: Disposal Points and Utilization Rates" project completed in 2010. The enhanced and expanded methods were focused on the management and analysis of equipment, usage, costs, and optimal life cycle for equipment in the NCDOT equipment fleet. Most important, a strategic goal was to develop, test, and refine a flexible and capable analytical model which can serve the long term management needs of the Fleet and Material Management Unit.

This executive summary segments results into three areas. Those related to the analytical model, points related to the analysis of the class codes, and finally those involving more general operational recommendations. The following improvements to the analytical model provide the ability to make data driven decisions in the management of the fleet and significantly reduce the analytical effort.

- Although utilization is an important metric of performance, it is limited in ability to reflect the actual wear and tear experienced by equipment in the various classes. Consequently, model options were provided which reflect both utilization and equipment usage (hours or miles per year) since this parameter more directly reflects operating costs (fuel, maintenance and repairs) and cost related trends. In the long term, it is likely utilization will become a less important measurement tool and more emphasis will be given to actual equipment usage.
- A second approach to economic life modeling, based on dividing the present value of the life-to-date cost by usage (cost/mile or cost/hour) was also integrated into the analytical capability, in addition to the equipment analysis model employing equivalent uniform annual cost. This rate model provides a second economic measure which presents an alternative perspective for the optimal life of some classes with high data variability in the NCDOT fleet.
- An additional technique was developed to determine optimal life for NCDOT classes which have no usage data (odometer or hour meter), such as various attachments. These classes are analyzed on an annual cost basis.
- To provide a flexible and efficient approach to modeling depreciation, a method was developed to model decline in value based on the sum of the years' digits depreciation.
- The management analysis capabilities of the model have been expanded and automated. The developed modeling application automates basic steps such as development of utilization and fleet age histograms and also automates calculations of economic life based on both the EUAC and rate models. Most importantly, it provides management with the capability to examine "what if" scenarios based on various levels of fleet reduction.

This project conducted economic analyses on all equipment class codes based on data from the 2011 calendar year. Additionally, a subset of class codes was studied for multiple years, including the six classes studied in the original report. The following conclusions are based on analysis of the raw data and the results of the economic analyses.

- NCDOT maintains a large and substantial data base that allows for the development of the economic models for most classes of equipment. For some classes, the number of pieces of equipment is too low to draw a statistically significant conclusion regarding the economic performance of that class.
- There is significant variability of the cost and usage data for some classes of equipment. The variability is from equipment to equipment, year to year, and across functional location for classes which contain multiple functional locations.
- Given the variability of the data, management may explore the "what if" analysis capabilities provided and use both the equivalent uniform annual cost and the rate model to make decisions regarding reduction of the fleet size. The EUAC model and rate model provide consistent results for classes in which the variability in annual usage is low.
- An economic life was determined for a majority of the NCDOT equipment class codes. However, for equipment for which usage was not measured in hours or miles, and therefore was analyzed with usage based on a year, a majority of these classes did not have a determinable economic life.

Several general recommendations involving broad aspects of operations are made.

- There are several equipment class codes with multiple functional locations. Often these represent significantly different usage and cost patterns. These classes should be separated by functional location and, from an economic standpoint, analyzed by functional location.
- Given the variability of the usage and operating cost data within a class code from year to year, a cumulative cost model should be explored. Using the capability of the NCDOT data base to accumulate usage hours, miles, and costs may improve the ability of the model to identify optimal disposal points.
- The automated modeling capabilities developed by this project provide NCDOT a powerful tool to consider many economic aspects of equipment fleet management, including owning costs, operating costs, economic life, fleet age, usage, and utilization as well as "what if" studies to understand the ramifications of fleet size reduction. NCDOT can employ this model to develop equipment management strategies that incorporate the economic data analysis along with operational requirements and constraints in order to more effectively manage their equipment fleet.

1 Project Introduction and Overview

This project was completed in support of the primary mission of the Fleet and Material Management Unit to provide a cost effective fleet of equipment in good working order and available for use when needed. In performing this mission, the unit is responsible for the acquisition and maintenance of the North Carolina Department of Transportation (NCDOT) fleet, comprised of approximately 24,000 pieces of heavy construction and ancillary support equipment.

1.1 Goals and Objectives

The principle goal of this project was to enhance and expand the analytical modeling methodology previously developed as part of the "Fleet Management Criteria: Disposal Points and Utilization Rates" project completed in 2010. The enhanced and expanded methods were focused on the management and analysis of equipment, usage, costs, and optimal life cycle for equipment in the NCDOT equipment fleet. Two project objectives were established from this goal. First, monitor and evaluate the analytical models developed for the six classes examined in the previous project by evaluating them with additional data for 2010 and 2011. The second objective was to apply the expanded methods to the equipment classes that were not included in the first study.

To accomplish the general objectives and goal, three tasks were identified:

- *Task 1 – Literature review:* Identify developments noted in the literature and determine if new methods and approaches are available and appropriate for the expanded and enhance modeling methods.
- *Task 2 – Integrate new data into existing models:* Update the methods employed in the first study and integrate operational data from 2010 and 2011. Improve and expand the basic model parameters for use in evaluating the additional classes.
- *Task 3 – Provide improved analytical tools for determining depreciation rate, usage, costs, utilization, age, and disposal point (optimal life) for the remaining equipment classes not covered by the previous research:* Apply the improved methodology to the entire fleet and evaluate the remaining classes. Develop automated methods and management tools to improve the continued and data driven analysis of the fleet operation and size.

This report addresses these goals and tasks and begins with a brief overview of the results of the first project which examined six equipment classes.

1.2 Initial Project Overview

The primary goal of the initial study was to develop a methodology for evaluating aging (or depreciation), disposal points, and overall utilization for the six classes of equipment that represent the greatest capital investment. The equipment classes included were pickup trucks, single axle dump trucks, flat bed and miscellaneous trucks, backhoe loaders, motor graders, and front end loaders.

The findings and recommendations of the initial project covered four categories: 1) Operational perspectives; 2) Data accuracy and information system considerations; 3) Equipment utilization

targets; 4) Long term recommendations to implement the findings of this study or identify improved approaches. Details of the findings and recommendations can be found in NCDOT Report 2010-04.

1.3 Current Project Overview

The team for this project consisted of investigators representing East Carolina University engineering and UNC Charlotte construction management. Graduate and undergraduate students in engineering, computer science, and construction management were also very involved in multiple aspects of the project. The project team originally planned to segment the analytical work based on equipment classifications, but found that a more integrated approach in which the combined team worked on improving the model and automating the data collection and analysis segments was more productive.

To provide context for the report, the following section provides a brief summary of changes and adjustments made to the original analytical model.

1.3.1 Analytical Model Adjustments and Improvements

The primary focus of the efforts was to develop, test, and refine a flexible and capable analytical model which can serve the long term management needs of the Fleet and Material Management Unit. With that focus, the project team provided several expanded options and modifications to the original model:

- Information was analyzed and provided that reflects both utilization and equipment usage (hours operated or miles driven per year), as this parameter better correlates with operating costs and cost related trends. While utilization is an important metric of fleet performance, it is limited in its ability to reflect the actual wear and tear experienced by equipment due to use. In addition to the previously developed equivalent uniform annual cost (EUAC) model, a second approach to economic life modeling, based on the present value of the average life-to-date rate (cost/mile or cost/hour) was developed. This rate model provides an economic measure that more accurately accounts for the significant decline in annual equipment usage and provides an alternative perspective for the optimal life.
- An additional technique was developed to determine optimal life for NCDOT classes which have no usage data (odometer or hour meter). These classes are analyzed on an annual cost basis.
- The depreciation model used in the original study was developed based on actual data from NCDOT salvage records and similar market information. This approach is labor intensive and also difficult to apply across a diverse equipment mix since there is limited historical information for depreciation for many equipment class codes. To address this issue, a more flexible method was developed based on the sum of the years' digits depreciation which can be implemented across all codes.
- The management analysis capabilities of the original model have been expanded and automated. The developed modeling application automates basic steps such as development of utilization and fleet age histograms and also automates calculations of

economic life based on both EUAC and rate models. Finally, it provides management capability to examine "what if" scenarios based on various levels of fleet reduction.

In general, this updated model provides the ability to make data driven decisions in the management of the fleet and significantly reduces the manual efforts required to develop economic models.

1.4 Report Organization

The remainder of the report presents the result of the current study and is organized along the general structure of the project and the analytical model.

- Chapter 2 presents the literature review and summarizes the annotated bibliography contained in Appendix A.
- Chapter 3 describes the data collection process and the procedures involved. A complete description is contained in Appendix B.
- Chapter 4 examines the economic optimization model and how it was applied to the remaining classes.
- Chapter 5 presents the automated data analysis application tool which was developed to accelerate the analytical capabilities of the model. A complete description is contained in Appendix C
- Chapter 6 presents the results of the analysis of the remaining equipment classes.
- Chapter 7 concludes the report with a summary and recommendations for next steps

2 Literature Search

At the initiation of this project, a comprehensive search of applicable literature was conducted. A large volume of publications address the issues of fleet management. However, the number relating to the specific fleet management project requirements related to this project and the needs of NCDOT are a small subset of the larger literature. Consequently, the literature search provided general benchmarks for examining various analytical approaches in the project. The next paragraphs highlight the literature most related to this project and addresses this literature in four areas: general models, operations research models, technology related models, and system based models. Appendix A contains a complete annotated bibliography of the most important literature.

2.1 General Models

The general model area involved analytical models broadly applicable to fleet management. One of the more common areas for model literature related to the traditional fleet management involving rental car companies or similar general fleets. Cho et al. (2010) is an example of this type of work and it evaluated the issues of steep depreciation and the related loss in fleet value, a particular issue relevant to the pickup truck equipment in NCDOT. Fork truck and material handling fleet management issues are also well studied, as evidenced by Drickhamer et al. (2005). Finally, another area of general models involves replacement of standby or back up equipment and the implications on optimal cost. The article by Yeh (1995) is an example of this type of analysis. Mitchell et al. (2011) describe models for heavy equipment based on cumulative costs and present a methodology for developing cumulative cost models from period cost data, which is similar to the methodology employed in this project. Finally, Sussams (1984) examines a number of depreciation methods including sum of the years' digits and applies several of the same cost parameters applied in this report.

The literature covering general models provided general validation that the employed methods in this project are consistent with those currently used.

2.2 Operations Research and Statistical Models

This section presents the findings related to operations research optimization and statistical models. In general, operations research methods explore optimization techniques, such as integer programming, goal programming, and linear programming, which attempt to find optimal solutions for replacement. Typical of these models is Goghrod et al. (2003) which applied goal programming to maximize the qualitative goals of the fleet manager. Another example is Simao et. al. (2011). This paper applied dynamic programming to minimize the number of non-productive miles driven by a class of equipment given duty hours and various location constraints. Weissman et al. (2003) apply a model in this category to examine the needs of the Texas DOT to prioritize units for replacement. Although these models are useful in many ways in examining and optimizing fleet issues, they are not applicable to the current problem due to their general nature. Fan et al. (2011) provided a comprehensive literature review of operations research models used for transportation replacement optimization.

Statistical models apply a form of probabilistic analysis to examine optimal policies and the related risk issues. For example, Chen and Lin (2006) applied a Weibull distribution survival model to fleet management decisions.

Operations research and statistical models are very useful for strategic planning and for risk analysis but do not provide a set of tools which are broadly adaptable to the diverse set of equipment classes which NCDOT manages.

2.3 Technology Related Models

Several models for fleet management examined the use of technology advances to improve data collection and utilization. In general, these models are more tactical in the sense of determining optimal routes and the required vehicle fleet to support these prescribed routes. Ireland (2000) provides an example of a technology model. He examined the use of GPS technology in route management and the related cost trades in fleet size and route development. Technology models were not found with immediate application to the specific direction of this project.

2.4 System Based Models

System based models typically explored life cycle and indirect, or unallocated, costs using analytical tools covering a complex range of fleet impact areas. For example, Harbuck (2009) explored life cycle concepts in transportation projects in general. Lin et al. (2008) investigated replacement models which looked at integration of emissions benefits in fleet replacement. Similarly, Kim et al. (2003) studied optimal replacement cycles based on overall environmental impact and cost. These system oriented models include cost factors generally beyond the scope or objectives of the current project.

3 Data Collection and Assembly

This section provides a brief overview of the process for collection and assembly of data from the SAP system. A complete instruction manual is contained in Appendix B and the following paragraphs summarize the key steps from that document. Although the analysis process has been automated, there are still a number of specific steps which must be completed manually in order to assemble the data for the analysis. It should be noted that the procedure described in Appendix B is the procedure used by the project team, which describes data collection via remote access to the SAP data base using Citrix client software.

- Logging In and Downloading Application: This section provides screen captures and information for the steps needed both by individuals outside the NCDOT computer system (using Citrix client) and those inside.
- Creation of the Equipment Identification Sheet: Once into the SAP BSIP system, this section describes the steps to access the data elements needed for the analysis step.
- Importing / Setting Up the Excel Spreadsheet: The data obtained in the previous step must be transferred into an Excel spreadsheet for the analysis application.
- Utilization Data from the Business Warehouse: Additional data fields must be obtained from the Business Warehouse area of SAP. This section details those steps and integration of this information into the master excel workbook.
- Equipment Rental Income Information: This section describes the steps involved in obtaining the equipment rental and cost information along with integrating that into the master excel spreadsheet
- Creating the Report Layout: this section provides the final details in creating the report layout after the data extraction process described above is completed.

4 Economic Model Description

This section provides a description of the economic analysis model used to analyze the optimal equipment life cycle. Economic models to estimate the annual costs over the life of operational equipment include both owning and operating costs. Owning costs reflect the expense of purchasing equipment and keeping it in the fleet on an annual basis. Operating costs are related to use of the equipment to perform tasks and are experienced for each hour of operation or mile driven. The following report elements cover a description of these costs (owning and operating) and the overall economic model.

4.1 Owning Costs

The cost of equipment ownership primarily results from the decrease in machine value as the machine ages, but may also include other annual costs such as licenses, insurances, taxes, etc. NCDOT does not directly incur these other annual costs and the ownership cost for this project was defined as the difference between the purchase price and the estimated resale value of the machine over time. The annual owning cost in a specific year of equipment life was the loss in resale value in that year. Thus, it was necessary to estimate the relationship between estimated resale value and machine age.

There are several methods for estimating the resale value of a machine. Estimates based on historical data are generally most preferred, but several other accounting methods are also acceptable options. Like the original study[1], historical equipment resale data from NCDOT auctions and public commercial auctions were examined.

Exponential regression models were developed to reflect market value decline of equipment assets over machine age. Two issues were noted leading to the decision to explore alternative methods. First, the available auction data primarily reflected older equipment at the end of equipment life and data regarding relatively young assets were not generally available. Second, due to the nature of the auction disposal process, there was substantial variability in the data. Therefore, it was necessary to adopt a more flexible model which can be more consistently applied to all equipment types and better estimate asset values for newer equipment.

4.1.1 Market Value Model

During the course of this study, several methods were examined and an improved market value modeling approach using the sum of years' digits method was selected. As the original exponential model did, this method produces a non-uniform annual loss in value schedule, where the loss in value is greatest in the first year and gradually decreases thereafter to a minimum resale value at a set point in the machine life[2]. The advantage to this approach is that it is more easily adapted to the various equipment classes, requiring only the selection of the minimum resale value (long term residual value) and the depreciation term, which is the machine age at which this minimum value is reached. Using the sum of the years' digits approach, the annual loss in machine value is calculated using equation 1.

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[1] See NCDOT report 2010-04, Fleet Management Criteria: Disposal Points and Utilization Rates, Chapter 3, pp 55-57 for a detailed description of the original market value decline model.

[2] Nunnally, S. (2007). *Construction Methods and Management*. 7th ed., Pearson-Prentice Hall, Upper Saddle River, NJ.

$$Dn = \frac{Year\ Digit}{Sum\ of\ Years' Digits} * Amount\ to\ be\ Depreciated$$ **Equation 1**

Where: *Dn* = Annual loss in machine value
Year Digit = Particular year digit taken in inverse order
Sum of Years' Digits = Sum of the years' digits for the depreciation term
Amount to be Depreciated = Purchase price less minimum resale value

The minimum resale value and deprecation term were estimated separately for each equipment class based on current NCDOT parameters and data published by the US Army Corps of Engineers (USACE).[3] Minimum resale value was defined as a percentage of the purchase price and the salvage values (percentages) published by USACE for various equipment types were used to estimate this value for each NCDOT equipment class. Depreciation term was determined considering both the period currently used by NCDOT and equipment life published by USACE. Since the USACE defines life in terms of hours of operation, the published life was converted to years by dividing the life in hours by 1,984 hours per year, which is the number of hours a machine is available for use in a year per NCDOT utilization guidance. Engineering judgment was used to determine a depreciation term to be included in the economic models that was in agreement with both the NCDOT and USACE values. An example of several classes is provided in Table 1 and the complete data is contained in Appendix C.

Table 1: Excerpt of Depreciation Term by Equipment Class

Class	Description	NCDOT Depreciation Term (yrs)	USACE Life Hours	USACE Life Years	USACE Salvage Value (% of Purchase)	Modeled Depreciation Term (yrs)
0200	TRUCK,MISC SPCL USE 5000 GVW	5	8,000	4.0	20%	5
0201	TRUCK,PICKUP 5000 GVW	5	8,000	4.0	20%	5
0202	TRUCK,PICKUP 7500 GVW	5	8,000	4.0	20%	5
0203	TRUCK,UTILITY BODY 15000 GVW	5	10,000	5.0	20%	5
0204	TRUCK,CREW CAB	5	8,000	4.0	20%	5
0205	TRUCK,DUMP 33000 GVW	8	12,000	6.0	20%	7
0206	TRUCK,MISC 32000 GVW	8	12,000	6.0	20%	7
0207	TRUCK, MAP 5,000/7500 GVW, EXT. CAB	4	8,000	4.0	20%	4

For example from Table 1, equipment in the 0200 class has a five year depreciation term per NCDOT procedures and a four year term based on 8,000 hours of use per USACE, with an

[3] USACE (2011). Construction Equipment Ownership and Operating Expense Schedule – Region III. Report EP 1110-1-8, Nov 2011.

ultimate residual value of 20 percent of the purchase price. Consequently, a depreciation term of five years and the residual value of 20 percent were selected. Table 2 provides the depreciation schedule details based on this plan for equipment in the 0200 class. Sensitivity study shows that the results of the economic analysis are very insensitive to the value selected for the depreciation life (as long as economic life is greater than depreciation life, there is almost no sensitivity).

Table 2: 0200 Equipment Class Depreciation Schedule

Age	Year Digit	Sum of Years' Digits	Depreciation Factor	Annual Depreciation	Estimated Resale Value
1	5	15	33%	27%	73%
2	4	15	27%	21%	52%
3	3	15	20%	16%	36%
4	2	15	13%	11%	25%
5	1	15	7%	5%	20%
Total after 5 years			**100%**	**80%**	

4.1.2 Capital Cost

Ownership cost was calculated over equipment life by using the capital recovery cost in each year to purchase the machine at the beginning of year 1 and sell the machine at the end of each year for the estimated resale value. The capital recovery (CR) cost is expressed as an EUAC and is calculated using equation 2.

$$\boldsymbol{CR = P(A/P, i, n) - S(A/F, i, n)} \qquad \textbf{Equation 2}$$

Where: *CR* = Capital recovery EUAC
P = Purchase price
S = Estimated resale value
i = Interest rate
n = Number of years

Terms such as *(A/P, i, n)* represent the standard engineering economic factors to convert values to present (P), future (F) , or annual worth (A) amounts based on a given interest rate (i) and the number of compounding periods (n). Throughout this study, a value of three percent was used for the interest rate to represent the time value of money.

Estimates of market (or resale) value of a machine throughout its life are expressed as a percentage of purchase price. An average purchase price was estimated for each class based on acquisition value adjusted to the current economic basis (2011$) using the consumer price index (CPI) value published by the US Bureau of Labor Statistics.

4.2 Operating Costs

The costs of operating equipment include items such as the costs for fuel, preventive maintenance (PM) supplies (oil, filters, etc.), repair parts, tires, and the labor required to perform maintenance and repair actions. Similar to the first study, operating cost was defined as the sum of the following SAP database items: PM labor, repair labor, PM parts, repair parts, fuel, oil, and tires. These costs result from operating the equipment and are commonly expressed as the operating rate in terms of cost per hour operated or cost per mile driven. Since the operating rate

generally increases as the machine ages, it is necessary to define the relationship between operating rate and machine age. The equation best fitting the average annual operating rate and age of equipment in each class was determined through least squared error techniques. The average annual operating rate for each machine was the total annual operating cost for the machine divided by the total hours operated or miles driven in the year. Machine age, in years, was calculated by determining the number of days between the start-up date for each machine and the end date of the year being evaluated and dividing by 365.25 days per year.

4.2.1 Average Annual Operating Rate

Following previous NCDOT research[4], the exponential relationship between average annual operating rate (AAOR) and machine age used as represented in equation 3.

$$AAOR = ke^{xt} \qquad \textbf{Equation 3}$$

Where: *AAOR* = Average annual operating rate (cost per hour or mile)
x = Machine age in years
k = Regression parameter representing the initial operating rate
t = Regression parameter representing the annual increase in operating rate

As noted above, least squared error regression techniques were used to develop the equation describing the relationship between annual average cost per mile or hour and age for each equipment class. In the original study, outliers were not eliminated, with the exception of those which were obviously an error. Management was interested in a thorough reflection of all data in the models developed. In this study, SAP data collected for all machines in a class was used to develop an initial model, which was then refined by paring the population of machines where AAOR was more than three standardized residuals from the estimated rate (the value on the equation line). The final AAOR model was used to estimate the operating rate of machines at any age. The AAOR model for equipment class 0314 BACKHOE, TRACTOR LOADER is provided as an example in Figure 1.

[4] This information is found in chapter 4, pp. 69-71 of the original study

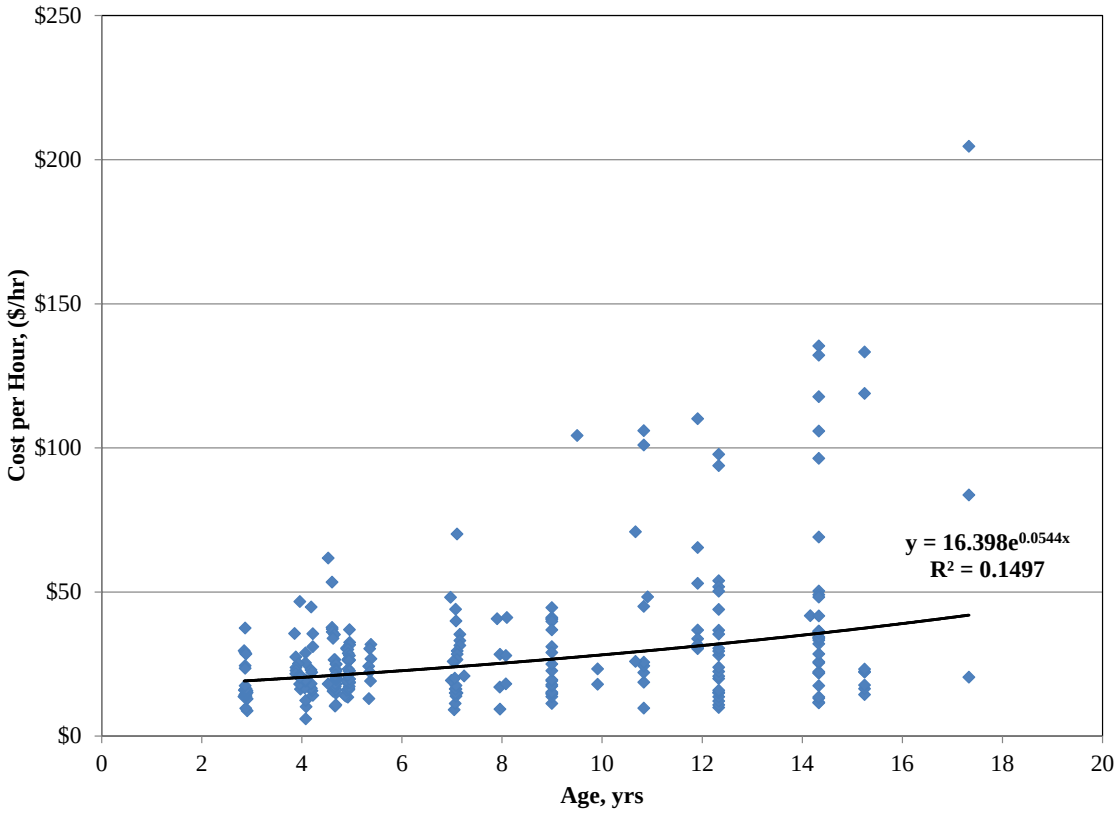


Figure 1: Class 0314 Average Annual Operating Rate Model based on data from 2011

As noted in the equation in Figure 1, the *k* regression parameter (noted in Eq. 3 above) in the AAOR model for class 0314 was 16.40, which represents that the AAOR for a new machine (age 0) in this class was estimated to be $16.40 per hour. Also, the *t* parameter (also in Eq. 3 above) was 0.0544, which can be shown to correspond to a 5.6 percent annual increase in AAOR.[5]

4.2.2 Annual Equipment Use

Annual operating cost is the product of the estimated operating rate per hour or mile calculated using equation 3 and the number of hours operated or miles driven in a given year. As a result, it was necessary to model equipment use throughout the life of the asset classes. Again following previous NCDOT research[6], the linear relationship between annual use and equipment age in equation 4 was applied to model the decline in usage over time for the various classes.

$$AU = mx + b \qquad \textbf{Equation 4}$$

Where: AU = Annual machine use (hours or miles)
m = Annual change in machine use (hours or miles per year)
x = Machine age in years
b = Initial machine use (hours or miles)

[5] The development of this conversion from the t parameter to annual percent increase is described on page 70 of the original report.

[6] These decline in use models are developed in chapter 4, pp. 71-78 in the original report.

The AU model for equipment class 0314 is shown in Figure 2.

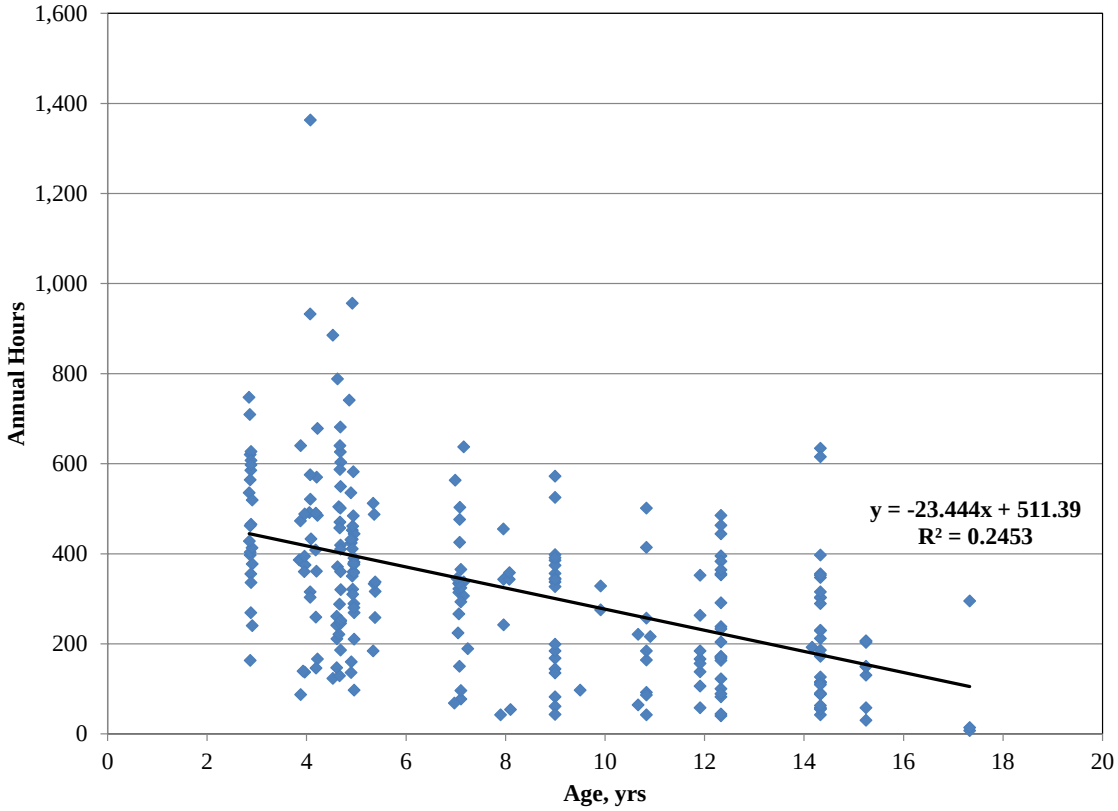


Figure 2: Class 0314 Annual Use Model Based on Data from 2011

As noted in the equation in Figure 2, the *b* regression parameter in the AU model is 511, which indicates that a new machine (age 0) in this class is estimated to operate 511 hours per year initially. Also, the *m* slope parameter was -23 indicating that the annual use declines by 23 hours each year as the machine ages.

It is important to clarify that a machine is not expected to operate *b* hours (or miles) during the first year it is in service. This is because *b* represents the level of use at age 0 and the average age of a machine during its first service year is 0.5 years. Thus, machine use in the first year was estimated as (*b* + 0.5*m)* and then declined by *m* hours (or miles) each year.

Modeling AU in this manner results in an age at which annual use can theoretically decline to less than zero, which is not realistic. The age at which this occurs varies depending on the magnitude of the *m* and *b* parameters. Therefore, the economic models developed for each class extended only to an age of 30 years maximum or the age at which annual use remains positive. Combining equations 3 and 4, the annual cost of operating equipment is described by equation 5.

$$\boldsymbol{AOC = AU * AAOR * (1 + i)^n} \qquad \textbf{Equation 5}$$

Where: *AOC* = Annual operating cost
AU = Annual use (hours or miles)
AAOR = Average annual operating rate (cost per hour or mile)
i = Estimated rate of inflation
n = Machine age (years)

Throughout this study, an estimated inflation rate of 2.4 percent was used based on an aggregation of long term inflation estimates and engineering judgment.

As an example of applying equation 5, the estimated annual use for equipment in the 0314 class, along with the estimated average annual operating rate and estimated annual operating cost is provided in Table 3. For the 0314 class, annual use in the first year is 500 hours and declines steadily to 7 hours when the machine has aged 22 years. The average annual operating rate is $17.73 per hour in the first year and increases to $91.39 at age 22 years, which correspond with annual operating costs of $8,859 and $672, respectively.

Table 3: Class 0314 Annual Use and Operating Cost Schedule

Age	Annual Use (hrs)	Average Annual Operating Rate ($/hr)	Annual Operating Cost
1	500	$ 17.73	$ 8,859
2	476	$ 19.17	$ 9,129
3	453	$ 20.73	$ 9,385
4	429	$ 22.41	$ 9,622
5	406	$ 24.23	$ 9,835
6	382	$ 26.20	$ 10,020
7	359	$ 28.33	$ 10,169
8	336	$ 30.63	$ 10,277
9	312	$ 33.11	$ 10,336
10	289	$ 35.80	$ 10,336
11	265	$ 38.71	$ 10,268
12	242	$ 41.86	$ 10,120
13	218	$ 45.26	$ 9,881
14	195	$ 48.93	$ 9,537
15	171	$ 52.90	$ 9,071
16	148	$ 57.20	$ 8,467
17	125	$ 61.85	$ 7,704
18	101	$ 66.87	$ 6,762
19	78	$ 72.30	$ 5,617
20	54	$ 78.17	$ 4,240
21	31	$ 84.52	$ 2,603
22	7	$ 91.39	$ 672

4.3 Economic Model Description

Using the cost information developed in the previous section, economic models were developed for each equipment class to estimate owning, operating, and total equipment costs throughout the life of equipment.[7] Also, the total life-to-date (LTD) cost assuming purchase in year 0 and disposal in each year was estimated on both the basis of EUAC and an average LTD rate so that an economic life for each class could be estimated. Economic life is the period that ends when the average total cost rate reaches a minimum.[8] Table 4 shows the cost calculations for equipment class 0314 (loader-backhoe). Details of each column in table 4 are described below.

[7] Derivation and details of the equivalent annual cost models employed are contained in Chapter 5, pp. 80-82 of the original report.

[8] Vorster, M. (2009). Construction Equipment Economics. Pen Publications, Christiansburg, VA

The initial project analyzed six classes and determined economic life based on a minimum LTD total cost EUAC. During this project, it was observed that equipment in many classes experienced significant variability in annual use (hours operated or miles driven). This reduced usage is detrimental in forcing the EUAC model to converge to a minimum. In fact, as will be seen in Chapter 6, many classes of equipment do not converge to a minimum EUAC. Consequently, the use of a rate model was employed as an alternative means of identifying economic life. In Table 4, estimated life cycle costs are shown both on the basis of EUAC (column 8) and using an average LTD rate (column 11).

For context in analyzing Table 4, the key data for equipment 0314 is listed below:

- Purchase price of $77,614
- Depreciation term of 7 years
- Minimum resale value of 25 percent
- Initial use of 511 hours per year
- Annual decline in use of 23 hours per year
- Initial operating rate of $16.40 per hour
- Annual operating rate factor of 0.0544
- Interest rate (time value of money) of 3 percent
- Inflation rate of 2.4 percent

Referencing the column numbers along the top of Table 4, the model estimates the following for each year of machine life:

(1) **Year** – Represents each year of operation and indicates the machine age at the end of the period.

(2) **Market Value** – The estimated resale value of the machine; calculated using the sum of the years' digits method based on the depreciation term and minimum resale value; note that after the depreciation term the estimated resale value remains the minimum resale (or residual) value.

(3) **Owning EUAC** – Capital recovery cost expressed as a uniform annual cost experienced from year 1 through each calculated year; for example, the capital cost of purchasing a machine for $77,614 in year 0 and reselling it for $25,640 in year 5 is equivalent to paying $12,118 annually from year 1 through year 5.

(4) **Annual Use** – The use of the machine based on the linear model of annual use.

(5) **Operating Cost** – The estimated cost (in the calculated year) of operating the machine the number of hours (or miles) indicated in column (4); calculated as the product of annual use and the estimated average annual operating rate adjusted for inflation.

(6) **Operating Cost PV** – The present value of the estimated operating cost in column (5); expressed in year 0 (2011) dollars; for example, an operating cost of $9,835 in year 5 is equivalent to $8,484 in year 0.

(7) **Operating Cost EUAC** – The uniform annual cost of all operating costs estimated from year 1 through each calculated year; for example, the sum of operating cost PV through year 5 is $42,827 and is equivalent to paying $9,352 annually from year 1 through year 5.

(8) **LTD Total EUAC** – The uniform annual cost of estimated owning and operating costs from year 1 through each calculated year; the sum of the Owning EUAC and Operating EUAC.

(9) **LTD Age** – Cumulative age of the machine (in hours or miles) based on operating the machine the number of hours in column (4)

(10) **LTD Total PV** – The present value of the sum of estimated owning and operating costs from year 1 through each calculated year expressed in year 0 (2011) dollars; for example, the total cost of owning and operating a machine through year 5 is equivalent to $98,324 paid in year 0.

(11) **LTD Rate** – The average life-to-date total rate expressed in year 0 (2011) dollars to own and operate a machine through each calculated year; calculated as the LTD Total PV divided by the LTD Age; for example, owning a machine through year 5 and operating it 2,264 hours at a PV cost of $98,324 produces an average rate of $43.43 per hour.

From Table 4, the economic life for equipment class 0314 was estimated at 14 years based on the minimum LTD total rate of $36.11 per hour. While a minimum LTD total EUAC of $12,881 was calculated based on a life of 22 years, this value was the smallest EUAC value calculated and is not a minimum. Rather, it is the result of a decreasing annual operating cost due to a decreasing level of use and is calculated for the last year in which use is greater than zero. It is important to note that for equipment classes where annual use is relatively consistent throughout the life of the machine, the economic life estimated based on minimum LTD total EUAC is meaningful and provides validation for the economic life estimated based on minimum LTD total rate.

It is also important to note that while the minimum LTD total rate calculated was in year 14, the rate of $36.11 per hour was less than a cent lower than the rate in year 15 and only a few cents less than the rates calculated in years 13 through 16. This indicates that the economic life should not be considered a singular point in time, but rather a small range of machine age where it is most advantageous to remove the machine from the fleet.

Table 4: Class 0314 Economic Model based on data from 2011

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Year	**Market Value**	**Owning EUAC**	**Annual Use (hrs)**	**Operating Cost**	**Operating Cost PV**	**Operating EUAC**	**LTD Total EUAC**	**LTD Age (hrs)**	**LTD Total PV**	**LTD Rate ($/hr)**
0	$77,614									
1	$63,062	$16,881	500	$ 8,859	$8,601	$8,859	$25,740	500	$ 24,991	$ 50.01
2	$50,588	$15,642	476	$ 9,129	$8,605	$8,992	$24,634	976	$ 47,137	$ 48.30
3	$40,193	$14,435	453	$ 9,385	$8,588	$9,119	$23,555	1,429	$ 66,627	$ 46.64
4	$31,877	$13,261	429	$ 9,622	$8,549	$9,239	$22,500	1,858	$ 83,635	$ 45.01
5	$25,640	$12,118	406	$ 9,835	$8,484	$9,352	$21,469	2,264	$ 98,324	$ 43.43
6	$21,482	$11,006	382	$10,020	$8,391	$9,455	$20,461	2,646	$110,842	$ 41.88
7	$19,404	$ 9,925	359	$10,169	$8,269	$9,548	$19,473	3,005	$121,325	$ 40.37
8	$19,404	$ 8,875	336	$10,277	$8,113	$9,630	$18,505	3,341	$129,897	$ 38.88
9	$19,404	$ 8,058	312	$10,336	$7,921	$9,700	$17,758	3,653	$138,265	$ 37.85
10	$19,404	$ 7,406	289	$10,336	$7,691	$9,755	$17,161	3,942	$146,389	$ 37.14
11	$19,404	$ 6,873	265	$10,268	$7,418	$9,795	$16,668	4,207	$154,227	$ 36.66
12	$19,404	$ 6,430	242	$10,120	$7,098	$9,818	$16,248	4,449	$161,733	$ 36.35
13	$19,404	$ 6,056	218	$ 9,881	$6,729	$9,822	$15,878	4,667	$168,858	$ 36.18
14	***$19,404***	***$ 5,735***	***195***	***$ 9,537***	***$6,305***	***$9,805***	***$15,541***	***4,862***	***$175,548***	***$ 36.11***
15	$19,404	$ 5,458	171	$ 9,071	$5,822	$9,766	$15,224	5,033	$181,744	$ 36.11
16	$19,404	$ 5,216	148	$ 8,467	$5,276	$9,701	$14,918	5,181	$187,383	$ 36.16
17	$19,404	$ 5,003	125	$ 7,704	$4,661	$9,610	$14,613	5,306	$192,396	$ 36.26
18	$19,404	$ 4,815	101	$ 6,762	$3,972	$9,488	$14,303	5,407	$196,710	$ 36.38
19	$19,404	$ 4,646	78	$ 5,617	$3,203	$9,334	$13,980	5,485	$200,245	$ 36.51
20	$19,404	$ 4,495	54	$ 4,240	$2,348	$9,144	$13,639	5,539	$202,915	$ 36.63
21	$19,404	$ 4,358	31	$ 2,603	$1,399	$8,916	$13,275	5,570	$204,627	$ 36.74
22	$19,404	$ 4,235	7	$ 672	$ 351	$8,646	$12,881	5,577	$205,282	$ 36.81

5 Spreadsheet Analysis and Modeling Application

One of the major improvements from the original study was a spreadsheet application developed to apply the analytical and modeling methods in an efficient and consistent manner to the data for each equipment class. The Fleet Analysis & Economic Modeling Application is a Microsoft Excel workbook containing the market value model parameters, CPI data, and VBA code necessary to develop the economic models for an equipment class from a set of data collected from the SAP and Business Warehouse databases. In addition to applying the economic models described previously, the application was designed to separately develop economic models based on equipment class fleets of a reduced size and a user defined annual decline in use. This Forward Analysis allows for evaluating the impact of fleet size reductions and/or consistent use levels on the timing (years) and magnitude (cost) of economic life. This is a powerful management tool as the Fleet Management Unit works to right size the equipment complement.

The application workbook consists of a *Main* worksheet and 3 supporting worksheets. The *Main Worksheet* is the beginning point for a user to analyze data and is shown in Figure 3.

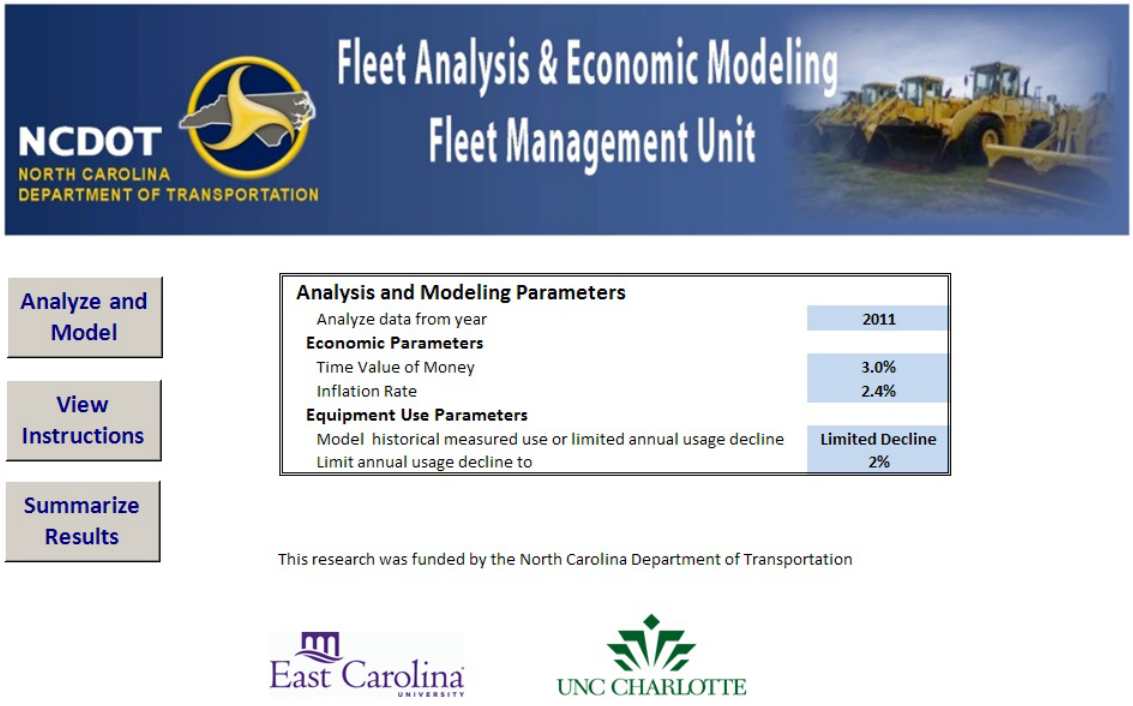


Figure 3: Main Worksheet of the Analysis and Modeling Application

The worksheet provides three buttons along the left side to initiate various functions and an area in the center for the user to define the analysis and modeling parameters.

- The *Analyze and Model* button begins the fleet modeling process by prompting the user to select the raw data file on which analysis will be performed based on the provided analysis and modeling parameter values.
- The *View Instructions* button causes the *Instructions* worksheet to appear, which provides the user with brief instructions and information regarding the equipment analysis and results.

- The *Summarize Results* button creates a separate summary workbook of all analyzed files in a user selected folder.

5.1 Preparation for Analysis

Prior to performing the data analysis, four key parameters should be reviewed by the user and entered into the center screen on the main worksheet:

1. Analysis and modeling parameter values
2. CPI data and base year
3. Market value model data
4. Raw data format

These elements are described in detail in the following sections.

5.1.1 Analysis and Modeling Parameter Values

Analysis and modeling is based on the following economic and equipment use parameters set by the user, and as shown in Figure 3:

Analyze data from year – The calendar year for which equipment data has been collected.

Time Value of Money – The annual rate at which the value of money is discounted.

Inflation Rate – The annual rate at which costs, in general, increase.

Model historical measured use or limited annual usage decline –Either "Measured Use" or "Limited Decline"; the method for modeling annual equipment use in the Forward Analysis.

Measured Use – Annual equipment use is based solely on the historical data provided.

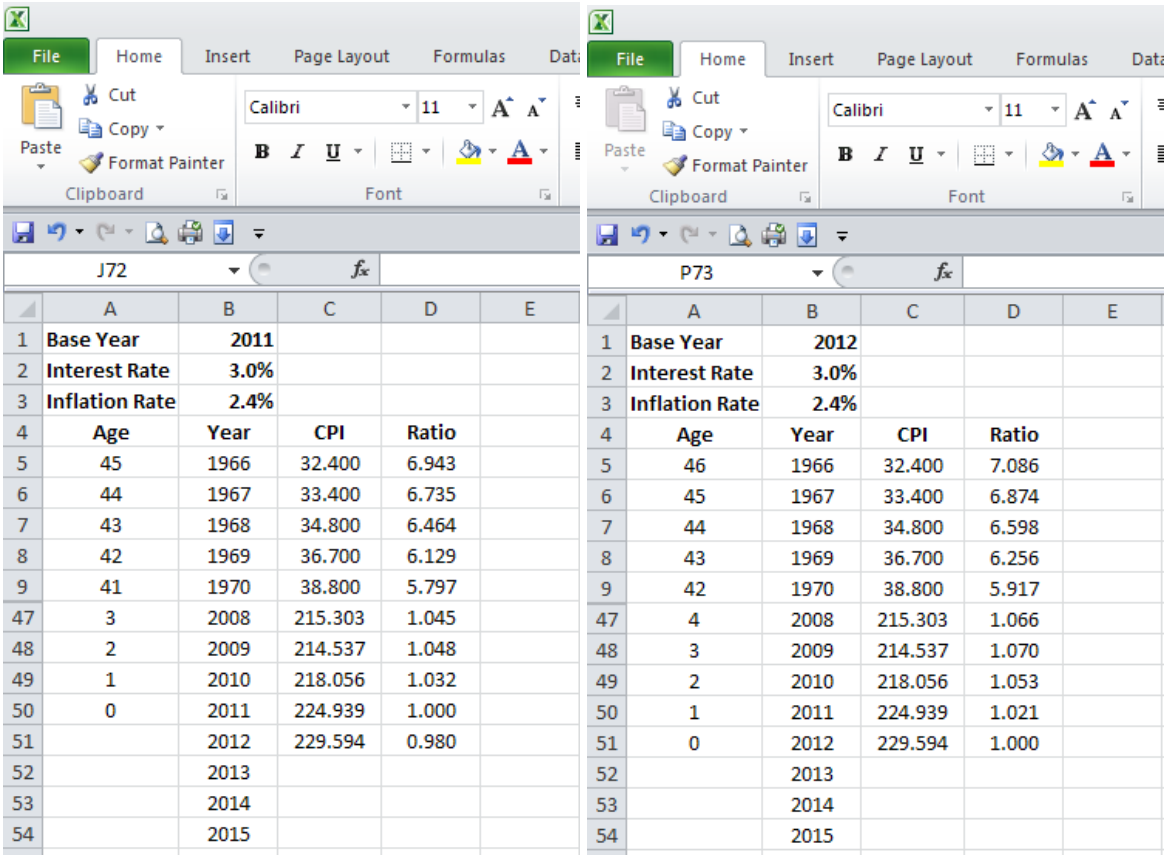
Limited Decline – Annual equipment use is adjusted to limit the year-over-year decline in use to the specified value.

Limit annual usage decline to – The year-over-year decrease in equipment use specified as a percentage of the initial annual use.

5.1.2 CPI Data and Base Year

CPI data is stored on the *CPI* worksheet and must be updated annually with data from the US Bureau of Labor Statistics. This data is used to convert equipment acquisition costs to an equivalent value in the year for which data is being analyzed. Additionally, the *Base Year* set on the CPI worksheet must be set to the year for which data has been collected and is being analyzed, as shown in Figure 4.

In Figure 4(a), the annual average CPI value of 229.594 for 2012 has been entered into the CPI column and the ratio of the CPI in 2012 to the value in the base year (2011) is shown as 0.98. In Figure 4(b), the base year has been set to 2012 and the ratio shown for 2012 is 1.00. Default rates for interest and inflation are set on this worksheet as well, but the values set by the user in the Analysis and Modeling Parameters on the *Main* worksheet are used in the analysis and modeling application.



(a) Before Updating

	A	B	C	D	E
1	Base Year	2011			
2	Interest Rate	3.0%			
3	Inflation Rate	2.4%			
4	Age	Year	CPI	Ratio	
5	45	1966	32.400	6.943	
6	44	1967	33.400	6.735	
7	43	1968	34.800	6.464	
8	42	1969	36.700	6.129	
9	41	1970	38.800	5.797	
47	3	2008	215.303	1.045	
48	2	2009	214.537	1.048	
49	1	2010	218.056	1.032	
50	0	2011	224.939	1.000	
51		2012	229.594	0.980	
52		2013			
53		2014			
54		2015			

(b) After Updating

	A	B	C	D	E
1	Base Year	2012			
2	Interest Rate	3.0%			
3	Inflation Rate	2.4%			
4	Age	Year	CPI	Ratio	
5	46	1966	32.400	7.086	
6	45	1967	33.400	6.874	
7	44	1968	34.800	6.598	
8	43	1969	36.700	6.256	
9	42	1970	38.800	5.917	
47	4	2008	215.303	1.066	
48	3	2009	214.537	1.070	
49	2	2010	218.056	1.053	
50	1	2011	224.939	1.021	
51	0	2012	229.594	1.000	
52		2013			
53		2014			
54		2015			

Figure 4: Updated CPI Data to 2012

5.1.3 Market Value Model Data

The market value model parameters are contained on the *MV Model* worksheet and include information necessary to model equipment depreciation. An example of this data is provided in Figure 5.

A	B	C	D	E	F
Class	Depreciation Term	Residual Value	Usage Metric	Maximum Age	Description
0200	5	20%	Miles	13	TRUCK,MISC SPCL USE 5000 GVW
0201	5	20%	Miles	13	TRUCK,PICKUP 5000 GVW
0202	5	20%	Miles	13	TRUCK,PICKUP 7500 GVW
0203	5	20%	Miles	13	TRUCK,UTILITY BODY 15000 GVW

Figure 5: Market Value Model Data

Specifically, the data contained on the worksheet includes:

Class – Equipment class code

Depreciation Term – The period in years over which equipment value is depreciated

Residual Value – The minimum resale value expressed as a percentage of the purchase price

Usage Metric – Units of measure for use of the equipment (hours, miles, or years)

Maximum Age – Approximately 2.5 times the depreciation term and the maximum age of equipment included in the analysis

Description – NCDOT description of the equipment class

Only equipment classes included on the *MV Model* worksheet can be analyzed. Additional equipment classes may be added, but must be added prior to analyzing data. Therefore, it is important that users review the list and confirm the data prior to initiating analysis.

5.1.4 Raw Data Format

The contents and format of the raw data collected from the SAP system should be verified prior to initiating analysis. The raw data file must have 3 separate worksheets:

1. Equipment Identification
2. Equipment Rental Income
3. Equipment Utilization

Each work sheet must be precisely named and contain the appropriate data. The processes for collecting the raw data are described in the *Procedure Manual for Assembling NCDOT Fleet Performance Data for Economic Analysis* in Appendix B.

5.2 Performing the Analysis and Modeling

Analysis and modeling is initiated by selecting the *Analyze and Model* button on the *Main* worksheet. The user is prompted to select the raw data file to be analyzed, and the analysis and modeling is automatically performed. The processes consist of processing the raw data and analyzing the data. A dialog box will appear to show the progress through the processes.

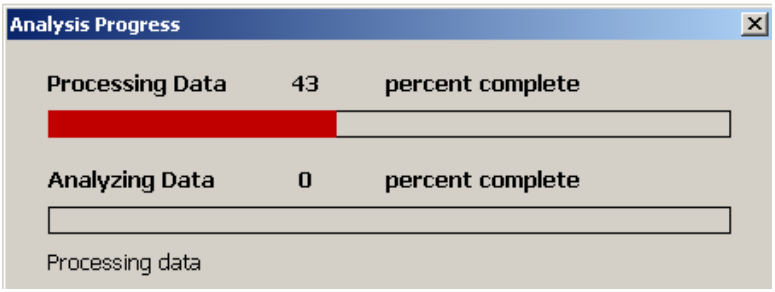


Figure 6: Analysis Progress Indicators

When analysis is complete, the user is prompted to save the workbook containing the analysis and results. The default filename is the filename of the raw data file appended with “Analyzed”.

5.3 Analysis and Modeling Results

Results of the analysis and modeling are presented in multiple forms, including tables, charts, histograms, mathematical models, and economic models. The makeup of results for equipment classes with use measured in miles or hours are slightly different than for classes measured in years. An analyzed workbook contains the following worksheets (ordered from right to left in the workbook and listed generally in the order created during analysis):

1. *Master* – Combined raw data for all machines in the class

2. *Excluded Data* – Data for machines excluded from the analysis
3. *Analyzed Data* – Data for machines included in the analysis
4. *Data Summary* – Data regarding machine acquisitions and data used to develop the histograms
5. *Process Summary* – Summary of the equipment class; including a count of equipment by class code and functional code, and a count of equipment excluded by exclusion criteria
6. *Usage Model* – Chart of annual use versus equipment age, including the mathematical model for annual use (not included for equipment use measured in years)
7. *Operating Rate Model* – Chart of average annual operating rate versus equipment age, including the mathematical model for estimating annual operating rate
8. *Usage Histogram* – Histogram of annual equipment use for analyzed equipment (not included for equipment use measured in years)
9. *Utilization Histogram* – Histogram of equipment utilization for analyzed equipment
10. *Age Histogram* – Histogram of equipment age for analyzed equipment
11. *Forward Analysis* – Economic model and results of analyses considering reduced fleet sizes and/or limited decline in annual use
12. *Current Analysis* – Economic model and analysis results for the analyzed equipment fleet
13. *Analyses Summary* – Summary of analyzed equipment class, economic analysis of current fleet, and forward analyses considering reduced fleet sizes

These worksheets are organized based on content and are characterized as:

- Data worksheets
- Equipment fleet summaries
- Fleet models
- Fleet histograms
- Analysis worksheets

5.3.1 Data Worksheets

The data worksheets include the *Master*, *Excluded Data*, and *Analyzed Data* worksheets.

The *Master* worksheet contains the data for all machines in the equipment class, and is the raw data combined into a single worksheet. The purpose of this worksheet is to provide historical documentation of the original data on which the analyses were performed.

The *Excluded Data* worksheet contains the data for each machine in the equipment class that was excluded from the analysis. Each machine record is tagged with the reason for exclusion from the analysis, and machines may be excluded based on the following criteria:

1. Annual use (hours or miles) is NULL or 0
2. Machine age is greater than the maximum age or less than 1
3. Total cost (annual operating cost) is NULL, 0, or not included in the data
4. Date of machine acquisition is not included in the data
5. Annual operating rate is significantly different relative to other machines in the class. Rates are considered significantly different if the standardized residual is less than -3 or greater than 3.

The *Analyzed Data* worksheet contains the data for each machine in the equipment class that was included in the analysis.

5.3.2 Equipment Fleet Summaries

The equipment fleet summaries include the *Data Summary* and *Process Summary* worksheets.

The *Data Summary* worksheet contains data regarding the acquisition of the analyzed machines and the adjustment of acquisition value to the current year (year for which data is analyzed). This worksheet also contains the data required to develop the annual usage, utilization, and age histograms.

The *Process Summary* worksheet is a snapshot summary of the analyzed machines of the equipment class in the year analyzed. The fleet is summarized in terms of number, use, age, utilization, operating cost, and adjusted acquisition value. Also included is a list and count of machines by class code, functional class, and exclusion criteria. An example of the *Process Summary* worksheet is provided as Figure 7.

	A	B	C	D	E	F	G	H	I	J	K
1	Year	**2011**		Class Code	Count		Functional Class	Count		Exclusion Criteria	Count
2	Number of Units	329		0210	57		GIMAPT	57		Zero Use	16
3	Average Miles/Year	18,408		0220	171		TRUCK1	269		Null or Blank Use	0
4	Total Miles	6,056,288		0202	101		GMCHST	2		Age Over 20	19
5	Average Age of Fleet at Year End	6.1					PAINTM	1		Age Less Than 1	12
6	Average Utilization	82								Zero Cost	0
7	Average Cost per Mile	$ 0.41								Null Cost	0
8	CPI Corrected Acquisition Value	$ 27,367								Blank Cost	0
9										Outlying Operating Rate	29
10										No Acquisition Date	0

Figure 7: Process Summary Worksheet

5.3.3 Fleet Models

The fleet models include the *Usage Model* and the *Operating Rate Model* worksheets.

The *Usage Model Worksheet* is a chart of the annual use versus age for the analyzed equipment. The linear model fit to the data and used to estimate annual machine use throughout machine life is also shown. An example of the annual usage data and model is provided as Figure 8.

The *Operating Rate Model* worksheet is a chart of the average annual operating rate versus age for the analyzed equipment. The exponential model fit to the data and used to estimate the average annual operating rate throughout machine life is also shown. An example of the average annual operating rate data and model is provided as Figure 9.

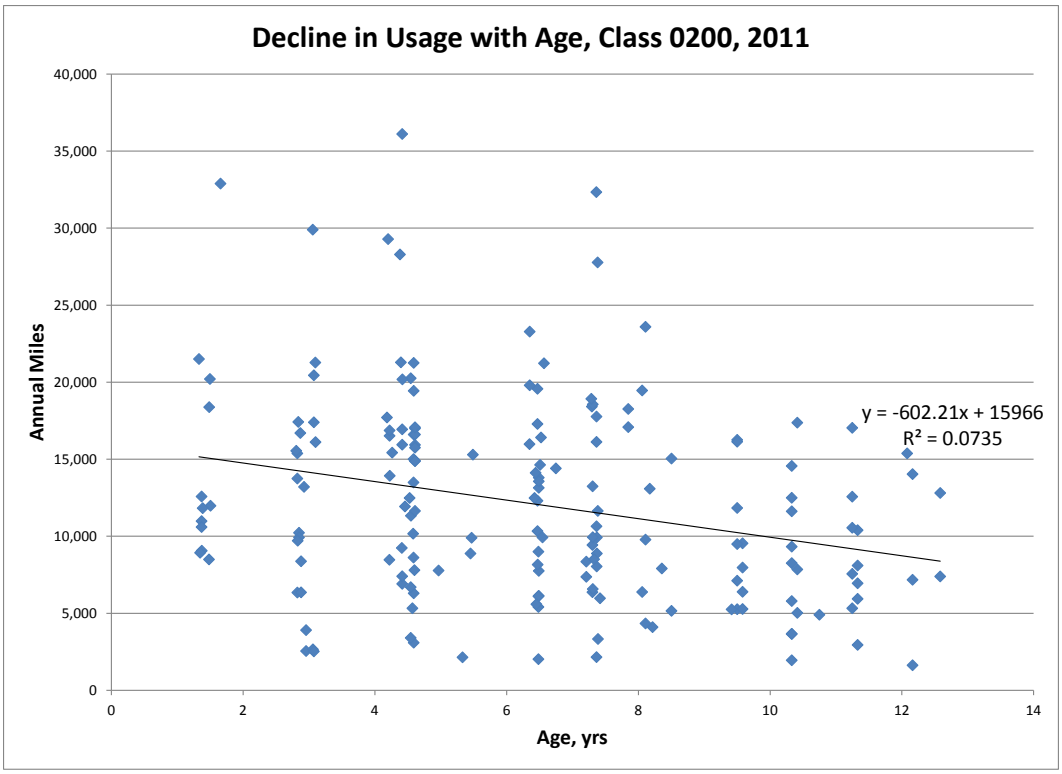


Figure 8: Annual Use Data and Model

Figure 9: Average Annual Operating Rate Data and Model

5.3.4 Fleet Histograms

The fleet histograms include the *Usage Histogram*, *Utilization Histogram*, and *Age Histogram* worksheets. The *Usage Histogram* worksheet is a histogram chart depicting the distribution of annual use for the machines analyzed, as shown in Figure 10.

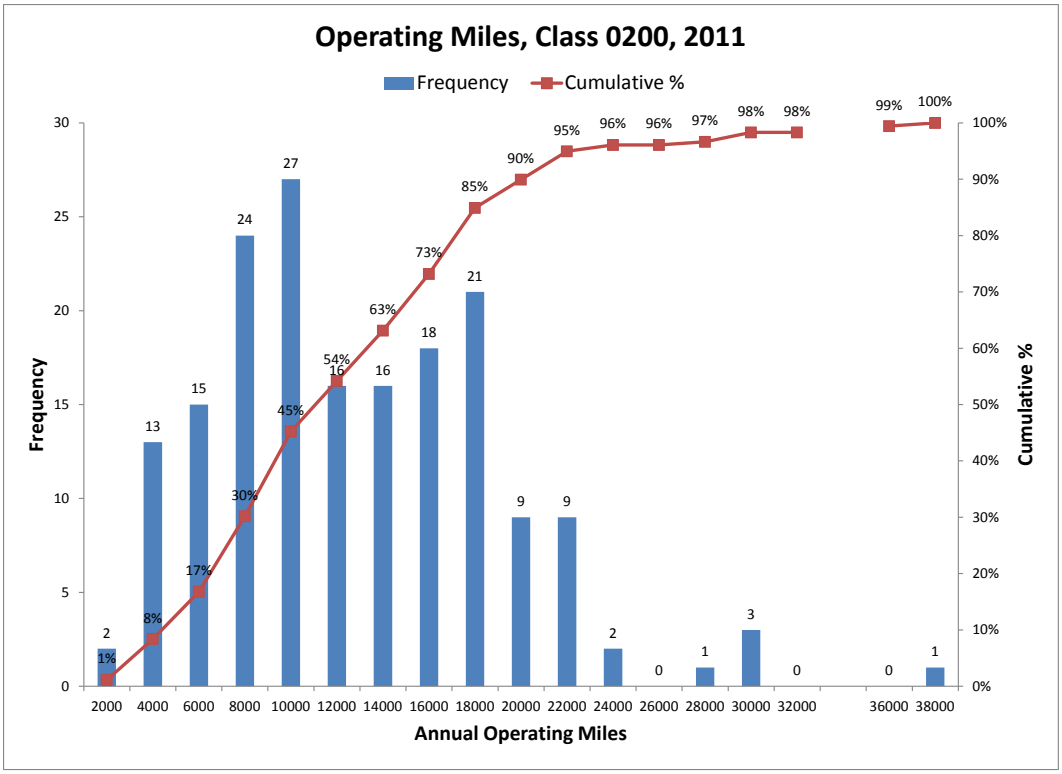


Figure 10: Usage Histogram

The *Utilization Histogram* worksheet is a histogram chart depicting the distribution of equipment utilization for the machines analyzed, as shown in Figure 11. The *Age Histogram* worksheet is a histogram chart depicting the distribution of equipment ages for the machines analyzed, as shown in Figure 12.

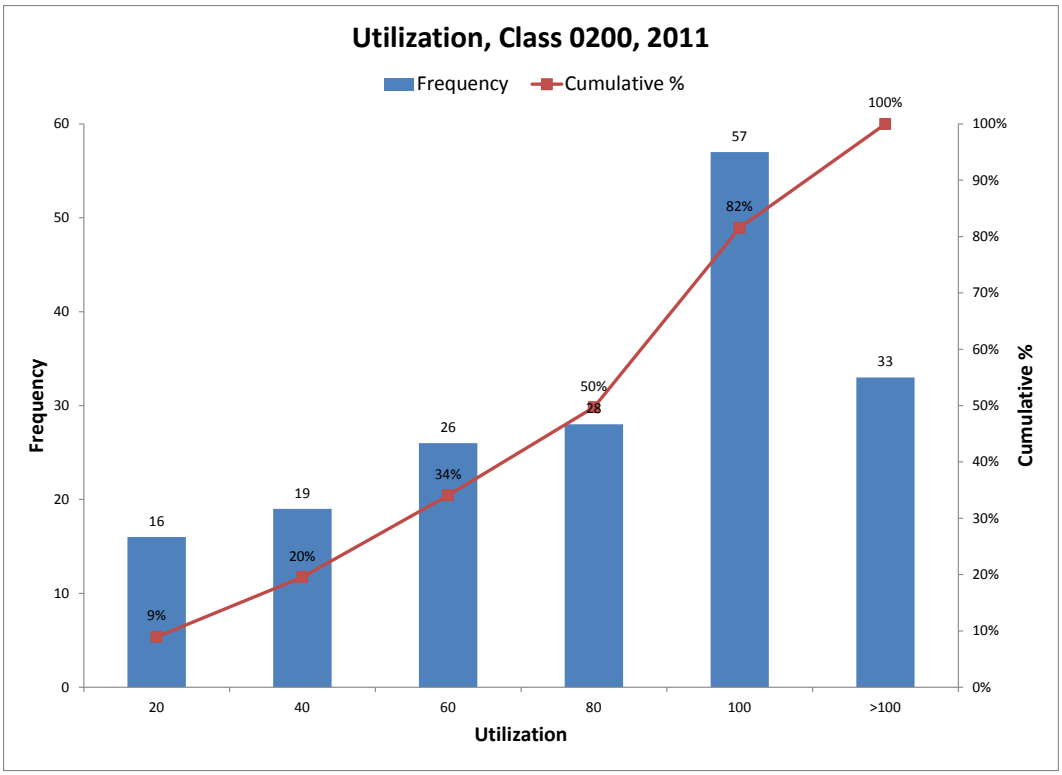


Figure 11: Utilization Histogram

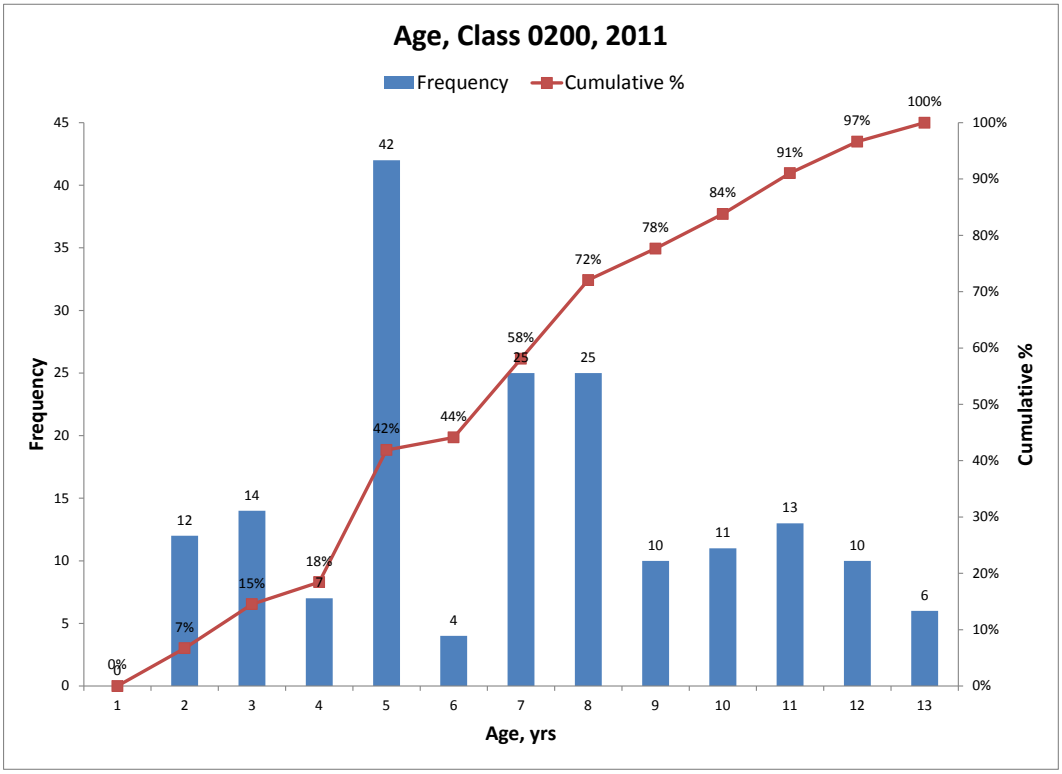


Figure 12: Age Histogram

5.3.5 Analysis Worksheets

The analysis worksheets include the *Current Analysis*, *Forward Analysis*, and *Analyses Summary* worksheets. The *Current Analysis* worksheet contains the economic model for a machine in the analyzed equipment class, the parameters on which the model is based, and charts of the LTD total EUAC and LTD total rate versus machine age. An example of the model and parameters is provided as Figure 13 and examples of the cost versus age charts is provided as Figure 14.

The economic lives estimated based on minimum LTD EUAC and LTD rate are highlighted. From Figure 13, the economic life based on LTD total EUAC is 18 years, the minimum EUAC is $31,623, the economic life based on LTD total rate is 28 years, and the minimum rate is $1.46 per mile.

Interest Rate	3%										
Initial MV	$ 91,606										
Depreciation Term	7										
Sum of Years	28										
Residual Value	20%										
Initial Miles	18,172										
Mile Decline	-214										
Cost/Mile	$ 1.11					Min	$ 31,623	per year		$ 1.46	per Mile
Annual Cost Factor	0.0151					Economic Life	16	years		28	years
Inflation Rate	0.024										
Year	**Market Value**	**Owning EUAC**	**Miles**	**Operating Cost**	**Operating Cost PV**	**Operating EUAC**	**LTD EUAC**	**LTD Miles**	**LTD PV**	**LTD Rate ($/Mile)**	
0	$ 91,606										
1	$ 73,285	$ 21,069	18,065	$ 20,938	$ 20,329	$ 20,938	$ 42,008	18,065	$ 40,784	$ 2.26	
2	$ 57,581	$ 19,509	17,851	$ 21,508	$ 20,274	$ 21,219	$ 40,729	35,917	$ 77,933	$ 2.17	
3	$ 44,495	$ 17,990	17,637	$ 22,090	$ 20,216	$ 21,501	$ 39,491	53,554	$ 111,706	$ 2.09	
4	$ 34,025	$ 16,512	17,423	$ 22,685	$ 20,155	$ 21,784	$ 38,296	70,977	$ 142,349	$ 2.01	
5	$ 26,173	$ 15,073	17,209	$ 23,292	$ 20,092	$ 22,068	$ 37,141	88,186	$ 170,095	$ 1.93	
6	$ 20,939	$ 13,673	16,995	$ 23,912	$ 20,026	$ 22,353	$ 36,026	105,180	$ 195,162	$ 1.86	
7	$ 18,321	$ 12,312	16,781	$ 24,544	$ 19,956	$ 22,639	$ 34,951	121,961	$ 217,757	$ 1.79	
8	$ 18,321	$ 10,990	16,566	$ 25,189	$ 19,884	$ 22,926	$ 33,915	138,527	$ 238,075	$ 1.72	
9	$ 18,321	$ 9,962	16,352	$ 25,846	$ 19,809	$ 23,213	$ 33,175	154,879	$ 258,305	$ 1.67	
10	$ 18,321	$ 9,141	16,138	$ 26,516	$ 19,730	$ 23,501	$ 32,642	171,018	$ 278,445	$ 1.63	
11	$ 18,321	$ 8,470	15,924	$ 27,199	$ 19,649	$ 23,790	$ 32,260	186,941	$ 298,491	$ 1.60	
12	$ 18,321	$ 7,912	15,710	$ 27,894	$ 19,564	$ 24,079	$ 31,991	202,651	$ 318,440	$ 1.57	
13	$ 18,321	$ 7,441	15,496	$ 28,601	$ 19,476	$ 24,369	$ 31,809	218,147	$ 338,291	$ 1.55	
14	$ 18,321	$ 7,037	15,282	$ 29,321	$ 19,385	$ 24,659	$ 31,696	233,429	$ 358,039	$ 1.53	
15	$ 18,321	$ 6,688	15,067	$ 30,054	$ 19,290	$ 24,949	$ 31,637	248,496	$ 377,682	$ 1.52	
16	$ 18,321	$ 6,384	14,853	$ 30,798	$ 19,192	$ 25,239	$ 31,623	263,349	$ 397,217	$ 1.51	
17	$ 18,321	$ 6,116	14,639	$ 31,554	$ 19,091	$ 25,529	$ 31,645	277,988	$ 416,640	$ 1.50	
18	$ 18,321	$ 5,878	14,425	$ 32,322	$ 18,986	$ 25,819	$ 31,697	292,413	$ 435,949	$ 1.49	
19	$ 18,321	$ 5,666	14,211	$ 33,101	$ 18,877	$ 26,109	$ 31,775	306,624	$ 455,139	$ 1.48	
20	$ 18,321	$ 5,476	13,997	$ 33,891	$ 18,765	$ 26,399	$ 31,874	320,621	$ 474,208	$ 1.48	
21	$ 18,321	$ 5,304	13,783	$ 34,692	$ 18,649	$ 26,688	$ 31,992	334,403	$ 493,152	$ 1.47	
22	$ 18,321	$ 5,148	13,568	$ 35,503	$ 18,529	$ 26,977	$ 32,125	347,972	$ 511,968	$ 1.47	
23	$ 18,321	$ 5,006	13,354	$ 36,324	$ 18,405	$ 27,265	$ 32,271	361,326	$ 530,651	$ 1.47	
24	$ 18,321	$ 4,877	13,140	$ 37,155	$ 18,278	$ 27,552	$ 32,429	374,466	$ 549,200	$ 1.47	
25	$ 18,321	$ 4,758	12,926	$ 37,995	$ 18,146	$ 27,838	$ 32,597	387,392	$ 567,609	$ 1.47	
26	$ 18,321	$ 4,649	12,712	$ 38,842	$ 18,011	$ 28,124	$ 32,773	400,104	$ 585,874	$ 1.46	
27	$ 18,321	$ 4,548	12,498	$ 39,698	$ 17,872	$ 28,408	$ 32,956	412,602	$ 603,993	$ 1.46	
28	$ 18,321	$ 4,455	12,284	$ 40,560	$ 17,728	$ 28,691	$ 33,146	424,885	$ 621,962	$ 1.46	
29	$ 18,321	$ 4,369	12,069	$ 41,429	$ 17,580	$ 28,973	$ 33,342	436,954	$ 639,775	$ 1.46	

Figure 13: Economic Model on the Current Analysis Worksheet

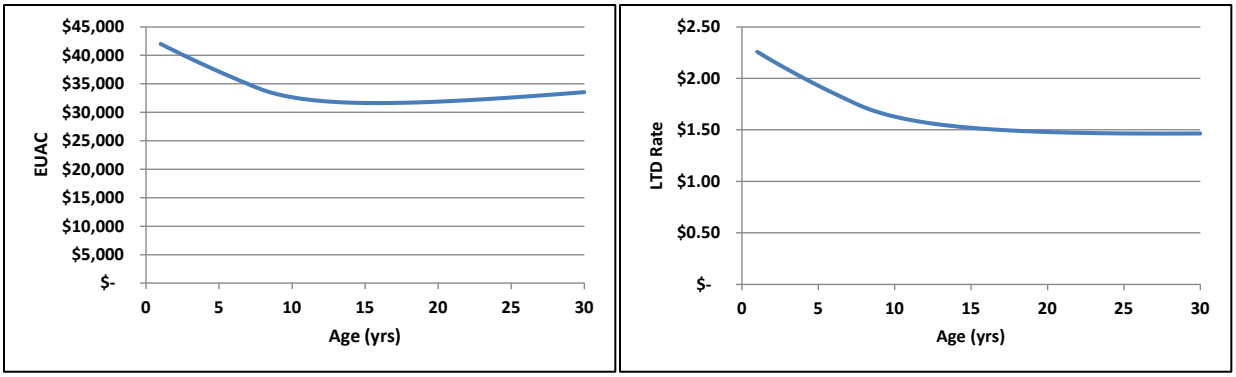


Figure 14: LTD Total EUAC and LTD Total Rate versus Machine Age

The *Forward Analysis* worksheet is an economic model of a machine in the equipment class where the number of machines in the fleet has been reduced and/or the decline in annual use has been limited. The principal goal of the forward analysis is to evaluate the impacts on the timing (years) and magnitude (cost) of economic life.

A reduction in fleet size requires modification to the usage model developed from the analyzed data. The principal constraint placed on the analysis is that the total fleet usage (total hours or miles worked in the year by all machines in the fleet) must be held constant. The parameters of the usage model are adjusted to consider a reduced number of machines and/or a limited year-over-year decline in annual usage.

The adjusted usage is mapped to the current usage and modeled to calculate an effective age modeled, as shown in Figure 15. The operating rate model is applied based on the effective machine age.

A number of scenarios are modeled and the results are summarized on the *Forward Analysis* worksheet, as shown in Figure 16. One parameter used to adjust the usage model is the planned life for machines in the equipment class, which is the period for which the machine is planned to remain a productive member of the class. Viable solutions to the forward analysis are considered to be those solutions where the planned life and economic life reasonably agree. For example, it would not be reasonable to plan to keep machines in the fleet for a life of 6 years when the modeled economic life is 12 years. It would be reasonable to plan for a machine life of 14 years when the modeled economic life is 13 years. The viable solutions are highlighted in green and the presented results are economic life (years), machine age at economic life (miles or hours), and total owning and operating rate at economic life (cost per mile or hour).

Life	20		Decline	-834		a	0.0429101					
Fleet Size	37		Initial	41,700		b	1.9075394					
Year	Market Value	Owning EUAC	Miles	Age (Mile)	Eff Age (yrs)	Eff Age Model (yrs)	Operating Cost	Operating Cost PV	Operating EUAC	Total EUAC	Total PV	Total Rate
0	$ 91,606											
1	$ 73,285	$ 21,069	41,283	41,283	2.30	1.95	$ 48,538	$ 47,125	$ 48,538	$ 69,608	$ 67,580	$ 1.64
2	$ 57,581	$ 19,509	40,449	81,732	4.62	3.99	$ 50,216	$ 47,333	$ 49,364	$ 68,874	$ 131,788	$ 1.61
3	$ 44,495	$ 17,990	39,615	121,347	6.96	6.11	$ 51,996	$ 47,584	$ 50,216	$ 68,206	$ 192,929	$ 1.59
4	$ 34,025	$ 16,512	38,781	160,128	9.32	8.32	$ 53,885	$ 47,876	$ 51,093	$ 67,605	$ 251,293	$ 1.57
5	$ 26,173	$ 15,073	37,947	198,075	11.71	10.61	$ 55,889	$ 48,210	$ 51,996	$ 67,069	$ 307,157	$ 1.55
6	$ 20,939	$ 13,673	37,113	235,188	14.12	12.99	$ 58,015	$ 48,586	$ 52,927	$ 66,600	$ 360,785	$ 1.53
7	$ 18,321	$ 12,312	36,279	271,467	16.55	15.46	$ 60,269	$ 49,004	$ 53,885	$ 66,197	$ 412,428	$ 1.52
8	$ 18,321	$ 10,990	35,445	306,912	19.02	18.01	$ 62,658	$ 49,463	$ 54,871	$ 65,861	$ 462,324	$ 1.51
9	$ 18,321	$ 9,962	34,611	341,523	21.52	20.64	$ 65,190	$ 49,963	$ 55,887	$ 65,849	$ 512,709	$ 1.50
10	$ 18,321	$ 9,141	33,777	375,300	24.06	23.37	$ 67,873	$ 50,504	$ 56,933	$ 66,074	$ 563,621	$ 1.50
11	$ 18,321	$ 8,470	32,943	408,243	26.65	26.18	$ 70,714	$ 51,086	$ 58,009	$ 66,479	$ 615,104	$ 1.51
12	$ 18,321	$ 7,912	32,109	440,352	29.28	29.07	$ 73,723	$ 51,708	$ 59,116	$ 67,028	$ 667,197	$ 1.52
13	$ 18,321	$ 7,441	31,275	471,627	31.98	32.05	$ 76,907	$ 52,370	$ 60,255	$ 67,696	$ 719,941	$ 1.53
14	$ 18,321	$ 7,037	30,441	502,068	34.74	35.12	$ 80,275	$ 53,071	$ 61,427	$ 68,464	$ 773,375	$ 1.54
15	$ 18,321	$ 6,688	29,607	531,675	37.58	38.27	$ 83,835	$ 53,811	$ 62,632	$ 69,320	$ 827,539	$ 1.56
16	$ 18,321	$ 6,384	28,773	560,448	40.51	41.51	$ 87,598	$ 54,588	$ 63,870	$ 70,254	$ 882,470	$ 1.57
17	$ 18,321	$ 6,116	27,939	588,387	43.56	44.83	$ 91,571	$ 55,402	$ 65,143	$ 71,259	$ 938,204	$ 1.59
18	$ 18,321	$ 5,878	27,105	615,492	46.74	48.24	$ 95,762	$ 56,250	$ 66,451	$ 72,329	$ 994,777	$ 1.62
19	$ 18,321	$ 5,666	26,271	641,763	50.11	51.73	$ 100,179	$ 57,131	$ 67,794	$ 73,460	$ 1,052,221	$ 1.64
20	$ 18,321	$ 5,476	25,437	667,200	53.71	55.31	$ 104,831	$ 58,042	$ 69,172	$ 74,648	$ 1,110,567	$ 1.66
21	$ 18,321	$ 5,304	24,603	691,803	57.65	58.98	$ 109,722	$ 58,981	$ 70,586	$ 75,890	$ 1,169,844	$ 1.69
22	$ 18,321	$ 5,148	23,769	715,572	62.09	62.73	$ 114,857	$ 59,943	$ 72,036	$ 77,184	$ 1,230,074	$ 1.72
23	$ 18,321	$ 5,006	22,935	738,507	67.42	66.57	$ 120,240	$ 60,925	$ 73,521	$ 78,528	$ 1,291,277	$ 1.75
24	$ 18,321	$ 4,877	22,101	760,608	74.98	70.50	$ 125,872	$ 61,921	$ 75,042	$ 79,919	$ 1,353,468	$ 1.78
25	$ 18,321	$ 4,758	21,267	781,875	#NUM!	74.51	$ 131,750	$ 62,924	$ 76,597	$ 81,355	$ 1,416,655	$ 1.81
26	$ 18,321	$ 4,649	20,433	802,308	#NUM!	78.60	$ 137,868	$ 63,929	$ 78,186	$ 82,836	$ 1,480,838	$ 1.85
27	$ 18,321	$ 4,548	19,599	821,907	#NUM!	82.79	$ 144,216	$ 64,925	$ 79,808	$ 84,357	$ 1,546,010	$ 1.88
28	$ 18,321	$ 4,455	18,765	840,672	#NUM!	87.05	$ 150,779	$ 65,902	$ 81,462	$ 85,917	$ 1,612,153	$ 1.92
29	$ 18,321	$ 4,369	17,931	858,603	#NUM!	91.41	$ 157,532	$ 66,848	$ 83,144	$ 87,513	$ 1,679,234	$ 1.96
30	$ 18,321	$ 4,289	17,097	875,700	#NUM!	95.85	$ 164,443	$ 67,749	$ 84,853	$ 89,141	$ 1,747,209	$ 2.00

Figure 15: Forward Analysis Economic Model

	O	P	Q	R	S	T	U	V	W	X
	Year at Minimum Total Rate									
	Portion	**Count/Life**	**6**	**8**	**10**	**12**	**14**	**16**	**18**	**20**
	100%	**73**	30	30	30	30	30	30	29	27
	90%	**66**	30	30	29	27	26	24	23	22
	80%	**58**	24	23	22	21	20	19	**18**	18
	70%	**51**	19	18	17	17	16	**16**	15	14
	60%	**44**	15	14	14	**13**	**13**	13	12	12
	50%	**37**	12	11	**11**	**11**	10	10	10	9
	Age at Minimum Total Rate									
	Portion	**Count/Life**	**6**	**8**	**10**	**12**	**14**	**16**	**18**	**20**
	100%	**73**	377,640	385,770	394,410	403,620	412,980	422,520	424,734	416,489
	90%	**66**	417,780	426,690	427,692	418,892	418,366	406,176	403,949	401,038
	80%	**58**	412,896	409,573	405,746	401,142	395,920	389,852	**383,076**	392,652
	70%	**51**	396,236	388,314	379,423	388,076	378,208	**387,264**	376,350	364,252
	60%	**44**	380,483	367,108	375,326	**360,503**	**368,966**	377,702	361,284	370,320
	50%	**37**	374,760	355,009	**362,907**	**371,140**	349,110	357,440	366,130	341,523
	Minimum Total Rate									
	Portion	**Count/Life**	**6**	**8**	**10**	**12**	**14**	**16**	**18**	**20**
	100%	**73**	$ 1.46	$ 1.46	$ 1.46	$ 1.46	$ 1.46	$ 1.47	$ 1.47	$ 1.47
	90%	**66**	$ 1.46	$ 1.47	$ 1.47	$ 1.47	$ 1.47	$ 1.48	$ 1.48	$ 1.48
	80%	**58**	$ 1.48	$ 1.48	$ 1.48	$ 1.48	$ 1.49	$ 1.49	**$ 1.49**	$ 1.49
	70%	**51**	$ 1.49	$ 1.49	$ 1.49	$ 1.49	$ 1.50	**$ 1.50**	$ 1.50	$ 1.50
	60%	**44**	$ 1.50	$ 1.50	$ 1.50	**$ 1.50**	**$ 1.50**	$ 1.50	$ 1.50	$ 1.50
	50%	**37**	$ 1.50	$ 1.50	**$ 1.50**	**$ 1.50**	$ 1.50	$ 1.50	$ 1.50	$ 1.50

Figure 16: Forward Analysis Solutions

The *Analyses Summary* worksheet provides a single page summary of the current fleet, parameters and results of the economic model for the current fleet, and forward analyses solutions. A sample summary sheet is provided as Figure 17. The results are also flagged if any of the following conditions are observed:

1. *Increasing use with age* – The slope parameter of the usage model (annual decline in use) is greater than zero, indicating that annual use increases with machine age.
2. *Negative Initial Use* – The intercept parameter of the usage model (annual use in the first year) is less than zero.
3. *Decreasing Cost with age* – The annual cost increase parameter of the operating cost model is less than zero, indicating that operating rate decreases with machine age.
4. *Very large increasing cost with age* – The annual cost increase parameter of the operating cost model is greater than 0.1, indicating that the operating rate increases greatly with machine age.
5. *Very small increasing cost with age* – The annual cost increase parameter of the operating cost model is less than 0.01, indicating that the operating rate only slightly increases with machine age.
6. *Small number of machines* – The number of machines on which the analysis was based is less than 20.

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**0202**	
Description:	TRUCK, 7500 GVW	
Functional Code:	All (4)	
Fleet Status Summary		
Data from year	2011	
Number of units	329	
Average annual usage	18,408	Miles
Total annual fleet usage	6,056,288	Miles/yr
Average unit age at year end	6.1	yrs
Average unit utilization	82.2 %	
Average operating rate	$ 0.41	per Mile

These analyses revealed the following issues:
- Very small increasing cost with age

Economic Analyses		
Input Values		
Interest Rate	3.0 %	
Inflation Rate	2.4 %	
Purchase Price	$ 27,367	
Depreciation Term	5	yrs
Residual Value	20 %	
Initial operating rate	$ 0.37	per Mile
Annual operating rate factor	0.0096	

Analyses Results

	Current Fleet	Reduced Fleet Size					
Fleet reduction	0 %	0 %	10 %	20 %	30 %	40 %	50 %
Number of units	329	329	296	263	230	197	165
Initial usage (Miles)	28,145	33,920	34,109	38,389	40,077	43,046	51,394
Annual usage decline (Miles)	-1,609	-1,939	-1,950	-2,194	-2,291	-2,461	-2,938
Economic life (yrs)	No Min	16	15	14	13	11	9
Age at economic life (Miles)		294,528	292,260	322,434	327,412	324,616	343,557
LTD total rate at economic life ($/Miles)		$ 0.47	$ 0.47	$ 0.47	$ 0.47	$ 0.47	$ 0.47

Figure 17: Analyses Summary Worksheet

6 Results

The spreadsheet analysis and modeling application discussed in the previous chapter was utilized to analyze the NCDOT equipment fleet. This section examines the results for the most recent data set, the 2011 calendar year. The analysis involves two steps: 1) reduction of the fleet data to provide the economic model input parameters and 2) analysis to determine economic life, including the forward analysis.

6.1 2011 Results

Table 5 shows the model input parameters as determined from the existing fleet data, and the economic life results based on economic analysis of the current fleet. The input parameters include data coming directly from SAP, such as *Functional Code* and *Description*, and parameters provided by the user, such as *Class*, *Units of Use*, *Interest Rate, Inflation Rate*, and *Forward Analysis Annual Usage*. The remaining parameters are calculated based on the SAP data. For equipment that does not have usage measured with an odometer or hour meter, usage is analyzed based on one year of service. Therefore, *Average Annual Usage*, *Initial Usage*, and *Annual Usage Decline* are not calculated for this equipment. The column titled *Current Fleet* represents the economic life in years, the age at economic life (hours or miles), and the rate for equipment retained up to economic life ($/hr, $/mile, or $/year) based on the 2011 data and the current fleet size and usage. Appendix E contains a more detailed summary of each class code.

The *Years Modeled* column of Table 5 shows the number of years for which the economic model was calculated and is the minimum of 30 years or the year prior to usage going negative based on decline in usage over the number of years. The tag *No Min* within the Current Economic Life column indicates that an economic life was not found within the *Years Modeled* time period. An economic life will never be determined when the *Annual Operating Factor* (increase in cost per mile or hour) is negative, indicating that operating costs are decreasing year over year. A negative *Annual Operating Factor* results in the longer the machine is owned, the less costly it becomes, and therefore, no minimum cost is achieved. An economic life is often not found when the *Annual Operating Factor* is positive, but very small, such as for class code 0202 (all) where the factor was determined to be 0.0096.

Tables 6 and 7 show a summary of the results for forward analysis of the NCDOT fleet for the 2011 calendar year. The data in Tables 6 and 7 is sorted by class code and arranged similar to Table 5 for easy reference. The columns titled *100%*, *90%*, *80%*, *70%*, *60%*, and *50% Fleet/Limited Decline* are the results of the forward analysis and contain the economic life, the age at economic life, and the rate ($/hr, $/mile, or $/year) based on a reduced fleet size corresponding to the titled percentage. The difference between the *Current Fleet* column of Table 5 and the *100%* column of Table 6 is that the *100%* column has its usage decline set to 2%, whereas the *Current Fleet* column uses actual usage.

The tag of *No Match* within the *Forward Analysis Economic Life* columns of Tables 6 and 7 indicates that a match between the number of years owned (6, 8, 10, 12, 14, 16, 18, or 20) and the calculated economic life for the given fleet size did not match to within ± 1 year for the proposed fleet size. This is a result of the forward analysis and is explained in more detail in section 5.3.5.

Table 5: Economic Life Model Input Parameters and Current Fleet Analysis Results

(Note: 2011 data, 3% interest, 2% decline, 2.4% inflation)

Class	Functional Code	Description	Units of Use	Count	Average Operating Rate ($/unit)	Average Unit Utilization	Average Age (Years)	Average Annual Usage	Annual Operating Rate Factor	Initial Usage	Annual Usage Decline	Current Fleet			Years Modeled
												Economic Life	Age at Economic Life	Rate ($/unit)	
0200	All (2)	TRUCK, MISCELLANEOUS	Miles	179	$0.36	72%	6.4	12,116	0.031	15,966	-602	20	198,869	$0.50	26
0201	All (5)	TRUCK, 5000 GVW	Miles	1,903	$0.33	78%	6.3	13,237	0.037	17,653	-697	15	186,379	$0.42	25
0202	TRUCK1	TRUCK, 7500 GVW	Miles	268	$0.39	79%	6.5	14,570	0.027	18,075	-538	18	238,128	$0.48	30
0202	GIMAPT	TRUCK, 7500 GVW	Miles	57	$0.50	98%	3.8	37,155	-0.007	44,353	-1872	No Min			23
0202	All (4)	TRUCK, 7500 GVW	Miles	329	$0.41	82%	6.1	18,408	0.01	28,145	-1609	No Min			17
0203	All (5)	TRUCK, 15000 GVW	Miles	345	$0.74	83%	6.4	12,119	0.046	17,340	-819	12	149,122	$0.83	21
0204	All (2)	TRUCK, 9000 - 10000 GVW	Miles	510	$0.50	75%	6.5	15,053	0.021	17,893	-434	20	271,013	$0.57	30
0205	TRKDMP	TRUCK, DUMP 33000 GVW	Miles	862	$1.89	43%	9.1	7,553	0.048	13,185	-621	12	113,525	$1.60	21
0206	TRUCK2	TRUCK, 20000 - 33000 GVW	Miles	549	$1.32	45%	10	6,916	0.038	10,914	-400	17	127,748	$1.30	27
0206	All (15)	TRUCK, 20000 - 33000 GVW	Miles	116	$1.45	40%	9.2	7,755	0.046	11,899	-451	15	127,762	$1.43	26
0206	GFUELT	TRUCK, 20000 - 33000 GVW	Miles	95	$1.15	104%	7.5	5,806	-0.002	7,171	-182	No Min			30
0206	GDIST1	TRUCK, 20000 - 33000 GVW	Miles	59	$1.67	39%	7.8	4,897	0.043	6,339	-184	17	81,171	$2.09	30
0206	GASPC1	TRUCK, 20000 - 33000 GVW	Miles	27	$1.15	40%	7.8	8,804	0.002	14,407	-722	No Min			19
206	All (19)	TRUCK, 20000 - 33000 GVW	Miles	847	$1.34	51%	9.4	6,819	0.031	9,991	-338	20	132,176	$1.37	29
0212	TRKDMP	TRUCK, DUMP 50000 GVW	Miles	610	$1.43	53%	7.8	12,127	0.045	17,412	-674	13	169,437	$1.62	25
0217	TRUCK5	TRUCK, TRACTOR 60000 GVW	Miles	84	$1.33	47%	8.2	8,820	0.033	11,639	-342	20	164,330	$1.70	30
0227	TRUCK5	TRUCK, TRACTOR 70000 GVW	Miles	19	$1.34	105%	9	12,234	-0.015	15,522	-367	No Min			30
0230	GCRAN2	TRUCK, 35000 - 50000 GVW	Miles	23	$4.38	21%	8	1,788	0.126	2,445	-82	14	26,168	$5.07	29

Class	Functional Code	Description	Units of Use	Count	Average Operating Rate ($/unit)	Average Unit Utilization	Average Age (Years)	Average Annual Usage	Annual Operating Rate Factor	Initial Usage	Annual Usage Decline	Current Fleet			Years Modeled
												Economic Life	Age at Economic Life	Rate ($/unit)	
0230	GCRAN1	TRUCK, 35000 - 50000 GVW	Miles	31	$1.95	26%	9	2,510	-0.106	2,221	32	No Min			30
0230	All (5)	TRUCK, 35000 - 50000 GVW	Miles	72	$3.05	28%	8	3,249	0.096	5,819	-320	13	48,617	$3.33	18
0232	TRKDMP	TRUCK, DUMP 60000 GVW	Miles	73	$1.27	63%	5.9	16,909	0.015	18,172	-214	28	424,885	$1.46	30
0233	TRUCK2	TRUCK, 17500 - 20000 GVW	Miles	59	$0.58	86%	3.5	17,214	0.038	16,794	119	13	228,378	$0.76	30
0233	GTRFSV	TRUCK, 17500 - 20000 GVW	Miles	55	$0.65	85%	5.3	21,478	0.028	33,875	-2360	11	229,838	$0.72	14
0233	GMCHST	TRUCK, 17500 - 20000 GVW	Miles	21	$0.68	105%	4.7	3,801	-0.032	3,876	-16	No Min			30
0233	GAER1A	TRUCK, 17500 - 20000 GVW	Miles	42	$0.86	89%	5.6	18,935	0.038	21,912	-532	11	208,858	$0.94	30
0233	All (7)	TRUCK, 17500 - 20000 GVW	Miles	183	$0.67	86%	4.8	16,943	0.043	20,068	-646	11	181,685	$0.81	30
0235	BUSBUS	BUS, PASSENGER	Miles	11	$2.83	91%	8.1	11,198	0.207	19,631	-1041	1	19,111	$0.82	18
0236	All (2)	UTILITY VEHICLE	Hours	18	$23.85	59%	4.4	148	-0.283	-248	90	No Min			2
0300	All (7)	TRACTOR, WHEEL	Hours	464	$27.54	27%	8.4	248	0.058	417	-20	15	3,992	$29.35	20
0314	BCKHOE	BACKHOE, TRACTOR LOADER	Hours	247	$31.02	48%	8.1	323	0.054	511	-23	14	4,862	$36.11	21
0404	CRWTRM	CRAWLER TRACTOR	Hours	18	$80.52	19%	11	143	0.027	238	-9	25	3,246	$102.65	27
0900	GRADRM	MOTOR GRADER	Hours	374	$51.48	33%	11.2	320	0.038	600	-25	17	6,568	$52.20	23
1010	All (2)	ASPHALT PATCH MACHINE, TRAILER MTD	Years	32	$2,710.98	27%	8		-0.039			No Min			30
1011	PAVERM	ASPHALT PAVER/ GRINDER	Hours	32	$41.68	21%	6.2	197	0.094	327	-21	12	2,419	$62.33	15
1012	All (2)	ASPHALT PATCHER, TRUCK MTD	Years	18	$3,843.09	43%	5.8		-0.081			No Min			30
1014	LOADRM	LOADER, SKID STEER	Hours	51	$59.37	25%	7.6	74	0.011	127	-7	No Min			18
1150	PAVERM	PAVER, ASPHALT	Hours	14	$48.65	26%	7.1	212	0.125	321	-15	13	2,878	$73.32	20
1300	TNKASP	ASPHALT TANK/KETTLE	Hours	18	$120.04	48%	7.2	282	0.235	619	-47	7	3,183	$41.50	13

Class	Functional Code	Description	Units of Use	Count	Average Operating Rate ($/unit)	Average Unit Utilization	Average Age (Years)	Average Annual Usage	Annual Operating Rate Factor	Initial Usage	Annual Usage Decline	Current Fleet			Years Modeled
												Economic Life	Age at Economic Life	Rate ($/unit)	
1302	All (2)	DISTRIBUTOR, ASPHALT	Hours	42	$50.17	34%	9.5	326	-0.032	192	14	No Min			30
1400	All (7)	BROOM	Years	89	$16,761.25	25%	7.3		0.1			1		$9,147.02	30
1404	SWEEPR	INTEGRAL SWEEPER	Hours	7	$29.53	25%	10.6	147	-0.068	241	-9	No Min			26
1450	All (2)	PAINT MACHINE, SPECIAL MARKING	Years	17	$7,957.76	56%	5.4		0.211			11		$22,854	30
1453	All (3)	PAINT MACHINE, PRELINE	Years	7	$615.58	14%	6		-0.107			No Min			30
1454	PAINTM	PAINT MACHINE, HAND TRAFFIC STRIPER	Years	11	$186.41	34%	6.2		0.111			21		$529.82	30
1457	All (2)	PAINT MACHINE, THERMOPLASTIC APPL.	Years	3	$1,636.22	27%	4.8		0.229			11		$3,403.88	30
1500	All (13)	COMPRESSOR, AIR	Years	291	$383.43	75%	9		0.059			26		$531.31	30
1600	CONVYR	CONVEYOR, SALT	Years	11	$3,131.97	3%	6.3		0.391			10		$7,318.06	30
1601	STBRNP	SYSTEM, SALT BRINE PRODUCTION	Years	28	$829.12	1%	5.8		-0.292			No Min			30
1602	STBRNT	TANK, SALT BRINE STORAGE	Years	21	$246.90	1%	4.9		-0.161			No Min			30
1603	STBRNS	STATION, SALT BRINE FILL	Years	62	$351.75	1%	5.1		-0.02			No Min			30
1604	STBRNA	SYSTEM, SALT BRINE APPLICATOR	Years	176	$1,038.79	2%	5.2		-0.03			No Min			30
1703	TRCATT	TRACTOR IMPLEMENT / ATTACHMENT	Years	6	$1,082.25	59%	7.3		-0.081			No Min			30
1709	DRILLM	DRILL, AUGER	Hours	7	$176.32	45%	8.5	147	0.166	287	-16	11	2,163	$148.35	17
1720	All (2)	BREAKER ATTACHMENT	Years	14	$68.62	38%	6.3		0.062			27		$174.00	30
1802	All (2)	AERIAL DEVICE, TRUCK MTD	Years	79	$1,461.17	59%	7.5		0.049			No Min			30
1803	GAER3A	AERIAL DEVICE, BRIDGE INSPECTION	Years	3	$1,309.01	55%	3.4		-0.522			No Min			30
1805	All (2)	AERIAL WORK PLATFORM	Years	9	$2,741.28	25%	8.5		-0.024			No Min			30
1806	AERDV2	AERIAL DEVICE, SELF PROPELLED	Years	14	$1,757.64	95%	7		0.059			26		$3,566.64	30

Class	Functional Code	Description	Units of Use	Count	Average Operating Rate ($/unit)	Average Unit Utilization	Average Age (Years)	Average Annual Usage	Annual Operating Rate Factor	Initial Usage	Annual Usage Decline	Current Fleet			Years Modeled
												Economic Life	Age at Economic Life	Rate ($/unit)	
1815	All (2)	CRANE, 16-18 TON	Years	54	$2,786.75	24%	8.6		-0.014			No Min			30
1822	All (4)	CRANE, MECHANIC	Years	266	$712.13	90%	7.5		-0.025			No Min			30
1852	EXCAVC	EXCAVATOR, WHEEL	Hours	20	$47.44	30%	8.7	279	0.11	384	-12	14	4,194	$73.31	30
1853	All (2)	EXCAVATOR, TRACK 20 - 36 METRIC TON	Hours	40	$27.47	43%	6.7	428	0.044	560	-20	19	7,089	$41.32	28
1854	EXCAVC	EXCAVATOR, TRACK 12 - 18 METRIC TON	Hours	20	$20.76	48%	6.9	509	0.048	638	-19	18	8,477	$30.89	30
2002	LOADRM	LOADER, WHEEL 2 CY	Hours	184	$33.75	68%	8.2	342	0.08	528	-23	13	4,950	$39.31	23
2008	LOADRM	LOADER, CRAWLER	Hours	9	$40.14	17%	8.6	166	0.099	246	-9	19	3,006	$81.93	26
2013	All (2)	LOADER ATTACHMENT	Years	6	$107.63	14%	6.4		-0.224			No Min			30
2101	GENRTR	GENERATOR/STANDBY POWER SYSTEM	Hours	89	$105.05	131%	7.4	47	-0.017	51	-1	No Min			30
2115	LTPLNT	LIGHT PLANT	Hours	20	$30.25	59%	6.9	64	0.314	104	-6	8	647	$15.77	18
2205	MIXERM	MIXER, MASONRY/ASPHALT	Years	4	$901.82	33%	10.3		-0.167			No Min			30
2215	All (2)	HYDRAULIC IMPACTOR	Years	4	$1,152.72	60%	11.1		-0.042			No Min			30
2301	All (2)	A-BOOM MOWER ATTACHMENT	Years	3	$876.69	34%	6.9		0.581			8		$1,207.12	30
2308	All (3)	A-BOOM MOWER ATTACHMENT	Years	174	$5,304.44	36%	8		-0.04			No Min			30
2310	MOWERM	RIDING MOWER	Hours	78	$34.32	59%	7.3	85	0.056	144	-8	14	1,220	$29.50	17
2502	ROLLRM	ROLLER, TANDEM, STATIC	Hours	15	$29.00	18%	9.8	87	-0.098	33	5	No Min			30
2504	ROLLRM	ROLLER, RUBBER TIRE	Hours	9	$31.60	24%	7.8	120	0.063	298	-23	12	1,939	$40.69	13
2507	ROLLRM	ROLLER, VIBRATORY	Hours	94	$20.26	27%	5.9	120	0.021	178	-10	17	1,615	$39.34	18
2604	SCRPER	SCRAPER, SELF PROPELLED, 11 CY	Hours	17	$118.96	23%	13.3	118	0.057	206	-7	24	3,035	$121.57	30
2703	CRANEM	CRANE, TRACK MOUNTED	Hours	6	$132.50	19%	15.9	98	-0.037	327	-14	No Min			22

Class	Functional Code	Description	Units of Use	Count	Average Operating Rate ($/unit)	Average Unit Utilization	Average Age (Years)	Average Annual Usage	Annual Operating Rate Factor	Initial Usage	Annual Usage Decline	Current Fleet			Years Modeled
												Economic Life	Age at Economic Life	Rate ($/unit)	
2850	SPRDRM	SPREADER, WIDENER	Hours	4	$46.59	19%	9.4	139	0.028	15	13	No Min			30
2851	All (2)	SHOULDER MACHINE	Years	24	$750.70	4%	7.8		-0.064			No Min			30
2853	SPRDRM	SPREADER, AGGREGATE	Hours	28	$99.53	44%	7.7	245	0.002	370	-16	No Min			22
3151	GFUELT	FUEL AND LUBE TANK, TRUCK MTD	Years	98	$507.40	104%	8.3		-0.029			No Min			30
3201	All (4)	TRAILER, LIGHT EQUIPMENT TRANSPORT	Years	650	$1,173.70	38%	9.3		0.038			28		$1,209.56	30
3202	TRALR3	TRAILER, HEAVY EQUIPMENT TRANSPORT	Years	76	$2,530.43	58%	8.1		0.093			20		$4,501.14	30
3203	TRALR4	TRAILER, MATERIAL TRANSPORT	Years	29	$1,049.56	46%	10.5		-0.089			No Min			30
3205	TRALR5	TRAILER, SPECIAL PURPOSE	Years	9	$878.95	148%	11.7		0.014			No Min			30
3214	All (6)	TRAILER, UTILITY	Years	245	$400.62	49%	10		0.048			26		$446.86	30
3221	MODULR	MODULAR OFFICE, SINGLE	Years	5	$1,160.42	221%	4.6		-0.032			No Min			30
3230	All (8)	TRUCK MOUNT ATTENUATOR	Years	150	$488.93	29%	6.6		0.03			No Min			30
3301	All (2)	BOAT, MOTOR, TRAILER	Years	34	$376.64	31%	5.5		0.214			15		$1,250.81	30
3500	All (2)	PUMP, WATER	Years	35	$544.39	38%	6.9		-0.083			No Min			30
3980	SNWEQA	PLOW, SNOW 10'	Years	1,159	$405.81	3%	11.1		-0.056			No Min			30
4102	BSHCPR	BRUSH CHIPPER	Hours	64	$54.95	11%	8	69	0.106	101	-4	13	979	$60.33	25
4103	CONFRM	CURB MACHINE	Years	7	$368.32	1%	11.7		0.255			17		$488.01	30
4104	All (2)	HYDRO-SEEDER ATTACHMENT	Hours	22	$112.33	34%	6.1	134	0.264	314	-29	1	299	$54.98	10
4106	All (5)	SPRAYER ATTACHMENT	Years	23	$1,426.23	27%	8.8		0.128			26		$3,267.69	30
4119	All (7)	WELDER/GENERATOR	Hours	115	$23.00	91%	7.6	58	0.002	33	3	No Min			30
4122	All (4)	POST, PULLER, AUGER/TOOL KIT	Years	97	$229.59	70%	6.2		-0.063			No Min			30

Class	Functional Code	Description	Units of Use	Count	Average Operating Rate ($/unit)	Average Unit Utilization	Average Age (Years)	Average Annual Usage	Annual Operating Rate Factor	Initial Usage	Annual Usage Decline	Current Fleet			Years Modeled
												Economic Life	Age at Economic Life	Rate ($/unit)	
4126	SPRTGM	SPREADER, TAILGATE MOUNT	Years	75	$291.38	4%	5.9		0.017			No Min			30
4127	SPRIBA	SPREADER, 5CY IN BODY	Years	751	$570.83	5%	6.4		0.018			No Min			30
4128	SNPLWA	PLOW, SNOW 10'	Years	317	$388.97	4%	4.7		-0.063			No Min			30
4136	FRKLFT	FORKLIFT	Hours	86	$19.78	102%	9.1	66	0.053	68	0	No Min			30
4145	All (3)	TRAFFIC CONTROL DEVICES	Years	290	$484.06	74%	7.8		0.012			No Min			30
4154	All (2)	PILE DRIVER	Years	3	$2,323.67	5%	8.7		0.076			23		$6,042.78	30
4229	SPRIBB	SPREADER, 10CY IN BODY	Years	689	$632.85	4%	5.8		0.057			22		$692.29	30
4230	GSNWBL	SNOW BLOWER	Years	4	$1,234.96	0%	9.8		0.214			23		$14,876.60	30
4231	SNPLWB	PLOW, SNOW 8'	Years	41	$204.01	2%	4.2		0.364			9		$473.22	30
4233	SNPLWC	PLOW, SNOW 12'	Years	324	$395.13	4%	4.3		0.101			15		$528.91	30
4241	SWRROD	SEWER RODDER	Hours	15	$42.00	15%	7.3	68	-0.031	74	-1	No Min			30
4248	TILLER	SOIL CONDITIONER	Years	8	$181.79	11%	5.1		0.321			13		$796.42	30
4254	All (2)	SKID STEER ATTACHMENTS	Years	11	$57.42	3%	5		0.037			No Min			30
230R	All (4)	REAR MOUNT MOWER ATT	Years	115	$1,293.93	22%	5.9		-0.076			No Min			30
230S	All (2)	SIDE/MID MOWER ATT	Years	83	$2,041.31	20%	6.1		-0.036			No Min			30

Table 6: Forward Analysis Results – 100 to 80 Percent of Fleet

(Note: Based on 2011 data, 3% interest, 2% decline, 2.4% inflation)

Class	Functional Code	Description	100% Fleet / Limited Decline			90% Fleet / Limited Decline			80% Fleet / Limited Decline		
			Economic Life	Age at Economic Life	Rate	Economic Life	Age at Economic Life	Rate	Economic Life	Age at Economic Life	Rate
0200	All (2)	TRUCK, MISCELLANEOUS	17	203,592	$0.50	15	199,733	$0.50	13	194,890	$0.50
0201	All (5)	TRUCK, 5000 GVW	14	185,290	$0.42	13	189,007	$0.42	11	180,015	$0.42
0202	TRUCK1	TRUCK, 7500 GVW	16	233,120	$0.48	14	226,814	$0.48	12	218,940	$0.48
0202	GIMAPT	TRUCK, 7500 GVW	No Match			No Match			No Match		
0202	All (4)	TRUCK, 7500 GVW	20	368,200	$0.46	17	352,079	$0.46	17	386,852	$0.46
0203	All (5)	TRUCK, 15000 GVW	12	145,464	$0.83	11	146,229	$0.83	9	137,840	$0.83
0204	All (2)	TRUCK, 9000 - 10000 GVW	17	259,038	$0.57	15	247,958	$0.58	13	241,787	$0.58
0205	TRKDMP	TRUCK, DUMP 33000 GVW	15	111,930	$1.58	13	110,351	$1.59	12	113,256	$1.59
0206	TRUCK2	TRUCK, 20000 - 33000 GVW	19	129,742	$1.29	17	129,107	$1.29	14	121,100	$1.30
0206	All (15)	TRUCK, 20000 - 33000 GVW	16	124,032	$1.42	14	121,114	$1.42	13	124,306	$1.42
0206	GFUELT	TRUCK, 20000 - 33000 GVW	No Match			No Match			No Match		
0206	GDIST1	TRUCK, 20000 - 33000 GVW	16	78,304	$2.08	14	76,300	$2.08	13	78,988	$2.09
0206	GASPC1	TRUCK, 20000 - 33000 GVW	No Match			No Match			No Match		
0206	All (19)	TRUCK, 20000 - 33000 GVW	19	128,041	$1.37	17	127,398	$1.37	15	126,315	$1.38
0212	TRKDMP	TRUCK, DUMP 50000 GVW	14	169,778	$1.61	12	161,700	$1.62	11	164,885	$1.63
0217	TRUCK5	TRUCK, TRACTOR 60000 GVW	18	158,778	$1.69	16	156,000	$1.70	14	154,826	$1.71
0227	TRUCK5	TRUCK, TRACTOR 70000 GVW	No Match			No Match			No Match		
0230	GCRAN2	TRUCK, 35000 - 50000 GVW	14	24,990	$5.05	13	25,123	$5.05	11	24,844	$5.06
0230	GCRAN1	TRUCK, 35000 - 50000 GVW	No Match			No Match			No Match		
0230	All (5)	TRUCK, 35000 - 50000 GVW	15	49,343	$3.33	14	50,344	$3.32	12	48,372	$3.34
0232	TRKDMP	TRUCK, DUMP 60000 GVW	No Match			No Match			18	383,076	$1.49
0233	TRUCK2	TRUCK, 17500 - 20000 GVW	13	226,408	$0.76	12	229,920	$0.76	10	216,100	$0.76
0233	GTRFSV	TRUCK, 17500 - 20000 GVW	11	233,646	$0.72	10	236,260	$0.72	9	238,986	$0.73
0233	GMCHST	TRUCK, 17500 - 20000 GVW	No Match			No Match			No Match		
0233	GAER1A	TRUCK, 17500 - 20000 GVW	11	205,959	$0.93	10	209,290	$0.92	9	208,211	$0.92
0233	All (7)	TRUCK, 17500 - 20000 GVW	11	184,278	$0.80	9	170,982	$0.80	8	169,888	$0.80
0235	BUSBUS	BUS, PASSENGER	9	99,707	$0.88	8	98,536	$0.88	6	82,122	$0.88
0236	All (2)	UTILITY VEHICLE	No Match			No Match			No Match		
0300	All (7)	TRACTOR, WHEEL	16	3,952	$29.21	14	3,892	$29.31	13	3,998	$29.45
0314	BCKHOE	BACKHOE, TRACTOR LOADER	15	4,860	$36.02	14	5,054	$36.09	12	4,836	$36.16
0404	CRWTRM	CRAWLER TRACTOR	No Match			No Match			No Match		

Class	Functional Code	Description	100% Fleet / Limited Decline			90% Fleet / Limited Decline			80% Fleet / Limited Decline		
			Economic Life	Age at Economic Life	Rate	Economic Life	Age at Economic Life	Rate	Economic Life	Age at Economic Life	Rate
0900	GRADRM	MOTOR GRADER	21	6,636	$51.82	19	6,603	$51.93	17	6,647	$52.04
1010	All (2)	ASPHALT PATCH MACHINE, TRAILER MTD	30		$2,231.87	30		$2,183.07	30		$2,127.61
1011	PAVERM	ASPHALT PAVER/ GRINDER	13	2,574	$61.96	12	2,604	$62.16	10	2,440	$62.44
1012	All (2)	ASPHALT PATCHER, TRUCK MTD	30		$3,111.02	30		$2,988.31	30		$2,855.11
1014	LOADRM	LOADER, SKID STEER	No Match			No Match			No Match		
1150	PAVERM	PAVER, ASPHALT	13	2,789	$73.65	12	2,760	$73.84	11	2,937	$74.13
1300	TNKASP	ASPHALT TANK/KETTLE	11	3,080	$41.29	10	3,170	$41.34	9	3,222	$41.48
1302	All (2)	DISTRIBUTOR, ASPHALT	No Match			No Match			No Match		
1400	All (7)	BROOM	1		$9,147.02	1		$9,225.25	1		$9,324.58
1404	SWEEPR	INTEGRAL SWEEPER	No Match			No Match			No Match		
1450	All (2)	PAINT MACHINE, SPECIAL MARKING	11		$22,854	10		$24,822	10		$26,035
1453	All (3)	PAINT MACHINE, PRELINE	30		$1,633.45	30		$1,605.50	30		$1,605.50
1454	PAINTM	PAINT MACHINE, HAND TRAFFIC STRIPER	21		$529.82	19		$562.62	18		$602.39
1457	All (2)	PAINT MACHINE, THERMOPLASTIC APPL.	11		$3,403.88	11		$3,403.88	8		$4,521.29
1500	All (13)	COMPRESSOR, AIR	26		$531.31	24		$560.71	22		$596.04
1600	CONVYR	CONVEYOR, SALT	10		$7,318.06	10		$7,893.17	9		$8,559.90
1601	STBRNP	SYSTEM, SALT BRINE PRODUCTION	30		$565.23	30		$548.86	30		$532.45
1602	STBRNT	TANK, SALT BRINE STORAGE	30		$119.91	30		$116.73	30		$113.49
1603	STBRNS	STATION, SALT BRINE FILL	30		$134.26	30		$132.28	30		$129.95
1604	STBRNA	SYSTEM, SALT BRINE APPLICATOR	30		$669.83	30		$655.73	30		$640.21
1703	TRCATT	TRACTOR IMPLEMENT / ATTACHMENT	30		$488.50	30		$472.27	30		$472.27
1709	DRILLM	DRILL, AUGER	15	2,228	$149.93	13	2,197	$149.76	13	2,197	$149.76
1720	All (2)	BREAKER ATTACHMENT	27		$174.00	26		$181.01	23		$198.16
1802	All (2)	AERIAL DEVICE, TRUCK MTD	30		$3,142.35	29		$3,317.18	26		$3,532.47
1803	GAER3A	AERIAL DEVICE, BRIDGE INSPECTION	30		$6,293.98	30		$6,293.98	30		$6,171.05
1805	All (2)	AERIAL WORK PLATFORM	30		$5,031.54	30		$4,965.88	30		$4,886.56
1806	AERDV2	AERIAL DEVICE, SELF PROPELLED	26		$3,566.64	24		$3,705.15	21		$4,044.45
1815	All (2)	CRANE, 16-18 TON	30		$4,561.09	30		$4,526.32	30		$4,475.71
1822	All (4)	CRANE, MECHANIC	30		$620.84	30		$606.56	30		$590.35
1852	EXCAVC	EXCAVATOR, WHEEL	15	4,185	$72.70	13	4,089	$72.82	12	4,176	$72.58
1853	All (2)	EXCAVATOR, TRACK 20 - 36 METRIC TON	17	7,225	$41.32	15	7,058	$41.36	13	6,890	$41.44
1854	EXCAVC	EXCAVATOR, TRACK 12 - 18 METRIC TON	16	8,160	$30.78	14	7,938	$30.72	13	8,216	$30.90
2002	LOADRM	LOADER, WHEEL 2 CY	14	4,788	$39.17	13	4,843	$39.26	11	4,752	$39.40
2008	LOADRM	LOADER, CRAWLER	18	3,006	$82.41	16	3,040	$82.26	14	2,982	$82.19

Class	Functional Code	Description	100% Fleet / Limited Decline			90% Fleet / Limited Decline			80% Fleet / Limited Decline		
			Economic Life	Age at Economic Life	Rate	Economic Life	Age at Economic Life	Rate	Economic Life	Age at Economic Life	Rate
2013	All (2)	LOADER ATTACHMENT	30		$303.58	30		$295.51	30		$295.51
2101	GENRTR	GENERATOR/STANDBY POWER SYSTEM	No Match			No Match			No Match		
2115	LTPLNT	LIGHT PLANT	10	660	$15.83	9	630	$15.77	8	632	$15.84
2205	MIXERM	MIXER, MASONRY/ASPHALT	30		$2,890.68	30		$2,890.68	30		$2,746.56
2215	All (2)	HYDRAULIC IMPACTOR	30		$1,274.30	30		$1,274.30	30		$1,227.78
2301	All (2)	A-BOOM MOWER ATTACHMENT	8		$1,207.12	8		$1,207.12	6		$1,710.93
2308	All (3)	A-BOOM MOWER ATTACHMENT	30		$3,598.13	30		$3,454.06	30		$3,279.34
2310	MOWERM	RIDING MOWER	15	1,260	$29.38	13	1,235	$29.44	11	1,221	$29.57
2502	ROLLRM	ROLLER, TANDEM, STATIC	No Match			No Match			No Match		
2504	ROLLRM	ROLLER, RUBBER TIRE	21	2,489	$38.53	19	2,594	$38.29	17	2,550	$38.57
2507	ROLLRM	ROLLER, VIBRATORY	No Match			21	2,825	$32.77	19	2,850	$32.99
2604	SCRPER	SCRAPER, SELF PROPELLED, 11 CY	No Match			No Match			No Match		
2703	CRANEM	CRANE, TRACK MOUNTED	No Match			No Match			No Match		
2850	SPRDRM	SPREADER, WIDENER	No Match			No Match			No Match		
2851	All (2)	SHOULDER MACHINE	30		$1,246.34	30		$1,233.44	30		$1,212.05
2853	SPRDRM	SPREADER, AGGREGATE	No Match			No Match			No Match		
3151	GFUELT	FUEL AND LUBE TANK, TRUCK MTD	30		$1,890.16	30		$1,880.79	30		$1,869.80
3201	All (4)	TRAILER, LIGHT EQUIPMENT TRANSPORT	28		$1,209.56	26		$1,264.29	24		$1,329.63
3202	TRALR3	TRAILER, HEAVY EQUIPMENT TRANSPORT	20		$4,501.14	18		$4,796.59	17		$5,112.06
3203	TRALR4	TRAILER, MATERIAL TRANSPORT	30		$904.95	30		$879.84	30		$852.98
3205	TRALR5	TRAILER, SPECIAL PURPOSE	30		$1,150.37	30		$1,171.20	30		$1,199.14
3214	All (6)	TRAILER, UTILITY	26		$446.86	24		$468.46	22		$495.43
3221	MODULR	MODULAR OFFICE, SINGLE	30		$1,294.84	30		$1,294.84	30		$1,249.67
3230	All (8)	TRUCK MOUNT ATTENUATOR	30		$978.32	30		$1,006.50	30		$1,044.73
3301	All (2)	BOAT, MOTOR, TRAILER	15		$1,250.81	14		$1,338.46	12		$1,486.12
3500	All (2)	PUMP, WATER	30		$631.65	30		$617.78	30		$597.91
3980	SNWEQA	PLOW, SNOW 10'	30		$240.37	30		$230.43	30		$219.35
4102	BSHCPR	BRUSH CHIPPER	15	990	$60.06	13	962	$60.26	11	946	$60.52
4103	CONFRM	CURB MACHINE	17		$488.01	15		$551.06	15		$551.06
4104	All (2)	HYDRO-SEEDER ATTACHMENT	10	1,340	$57.17	9	1,319	$57.29	8	1,296	$57.42
4106	All (5)	SPRAYER ATTACHMENT	26		$3,267.69	24		$3,485.62	21		$3,891.90
4119	All (7)	WELDER/GENERATOR	No Match			No Match			No Match		
4122	All (4)	POST, PULLER, AUGER/TOOL KIT	30		$270.36	30		$266.66	30		$263.00
4126	SPRTGM	SPREADER, TAILGATE MOUNT	30		$214.27	30		$219.04	30		$226.18

Class	Functional Code	Description	100% Fleet / Limited Decline			90% Fleet / Limited Decline			80% Fleet / Limited Decline		
			Economic Life	Age at Economic Life	Rate	Economic Life	Age at Economic Life	Rate	Economic Life	Age at Economic Life	Rate
4127	SPRIBA	SPREADER, 5CY IN BODY	30		$487.08	30		$497.44	30		$511.04
4128	SNPLWA	PLOW, SNOW 10'	30		$234.63	30		$227.46	30		$219.81
4136	FRKLFT	FORKLIFT	No Match			No Match			No Match		
4145	All (3)	TRAFFIC CONTROL DEVICES	30		$539.87	30		$545.47	30		$552.68
4154	All (2)	PILE DRIVER	23		$6,042.78	23		$6,042.78	17		$7,565.08
4229	SPRIBB	SPREADER, 10CY IN BODY	22		$692.29	21		$726.55	19		$767.40
4230	GSNWBL	SNOW BLOWER	23		$14,876.60	23		$14,876.60	18		$18,679.40
4231	SNPLWB	PLOW, SNOW 8'	9		$473.22	8		$510.66	7		$558.69
4233	SNPLWC	PLOW, SNOW 12'	15		$528.91	14		$557.99	13		$594.30
4241	SWRROD	SEWER RODDER	No Match			No Match			No Match		
4248	TILLER	SOIL CONDITIONER	13		$796.42	11		$885.60	10		$1,000.88
4254	All (2)	SKID STEER ATTACHMENTS	30		$216.93	30		$222.22	30		$229.32
230R	All (4)	REAR MOUNT MOWER ATT	30		$479.88	30		$457.01	30		$429.97
230S	All (2)	SIDE/MID MOWER ATT	30		$1,323.18	30		$1,280.43	30		$1,224.76

Table 7: Forward Analysis Results – 70 to 50 Percent of Fleet

(Note: Based on 2011 data, 3% interest, 2% decline, 2.4% inflation)

Class	Functional Code	Description	70% Fleet / Limited Decline			60% Fleet / Limited Decline			50% Fleet / Limited Decline		
			Economic Life	Age at Economic Life	Rate	Economic Life	Age at Economic Life	Rate	Economic Life	Age at Economic Life	Rate
0200	All (2)	TRUCK, MISCELLANEOUS	11	188,705	$0.50	9	184,464	$0.51	8	192,776	$0.51
0201	All (5)	TRUCK, 5000 GVW	9	172,098	$0.42	8	176,440	$0.43	7	183,243	$0.43
0202	TRUCK1	TRUCK, 7500 GVW	11	225,907	$0.48	9	215,924	$0.48	7	206,192	$0.49
0202	GIMAPT	TRUCK, 7500 GVW	No Match			No Match			No Match		
0202	All (4)	TRUCK, 7500 GVW	13	338,455	$0.47	12	368,892	$0.47	10	367,030	$0.47
0203	All (5)	TRUCK, 15000 GVW	8	138,208	$0.84	7	139,881	$0.84	6	145,014	$0.85
0204	All (2)	TRUCK, 9000 - 10000 GVW	11	233,904	$0.58	10	250,850	$0.58	8	240,856	$0.59
0205	TRKDMP	TRUCK, DUMP 33000 GVW	10	107,960	$1.60	9	112,095	$1.61	7	104,626	$1.62
0206	TRUCK2	TRUCK, 20000 - 33000 GVW	13	127,056	$1.30	11	125,565	$1.31	9	122,922	$1.31
0206	All (15)	TRUCK, 20000 - 33000 GVW	11	120,786	$1.43	9	116,928	$1.44	8	124,080	$1.45
0206	GFUELT	TRUCK, 20000 - 33000 GVW	No Match			No Match			No Match		

Class	Functional Code	Description	70% Fleet / Limited Decline			60% Fleet / Limited Decline			50% Fleet / Limited Decline		
			Economic Life	Age at Economic Life	Rate	Economic Life	Age at Economic Life	Rate	Economic Life	Age at Economic Life	Rate
0206	GDIST1	TRUCK, 20000 - 33000 GVW	11	76,643	$2.10	9	73,508	$2.11	8	77,064	$2.13
0206	GASPC1	TRUCK, 20000 - 33000 GVW	No Match			No Match			No Match		
0206	All (19)	TRUCK, 20000 - 33000 GVW	13	125,210	$1.38	11	123,657	$1.39	9	121,275	$1.40
0212	TRKDMP	TRUCK, DUMP 50000 GVW	9	157,649	$1.63	7	143,028	$1.64	No Match		
0217	TRUCK5	TRUCK, TRACTOR 60000 GVW	12	150,720	$1.71	11	161,200	$1.72	9	157,055	$1.73
0227	TRUCK5	TRUCK, TRACTOR 70000 GVW	No Match			No Match			No Match		
0230	GCRAN2	TRUCK, 35000 - 50000 GVW	10	25,710	$5.11	8	23,496	$5.09	6	20,562	$5.03
0230	GCRAN1	TRUCK, 35000 - 50000 GVW	No Match			No Match			No Match		
0230	All (5)	TRUCK, 35000 - 50000 GVW	11	50,886	$3.35	9	48,429	$3.35	7	45,003	$3.36
0232	TRKDMP	TRUCK, DUMP 60000 GVW	16	387,264	$1.50	13	360,503	$1.50	11	362,907	$1.50
0233	TRUCK2	TRUCK, 17500 - 20000 GVW	9	220,496	$0.76	7	205,328	$0.77	6	203,130	$0.77
0233	GTRFSV	TRUCK, 17500 - 20000 GVW	7	214,340	$0.73	7	247,898	$0.73	6	253,128	$0.74
0233	GMCHST	TRUCK, 17500 - 20000 GVW	No Match			No Match			No Match		
0233	GAER1A	TRUCK, 17500 - 20000 GVW	7	189,935	$0.93	6	190,866	$0.94	No Match		
0233	All (7)	TRUCK, 17500 - 20000 GVW	7	167,773	$0.80	6	169,122	$0.82	No Match		
0235	BUSBUS	BUS, PASSENGER	No Match			No Match			No Match		
0236	All (2)	UTILITY VEHICLE	No Match			No Match			No Match		
0300	All (7)	TRACTOR, WHEEL	11	3,850	$29.54	9	3,776	$29.73	6	2,970	$29.33
0314	BCKHOE	BACKHOE, TRACTOR LOADER	11	5,027	$36.29	9	4,779	$36.36	7	4,550	$36.61
0404	CRWTRM	CRAWLER TRACTOR	No Match			18	4,158	$96.50	14	3,962	$96.71
0900	GRADRM	MOTOR GRADER	14	6,356	$52.20	12	6,420	$52.36	10	6,400	$52.61
1010	All (2)	ASPHALT PATCH MACHINE, TRAILER MTD	30		$2,041.03	30		$1,964.53	30		$1,876.04
1011	PAVERM	ASPHALT PAVER/ GRINDER	8	2,296	$63.42	8	2,656	$62.94	6	2,370	$63.42
1012	All (2)	ASPHALT PATCHER, TRUCK MTD	30		$2,784.49	30		$2,635.31	30		$2,476.31
1014	LOADRM	LOADER, SKID STEER	No Match			No Match			15	2,258	$69.03
1150	PAVERM	PAVER, ASPHALT	9	2,687	$74.48	7	2,632	$75.33	6	2,550	$74.65
1300	TNKASP	ASPHALT TANK/KETTLE	8	3,136	$41.62	7	3,192	$41.94	5	2,850	$41.59
1302	All (2)	DISTRIBUTOR, ASPHALT	No Match			No Match			No Match		
1400	All (7)	BROOM	1		$9,454.83	1		$9,633.09	1		$9,857.44
1404	SWEEPR	INTEGRAL SWEEPER	No Match			No Match			No Match		
1450	All (2)	PAINT MACHINE, SPECIAL MARKING	9		$28,976	7		$32,870	7		$35,379
1453	All (3)	PAINT MACHINE, PRELINE	30		$1,575.64	30		$1,544.15	30		$1,544.15
1454	PAINTM	PAINT MACHINE, HAND TRAFFIC STRIPER	16		$649.87	14		$710.33	13		$787.36
1457	All (2)	PAINT MACHINE, THERMOPLASTIC APPL.	8		$4,521.29	8		$4,521.29	8		$4,521.29

Class	Functional Code	Description	70% Fleet / Limited Decline			60% Fleet / Limited Decline			50% Fleet / Limited Decline		
			Economic Life	Age at Economic Life	Rate	Economic Life	Age at Economic Life	Rate	Economic Life	Age at Economic Life	Rate
1500	All (13)	COMPRESSOR, AIR	20		$639.62	18		$695.23	15		$768.61
1600	CONVYR	CONVEYOR, SALT	8		$9,391.21	7		$10,458	6		$11,608
1601	STBRNP	SYSTEM, SALT BRINE PRODUCTION	30		$521.49	30		$505.06	30		$488.68
1602	STBRNT	TANK, SALT BRINE STORAGE	30		$110.21	30		$106.88	30		$103.53
1603	STBRNS	STATION, SALT BRINE FILL	30		$126.61	30		$123.04	30		$118.57
1604	STBRNA	SYSTEM, SALT BRINE APPLICATOR	30		$620.83	30		$599.01	30		$571.12
1703	TRCATT	TRACTOR IMPLEMENT / ATTACHMENT	30		$453.96	30		$453.96	30		$433.66
1709	DRILLM	DRILL, AUGER	11	2,206	$149.32	8	2,040	$150.78	8	2,040	$150.78
1720	All (2)	BREAKER ATTACHMENT	21		$208.81	18		$236.73	16		$255.62
1802	All (2)	AERIAL DEVICE, TRUCK MTD	24		$3,797.93	21		$4,136.79	19		$4,526.32
1803	GAER3A	AERIAL DEVICE, BRIDGE INSPECTION	30		$6,171.05	30		$6,171.05	30		$6,171.05
1805	All (2)	AERIAL WORK PLATFORM	30		$4,789.00	30		$4,666.51	30		$4,666.51
1806	AERDV2	AERIAL DEVICE, SELF PROPELLED	20		$4,254.52	17		$4,806.50	15		$5,181.25
1815	All (2)	CRANE, 16-18 TON	30		$4,423.63	30		$4,344.38	30		$4,258.30
1822	All (4)	CRANE, MECHANIC	30		$570.24	30		$546.76	30		$516.71
1852	EXCAVC	EXCAVATOR, WHEEL	10	3,980	$73.18	9	4,140	$72.80	7	3,864	$73.96
1853	All (2)	EXCAVATOR, TRACK 20 - 36 METRIC TON	11	6,798	$41.57	10	7,130	$41.72	8	6,840	$41.87
1854	EXCAVC	EXCAVATOR, TRACK 12 - 18 METRIC TON	11	7,920	$30.91	9	7,718	$31.12	8	8,152	$31.25
2002	LOADRM	LOADER, WHEEL 2 CY	10	4,880	$39.42	8	4,600	$39.55	6	4,104	$39.76
2008	LOADRM	LOADER, CRAWLER	12	2,964	$82.38	10	2,970	$83.02	10	2,970	$83.02
2013	All (2)	LOADER ATTACHMENT	30		$287.37	30		$287.37	30		$279.19
2101	GENRTR	GENERATOR/STANDBY POWER SYSTEM	No Match			No Match			No Match		
2115	LTPLNT	LIGHT PLANT	7	630	$15.96	5	545	$15.47	No Match		
2205	MIXERM	MIXER, MASONRY/ASPHALT	30		$2,746.56	30		$2,598.12	30		$2,598.12
2215	All (2)	HYDRAULIC IMPACTOR	30		$1,227.78	30		$1,161.62	30		$1,161.62
2301	All (2)	A-BOOM MOWER ATTACHMENT	6		$1,710.93	6		$1,710.93	6		$1,710.93
2308	All (3)	A-BOOM MOWER ATTACHMENT	30		$3,089.10	30		$2,855.42	30		$2,598.43
2310	MOWERM	RIDING MOWER	11	1,293	$29.58	9	1,256	$29.92	7	1,197	$30.02
2502	ROLLRM	ROLLER, TANDEM, STATIC	No Match			No Match			No Match		
2504	ROLLRM	ROLLER, RUBBER TIRE	14	2,534	$38.30	12	2,592	$37.95	12	2,592	$37.95
2507	ROLLRM	ROLLER, VIBRATORY	17	2,890	$32.76	14	2,800	$32.92	11	2,701	$33.12
2604	SCRPER	SCRAPER, SELF PROPELLED, 11 CY	19	3,154	$121.48	15	3,023	$121.95	14	3,136	$121.88
2703	CRANEM	CRANE, TRACK MOUNTED	No Match			No Match			No Match		
2850	SPRDRM	SPREADER, WIDENER	No Match			No Match			No Match		

Class	Functional Code	Description	70% Fleet / Limited Decline			60% Fleet / Limited Decline			50% Fleet / Limited Decline		
			Economic Life	Age at Economic Life	Rate	Economic Life	Age at Economic Life	Rate	Economic Life	Age at Economic Life	Rate
2851	All (2)	SHOULDER MACHINE	30		$1,196.30	30		$1,170.26	30		$1,151.27
2853	SPRDRM	SPREADER, AGGREGATE	No Match			No Match			No Match		
3151	GFUELT	FUEL AND LUBE TANK, TRUCK MTD	30		$1,858.15	30		$1,842.72	30		$1,823.92
3201	All (4)	TRAILER, LIGHT EQUIPMENT TRANSPORT	22		$1,409.63	20		$1,511.03	17		$1,643.65
3202	TRALR3	TRAILER, HEAVY EQUIPMENT TRANSPORT	15		$5,553.95	13		$6,056.02	12		$6,820.51
3203	TRALR4	TRAILER, MATERIAL TRANSPORT	30		$824.38	30		$794.13	30		$773.16
3205	TRALR5	TRAILER, SPECIAL PURPOSE	30		$1,238.53	30		$1,298.08	30		$1,298.08
3214	All (6)	TRAILER, UTILITY	20		$527.22	18		$569.26	16		$622.81
3221	MODULR	MODULAR OFFICE, SINGLE	30		$1,249.67	30		$1,187.14	30		$1,187.14
3230	All (8)	TRUCK MOUNT ATTENUATOR	30		$1,099.32	28		$1,181.23	25		$1,291.73
3301	All (2)	BOAT, MOTOR, TRAILER	11		$1,621.64	10		$1,863.92	8		$2,120.67
3500	All (2)	PUMP, WATER	30		$581.95	30		$559.29	30		$541.34
3980	SNWEQA	PLOW, SNOW 10'	30		$206.98	30		$193.17	30		$177.94
4102	BSHCPR	BRUSH CHIPPER	9	909	$60.77	8	920	$61.07	6	834	$61.24
4103	CONFRM	CURB MACHINE	13		$638.14	10		$763.02	10		$763.02
4104	All (2)	HYDRO-SEEDER ATTACHMENT	6	1,182	$58.10	5	1,148	$57.34	No Match		
4106	All (5)	SPRAYER ATTACHMENT	19		$4,237.17	17		$4,669.81	15		$5,231.23
4119	All (7)	WELDER/GENERATOR	No Match			No Match			No Match		
4122	All (4)	POST, PULLER, AUGER/TOOL KIT	30		$258.52	30		$253.59	30		$248.74
4126	SPRTGM	SPREADER, TAILGATE MOUNT	29		$234.55	25		$246.52	22		$259.92
4127	SPRIBA	SPREADER, 5CY IN BODY	30		$529.62	30		$556.47	27		$595.75
4128	SNPLWA	PLOW, SNOW 10'	30		$211.11	30		$201.55	30		$191.44
4136	FRKLFT	FORKLIFT	20	1,980	$34.66	18	1,926	$34.73	15	1,973	$34.86
4145	All (3)	TRAFFIC CONTROL DEVICES	30		$562.33	30		$575.87	30		$596.23
4154	All (2)	PILE DRIVER	17		$7,565.08	17		$7,565.08	17		$7,565.08
4229	SPRIBB	SPREADER, 10CY IN BODY	17		$817.82	15		$882.03	13		$965.98
4230	GSNWBL	SNOW BLOWER	18		$18,679	12		$25,907	12		$25,907
4231	SNPLWB	PLOW, SNOW 8'	6		$608.68	5		$660.41	4		$713.49
4233	SNPLWC	PLOW, SNOW 12'	12		$638.26	10		$697.30	9		$771.71
4241	SWRROD	SEWER RODDER	No Match			No Match			No Match		
4248	TILLER	SOIL CONDITIONER	10		$1,000.88	8		$1,167.37	7		$1,396.17
4254	All (2)	SKID STEER ATTACHMENTS	30		$239.26	30		$254.08	28		$276.69
230R	All (4)	REAR MOUNT MOWER ATT	30		$403.18	30		$371.73	30		$340.97
230S	All (2)	SIDE/MID MOWER ATT	30		$1,167.00	30		$1,099.64	30		$1,020.59

6.2 Current Economic Life Estimates

To provide additional insight to the 2011 analysis results, the data in Tables 5, 6 and, 7 was filtered by *Current Economic Life* and is presented in Tables 8, 9, and 10 for classes in which an economic life was determined. Equipment classes with a *Count* of less than 20 do not have enough data for statistical significant and should be discounted. An *Economic Life* of one year indicates that the minimum was found in the first year ownership and should not be viewed as a true economic life.

For comparison, Tables 11, 12 and 13 show equipment for which an economic life was not determined. As previously stated, the classes for which the model unable to determine an economic life are those with very low or negative *Annual Operating Rate Factors*. Interestingly, while 74% of equipment classes with usage measured in miles and 63% of equipment classes with usage measured in hours have a determinable economic life, only 39% of equipment classes with usage measured in years have determinable economic life. The cause of an undeterminable economic life is twofold. First, much of the equipment with usage measured in years are attachments or trailers that tend to have relatively low operating cost, hence a low or negative *Annual Operating Rate Factor*. Second, for equipment with measured usage, low usage generally results in low operating costs, and hence, a low or negative *Annual Operating Rate Factor*.

Table 8: Summary of Results for Classes with Estimated Economic Life for Current Fleet

(Note: Based on 2011 data, 3% interest, 2% decline, 2.4% inflation)

Class	Functional Code	Description	Count	Units of Use	Economic Life	Age at Economic Life	Rate ($/unit)
0200	All (2)	TRUCK, MISCELLANEOUS	179	Miles	20	198,869	$0.50
0201	All (5)	TRUCK, 5000 GVW	1,903	Miles	15	186,379	$0.42
0202	TRUCK1	TRUCK, 7500 GVW	268	Miles	18	238,128	$0.48
0203	All (5)	TRUCK, 15000 GVW	345	Miles	12	149,122	$0.83
0204	All (2)	TRUCK, 9000 - 10000 GVW	510	Miles	20	271,013	$0.57
0205	TRKDMP	TRUCK, DUMP 33000 GVW	862	Miles	12	113,525	$1.60
0206	All (15)	TRUCK, 20000 - 33000 GVW	116	Miles	15	127,762	$1.43
0206	TRUCK2	TRUCK, 20000 - 33000 GVW	549	Miles	17	127,748	$1.30
0206	GDIST1	TRUCK, 20000 - 33000 GVW	59	Miles	17	81,171	$2.09
0206	All (19)	TRUCK, 20000 - 33000 GVW	847	Miles	20	132,176	$1.37
0212	TRKDMP	TRUCK, DUMP 50000 GVW	610	Miles	13	169,437	$1.62
0217	TRUCK5	TRUCK, TRACTOR 60000 GVW	84	Miles	20	164,330	$1.70
0230	All (5)	TRUCK, 35000 - 50000 GVW	72	Miles	13	48,617	$3.33
0230	GCRAN2	TRUCK, 35000 - 50000 GVW	23	Miles	14	26,168	$5.07
0232	TRKDMP	TRUCK, DUMP 60000 GVW	73	Miles	28	424,885	$1.46
0233	GTRFSV	TRUCK, 17500 - 20000 GVW	55	Miles	11	229,838	$0.72
0233	GAER1A	TRUCK, 17500 - 20000 GVW	42	Miles	11	208,858	$0.94
0233	All (7)	TRUCK, 17500 - 20000 GVW	183	Miles	11	181,685	$0.81
0233	TRUCK2	TRUCK, 17500 - 20000 GVW	59	Miles	13	228,378	$0.76
0235	BUSBUS	BUS, PASSENGER	11	Miles	1	19,111	$0.82
0300	All (7)	TRACTOR, WHEEL	464	Hours	15	3,992	$29.35
0314	BCKHOE	BACKHOE, TRACTOR LOADER	247	Hours	14	4,862	$36.11
0404	CRWTRM	CRAWLER TRACTOR	18	Hours	25	3,246	$102.65
0900	GRADRM	MOTOR GRADER	374	Hours	17	6,568	$52.20
1011	PAVERM	ASPHALT PAVER/ GRINDER	32	Hours	12	2,419	$62.33
1150	PAVERM	PAVER, ASPHALT	14	Hours	13	2,878	$73.32
1300	TNKASP	ASPHALT TANK/KETTLE	18	Hours	7	3,183	$41.50
1400	All (7)	BROOM	89	Years	1		$9,147.02
1450	All (2)	PAINT MACHINE, SPECIAL MARKING	17	Years	11		$22,854
1454	PAINTM	PAINT MACHINE, HAND TRAFFIC STRIPER	11	Years	21		$529.82
1457	All (2)	PAINT MACHINE, THERMOPLASTIC APPL.	3	Years	11		$3,403.88
1500	All (13)	COMPRESSOR, AIR	291	Years	26		$531.31
1600	CONVYR	CONVEYOR, SALT	11	Years	10		$7,318.06
1709	DRILLM	DRILL, AUGER	7	Hours	11	2,163	$148.35
1720	All (2)	BREAKER ATTACHMENT	14	Years	27		$174.00
1806	AERDV2	AERIAL DEVICE, SELF PROPELLED	14	Years	26		$3,566.64
1852	EXCAVC	EXCAVATOR, WHEEL	20	Hours	14	4,194	$73.31
1853	All (2)	EXCAVATOR, TRACK 20 - 36 METRIC TON	40	Hours	19	7,089	$41.32
1854	EXCAVC	EXCAVATOR, TRACK 12 - 18 METRIC TON	20	Hours	18	8,477	$30.89
2002	LOADRM	LOADER, WHEEL 2 CY	184	Hours	13	4,950	$39.31
2008	LOADRM	LOADER, CRAWLER	9	Hours	19	3,006	$81.93
2115	LTPLNT	LIGHT PLANT	20	Hours	8	647	$15.77
2301	All (2)	A-BOOM MOWER ATTACHMENT	3	Years	8		$1,207.12
2310	MOWERM	RIDING MOWER	78	Hours	14	1,220	$29.50
2504	ROLLRM	ROLLER, RUBBER TIRE	9	Hours	12	1,939	$40.69
2507	ROLLRM	ROLLER, VIBRATORY	94	Hours	17	1,615	$39.34
2604	SCRPER	SCRAPER, SELF PROPELLED, 11 CY	17	Hours	24	3,035	$121.57
3201	All (4)	TRAILER, LIGHT EQUIPMENT TRANSPORT	650	Years	28		$1,209.56
3202	TRALR3	TRAILER, HEAVY EQUIPMENT TRANSPORT	76	Years	20		$4,501.14
3214	All (6)	TRAILER, UTILITY	245	Years	26		$446.86

Class	Functional Code	Description	Count	Units of Use	Economic Life	Age at Economic Life	Rate ($/unit)
3301	All (2)	BOAT, MOTOR, TRAILER	34	Years	15		$1,250.81
4102	BSHCPR	BRUSH CHIPPER	64	Hours	13	979	$60.33
4103	CONFRM	CURB MACHINE	7	Years	17		$488.01
4104	All (2)	HYDRO-SEEDER ATTACHMENT	22	Hours	1	299	$54.98
4106	All (5)	SPRAYER ATTACHMENT	23	Years	26		$3,267.69
4154	All (2)	PILE DRIVER	3	Years	23		$6,042.78
4229	SPRIBB	SPREADER, 10CY IN BODY	689	Years	22		$692.29
4230	GSNWBL	SNOW BLOWER	4	Years	23		$14,876.60
4231	SNPLWB	PLOW, SNOW 8'	41	Years	9		$473.22
4233	SNPLWC	PLOW, SNOW 12'	324	Years	15		$528.91
4248	TILLER	SOIL CONDITIONER	8	Years	13		$796.42

Table 9: Summary of Forward Analysis Results for Classes with Estimated Economic Life – 100 to 80 Percent of Fleet

(Note: Based on 2011 data, 3% interest, 2% decline, 2.4% inflation)

Class	Functional Code	Description	100% Fleet / Limited Decline			90% Fleet / Limited Decline			80% Fleet / Limited Decline		
			Economic Life	Age at Economic Life	Rate	Economic Life	Age at Economic Life	Rate	Economic Life	Age at Economic Life	Rate
0200	All (2)	TRUCK, MISCELLANEOUS	17	203,592	$0.50	15	199,733	$0.50	13	194,890	$0.50
0201	All (5)	TRUCK, 5000 GVW	14	185,290	$0.42	13	189,007	$0.42	11	180,015	$0.42
0202	TRUCK1	TRUCK, 7500 GVW	16	233,120	$0.48	14	226,814	$0.48	12	218,940	$0.48
0203	All (5)	TRUCK, 15000 GVW	12	145,464	$0.83	11	146,229	$0.83	9	137,840	$0.83
0204	All (2)	TRUCK, 9000 - 10000 GVW	17	259,038	$0.57	15	247,958	$0.58	13	241,787	$0.58
0205	TRKDMP	TRUCK, DUMP 33000 GVW	15	111,930	$1.58	13	110,351	$1.59	12	113,256	$1.59
0206	All (15)	TRUCK, 20000 - 33000 GVW	16	124,032	$1.42	14	121,114	$1.42	13	124,306	$1.42
0206	TRUCK2	TRUCK, 20000 - 33000 GVW	19	129,742	$1.29	17	129,107	$1.29	14	121,100	$1.30
0206	GDIST1	TRUCK, 20000 - 33000 GVW	16	78,304	$2.08	14	76,300	$2.08	13	78,988	$2.09
0206	All (19)	TRUCK, 20000 - 33000 GVW	19	128,041	$1.37	17	127,398	$1.37	15	126,315	$1.38
0212	TRKDMP	TRUCK, DUMP 50000 GVW	14	169,778	$1.61	12	161,700	$1.62	11	164,885	$1.63
0217	TRUCK5	TRUCK, TRACTOR 60000 GVW	18	158,778	$1.69	16	156,000	$1.70	14	154,826	$1.71
0230	All (5)	TRUCK, 35000 - 50000 GVW	15	49,343	$3.33	14	50,344	$3.32	12	48,372	$3.34
0230	GCRAN2	TRUCK, 35000 - 50000 GVW	14	24,990	$5.05	13	25,123	$5.05	11	24,844	$5.06
0232	TRKDMP	TRUCK, DUMP 60000 GVW	No Match			No Match			18	383,076	$1.49
0233	GTRFSV	TRUCK, 17500 - 20000 GVW	11	233,646	$0.72	10	236,260	$0.72	9	238,986	$0.73
0233	GAER1A	TRUCK, 17500 - 20000 GVW	11	205,959	$0.93	10	209,290	$0.92	9	208,211	$0.92
0233	All (7)	TRUCK, 17500 - 20000 GVW	11	184,278	$0.80	9	170,982	$0.80	8	169,888	$0.80
0233	TRUCK2	TRUCK, 17500 - 20000 GVW	13	226,408	$0.76	12	229,920	$0.76	10	216,100	$0.76
0235	BUSBUS	BUS, PASSENGER	9	99,707	$0.88	8	98,536	$0.88	6	82,122	$0.88
0300	All (7)	TRACTOR, WHEEL	16	3,952	$29.21	14	3,892	$29.31	13	3,998	$29.45
0314	BCKHOE	BACKHOE, TRACTOR LOADER	15	4,860	$36.02	14	5,054	$36.09	12	4,836	$36.16
0404	CRWTRM	CRAWLER TRACTOR	No Match			No Match			No Match		
0900	GRADRM	MOTOR GRADER	21	6,636	$51.82	19	6,603	$51.93	17	6,647	$52.04
1011	PAVERM	ASPHALT PAVER/ GRINDER	13	2,574	$61.96	12	2,604	$62.16	10	2,440	$62.44
1150	PAVERM	PAVER, ASPHALT	13	2,789	$73.65	12	2,760	$73.84	11	2,937	$74.13
1300	TNKASP	ASPHALT TANK/KETTLE	11	3,080	$41.29	10	3,170	$41.34	9	3,222	$41.48
1400	All (7)	BROOM	1		$9,147.02	1		$9,225.25	1		$9,324.58
1450	All (2)	PAINT MACHINE, SPECIAL MARKING	11		$22,854	10		$24,822	10		$26,035

Class	Functional Code	Description	100% Fleet / Limited Decline			90% Fleet / Limited Decline			80% Fleet / Limited Decline		
			Economic Life	Age at Economic Life	Rate	Economic Life	Age at Economic Life	Rate	Economic Life	Age at Economic Life	Rate
1454	PAINTM	PAINT MACHINE, HAND TRAFFIC STRIPER	21		$529.82	19		$562.62	18		$602.39
1457	All (2)	PAINT MACHINE, THERMOPLASTIC APPL.	11		$3,403.88	11		$3,403.88	8		$4,521.29
1500	All (13)	COMPRESSOR, AIR	26		$531.31	24		$560.71	22		$596.04
1600	CONVYR	CONVEYOR, SALT	10		$7,318.06	10		$7,893.17	9		$8,559.90
1709	DRILLM	DRILL, AUGER	15	2,228	$149.93	13	2,197	$149.76	13	2,197	$149.76
1720	All (2)	BREAKER ATTACHMENT	27		$174.00	26		$181.01	23		$198.16
1806	AERDV2	AERIAL DEVICE, SELF PROPELLED	26		$3,566.64	24		$3,705.15	21		$4,044.45
1852	EXCAVC	EXCAVATOR, WHEEL	15	4,185	$72.70	13	4,089	$72.82	12	4,176	$72.58
1853	All (2)	EXCAVATOR, TRACK 20 - 36 METRIC TON	17	7,225	$41.32	15	7,058	$41.36	13	6,890	$41.44
1854	EXCAVC	EXCAVATOR, TRACK 12 - 18 METRIC TON	16	8,160	$30.78	14	7,938	$30.72	13	8,216	$30.90
2002	LOADRM	LOADER, WHEEL 2 CY	14	4,788	$39.17	13	4,843	$39.26	11	4,752	$39.40
2008	LOADRM	LOADER, CRAWLER	18	3,006	$82.41	16	3,040	$82.26	14	2,982	$82.19
2115	LTPLNT	LIGHT PLANT	10	660	$15.83	9	630	$15.77	8	632	$15.84
2301	All (2)	A-BOOM MOWER ATTACHMENT	8		$1,207.12	8		$1,207.12	6		$1,710.93
2310	MOWERM	RIDING MOWER	15	1,260	$29.38	13	1,235	$29.44	11	1,221	$29.57
2504	ROLLRM	ROLLER, RUBBER TIRE	21	2,489	$38.53	19	2,594	$38.29	17	2,550	$38.57
2507	ROLLRM	ROLLER, VIBRATORY	No Match			21	2,825	$32.77	19	2,850	$32.99
2604	SCRPER	SCRAPER, SELF PROPELLED, 11 CY	No Match			No Match			No Match		
3201	All (4)	TRAILER, LIGHT EQUIPMENT TRANSPORT	28		$1,209.56	26		$1,264.29	24		$1,329.63
3202	TRALR3	TRAILER, HEAVY EQUIPMENT TRANSPORT	20		$4,501.14	18		$4,796.59	17		$5,112.06
3214	All (6)	TRAILER, UTILITY	26		$446.86	24		$468.46	22		$495.43
3301	All (2)	BOAT, MOTOR, TRAILER	15		$1,250.81	14		$1,338.46	12		$1,486.12
4102	BSHCPR	BRUSH CHIPPER	15	990	$60.06	13	962	$60.26	11	946	$60.52
4103	CONFRM	CURB MACHINE	17		$488.01	15		$551.06	15		$551.06
4104	All (2)	HYDRO-SEEDER ATTACHMENT	10	1,340	$57.17	9	1,319	$57.29	8	1,296	$57.42
4106	All (5)	SPRAYER ATTACHMENT	26		$3,267.69	24		$3,485.62	21		$3,891.90
4154	All (2)	PILE DRIVER	23		$6,042.78	23		$6,042.78	17		$7,565.08
4229	SPRIBB	SPREADER, 10CY IN BODY	22		$692.29	21		$726.55	19		$767.40
4230	GSNWBL	SNOW BLOWER	23		$14,876.60	23		$14,876.60	18		$18,679.40
4231	SNPLWB	PLOW, SNOW 8'	9		$473.22	8		$510.66	7		$558.69
4233	SNPLWC	PLOW, SNOW 12'	15		$528.91	14		$557.99	13		$594.30
4248	TILLER	SOIL CONDITIONER	13		$796.42	11		$885.60	10		$1,000.88

Table 10: Summary of Forward Analysis Results for Classes with Estimated Economic Life – 70 to 50 Percent of Fleet

(Note: Based on 2011 data, 3% interest, 2% decline, 2.4% inflation)

Class	Functional Code	Description	70% Fleet / Limited Decline			60% Fleet / Limited Decline			50% Fleet / Limited Decline		
			Economic Life	Age at Economic Life	Rate	Economic Life	Age at Economic Life	Rate	Economic Life	Age at Economic Life	Rate
0200	All (2)	TRUCK, MISCELLANEOUS	11	188,705	$0.50	9	184,464	$0.51	8	192,776	$0.51
0201	All (5)	TRUCK, 5000 GVW	9	172,098	$0.42	8	176,440	$0.43	7	183,243	$0.43
0202	TRUCK1	TRUCK, 7500 GVW	11	225,907	$0.48	9	215,924	$0.48	7	206,192	$0.49
0203	All (5)	TRUCK, 15000 GVW	8	138,208	$0.84	7	139,881	$0.84	6	145,014	$0.85
0204	All (2)	TRUCK, 9000 - 10000 GVW	11	233,904	$0.58	10	250,850	$0.58	8	240,856	$0.59
0205	TRKDMP	TRUCK, DUMP 33000 GVW	10	107,960	$1.60	9	112,095	$1.61	7	104,626	$1.62
0206	All (15)	TRUCK, 20000 - 33000 GVW	11	120,786	$1.43	9	116,928	$1.44	8	124,080	$1.45
0206	TRUCK2	TRUCK, 20000 - 33000 GVW	13	127,056	$1.30	11	125,565	$1.31	9	122,922	$1.31
0206	GDIST1	TRUCK, 20000 - 33000 GVW	11	76,643	$2.10	9	73,508	$2.11	8	77,064	$2.13
0206	All (19)	TRUCK, 20000 - 33000 GVW	13	125,210	$1.38	11	123,657	$1.39	9	121,275	$1.40
0212	TRKDMP	TRUCK, DUMP 50000 GVW	9	157,649	$1.63	7	143,028	$1.64	No Match		
0217	TRUCK5	TRUCK, TRACTOR 60000 GVW	12	150,720	$1.71	11	161,200	$1.72	9	157,055	$1.73
0230	All (5)	TRUCK, 35000 - 50000 GVW	11	50,886	$3.35	9	48,429	$3.35	7	45,003	$3.36
0230	GCRAN2	TRUCK, 35000 - 50000 GVW	10	25,710	$5.11	8	23,496	$5.09	6	20,562	$5.03
0232	TRKDMP	TRUCK, DUMP 60000 GVW	16	387,264	$1.50	13	360,503	$1.50	11	362,907	$1.50
0233	GTRFSV	TRUCK, 17500 - 20000 GVW	7	214,340	$0.73	7	247,898	$0.73	6	253,128	$0.74
0233	GAER1A	TRUCK, 17500 - 20000 GVW	7	189,935	$0.93	6	190,866	$0.94	No Match		
0233	All (7)	TRUCK, 17500 - 20000 GVW	7	167,773	$0.80	6	169,122	$0.82	No Match		
0233	TRUCK2	TRUCK, 17500 - 20000 GVW	9	220,496	$0.76	7	205,328	$0.77	6	203,130	$0.77
0235	BUSBUS	BUS, PASSENGER	No Match			No Match			No Match		
0300	All (7)	TRACTOR, WHEEL	11	3,850	$29.54	9	3,776	$29.73	6	2,970	$29.33
0314	BCKHOE	BACKHOE, TRACTOR LOADER	11	5,027	$36.29	9	4,779	$36.36	7	4,550	$36.61
0404	CRWTRM	CRAWLER TRACTOR	No Match			18	4,158	$96.50	14	3,962	$96.71
0900	GRADRM	MOTOR GRADER	14	6,356	$52.20	12	6,420	$52.36	10	6,400	$52.61
1011	PAVERM	ASPHALT PAVER/ GRINDER	8	2,296	$63.42	8	2,656	$62.94	6	2,370	$63.42
1150	PAVERM	PAVER, ASPHALT	9	2,687	$74.48	7	2,632	$75.33	6	2,550	$74.65
1300	TNKASP	ASPHALT TANK/KETTLE	8	3,136	$41.62	7	3,192	$41.94	5	2,850	$41.59
1400	All (7)	BROOM	1		$9,454.83	1		$9,633.09	1		$9,857.44
1450	All (2)	PAINT MACHINE, SPECIAL MARKING	9		$28,976	7		$32,870	7		$35,379
1454	PAINTM	PAINT MACHINE, HAND TRAFFIC STRIPER	16		$649.87	14		$710.33	13		$787.36
1457	All (2)	PAINT MACHINE, THERMOPLASTIC APPL.	8		$4,521.29	8		$4,521.29	8		$4,521.29

Class	Functional Code	Description	70% Fleet / Limited Decline			60% Fleet / Limited Decline			50% Fleet / Limited Decline		
			Economic Life	Age at Economic Life	Rate	Economic Life	Age at Economic Life	Rate	Economic Life	Age at Economic Life	Rate
1500	All (13)	COMPRESSOR, AIR	20		$639.62	18		$695.23	15		$768.61
1600	CONVYR	CONVEYOR, SALT	8		$9,391.21	7		$10,458	6		$11,608
1709	DRILLM	DRILL, AUGER	11	2,206	$149.32	8	2,040	$150.78	8	2,040	$150.78
1720	All (2)	BREAKER ATTACHMENT	21		$208.81	18		$236.73	16		$255.62
1806	AERDV2	AERIAL DEVICE, SELF PROPELLED	20		$4,254.52	17		$4,806.50	15		$5,181.25
1852	EXCAVC	EXCAVATOR, WHEEL	10	3,980	$73.18	9	4,140	$72.80	7	3,864	$73.96
1853	All (2)	EXCAVATOR, TRACK 20 - 36 METRIC TON	11	6,798	$41.57	10	7,130	$41.72	8	6,840	$41.87
1854	EXCAVC	EXCAVATOR, TRACK 12 - 18 METRIC TON	11	7,920	$30.91	9	7,718	$31.12	8	8,152	$31.25
2002	LOADRM	LOADER, WHEEL 2 CY	10	4,880	$39.42	8	4,600	$39.55	6	4,104	$39.76
2008	LOADRM	LOADER, CRAWLER	12	2,964	$82.38	10	2,970	$83.02	10	2,970	$83.02
2115	LTPLNT	LIGHT PLANT	7	630	$15.96	5	545	$15.47	No Match		
2301	All (2)	A-BOOM MOWER ATTACHMENT	6		$1,710.93	6		$1,710.93	6		$1,710.93
2310	MOWERM	RIDING MOWER	11	1,293	$29.58	9	1,256	$29.92	7	1,197	$30.02
2504	ROLLRM	ROLLER, RUBBER TIRE	14	2,534	$38.30	12	2,592	$37.95	12	2,592	$37.95
2507	ROLLRM	ROLLER, VIBRATORY	17	2,890	$32.76	14	2,800	$32.92	11	2,701	$33.12
2604	SCRPER	SCRAPER, SELF PROPELLED, 11 CY	19	3,154	$121.48	15	3,023	$121.95	14	3,136	$121.88
3201	All (4)	TRAILER, LIGHT EQUIPMENT TRANSPORT	22		$1,409.63	20		$1,511.03	17		$1,643.65
3202	TRALR3	TRAILER, HEAVY EQUIPMENT TRANSPORT	15		$5,553.95	13		$6,056.02	12		$6,820.51
3214	All (6)	TRAILER, UTILITY	20		$527.22	18		$569.26	16		$622.81
3301	All (2)	BOAT, MOTOR, TRAILER	11		$1,621.64	10		$1,863.92	8		$2,120.67
4102	BSHCPR	BRUSH CHIPPER	9	909	$60.77	8	920	$61.07	6	834	$61.24
4103	CONFRM	CURB MACHINE	13		$638.14	10		$763.02	10		$763.02
4104	All (2)	HYDRO-SEEDER ATTACHMENT	6	1,182	$58.10	5	1,148	$57.34	No Match		
4106	All (5)	SPRAYER ATTACHMENT	19		$4,237.17	17		$4,669.81	15		$5,231.23
4154	All (2)	PILE DRIVER	17		$7,565.08	17		$7,565.08	17		$7,565.08
4229	SPRIBB	SPREADER, 10CY IN BODY	17		$817.82	15		$882.03	13		$965.98
4230	GSNWBL	SNOW BLOWER	18		$18,679	12		$25,907	12		$25,907
4231	SNPLWB	PLOW, SNOW 8'	6		$608.68	5		$660.41	4		$713.49
4233	SNPLWC	PLOW, SNOW 12'	12		$638.26	10		$697.30	9		$771.71
4248	TILLER	SOIL CONDITIONER	10		$1,000.88	8		$1,167.37	7		$1,396.17

Table 11: Summary of Results for Classes without Estimated Economic Life for Current Fleet

(Note: Based on 2011 data, 3% interest, 2% decline, 2.4% inflation)

Class	Functional Code	Description	Count	Units of Use	Economic Life	Age at Economic Life	Rate ($/unit)
202	GIMAPT	TRUCK, 7500 GVW	57	Miles	No Min		
202	All (4)	TRUCK, 7500 GVW	329	Miles	No Min		
206	GFUELT	TRUCK, 20000 - 33000 GVW	95	Miles	No Min		
206	GASPC1	TRUCK, 20000 - 33000 GVW	27	Miles	No Min		
227	TRUCK5	TRUCK, TRACTOR 70000 GVW	19	Miles	No Min		
230	GCRAN1	TRUCK, 35000 - 50000 GVW	31	Miles	No Min		
233	GMCHST	TRUCK, 17500 - 20000 GVW	21	Miles	No Min		
236	All (2)	UTILITY VEHICLE	18	Hours	No Min		
1010	All (2)	ASPHALT PATCH MACHINE, TRAILER MTD	32	Years	No Min		
1012	All (2)	ASPHALT PATCHER, TRUCK MTD	18	Years	No Min		
1014	LOADRM	LOADER, SKID STEER	51	Hours	No Min		
1302	All (2)	DISTRIBUTOR, ASPHALT	42	Hours	No Min		
1404	SWEEPR	INTEGRAL SWEEPER	7	Hours	No Min		
1453	All (3)	PAINT MACHINE, PRELINE	7	Years	No Min		
1601	STBRNP	SYSTEM, SALT BRINE PRODUCTION	28	Years	No Min		
1602	STBRNT	TANK, SALT BRINE STORAGE	21	Years	No Min		
1603	STBRNS	STATION, SALT BRINE FILL	62	Years	No Min		
1604	STBRNA	SYSTEM, SALT BRINE APPLICATOR	176	Years	No Min		
1703	TRCATT	TRACTOR IMPLEMENT / ATTACHMENT	6	Years	No Min		
1802	All (2)	AERIAL DEVICE, TRUCK MTD	79	Years	No Min		
1803	GAER3A	AERIAL DEVICE, BRIDGE INSPECTION	3	Years	No Min		
1805	All (2)	AERIAL WORK PLATFORM	9	Years	No Min		
1815	All (2)	CRANE, 16-18 TON	54	Years	No Min		
1822	All (4)	CRANE, MECHANIC	266	Years	No Min		
2013	All (2)	LOADER ATTACHMENT	6	Years	No Min		
2101	GENRTR	GENERATOR/STANDBY POWER SYSTEM	89	Hours	No Min		
2205	MIXERM	MIXER, MASONRY/ASPHALT	4	Years	No Min		
2215	All (2)	HYDRAULIC IMPACTOR	4	Years	No Min		
2308	All (3)	A-BOOM MOWER ATTACHMENT	174	Years	No Min		
2502	ROLLRM	ROLLER, TANDEM, STATIC	15	Hours	No Min		
2703	CRANEM	CRANE, TRACK MOUNTED	6	Hours	No Min		
2850	SPRDRM	SPREADER, WIDENER	4	Hours	No Min		
2851	All (2)	SHOULDER MACHINE	24	Years	No Min		
2853	SPRDRM	SPREADER, AGGREGATE	28	Hours	No Min		
3151	GFUELT	FUEL AND LUBE TANK, TRUCK MTD	98	Years	No Min		
3203	TRALR4	TRAILER, MATERIAL TRANSPORT	29	Years	No Min		
3205	TRALR5	TRAILER, SPECIAL PURPOSE	9	Years	No Min		
3221	MODULR	MODULAR OFFICE, SINGLE	5	Years	No Min		
3230	All (8)	TRUCK MOUNT ATTENUATOR	150	Years	No Min		
3500	All (2)	PUMP, WATER	35	Years	No Min		
3980	SNWEQA	PLOW, SNOW 10'	1,159	Years	No Min		
4119	All (7)	WELDER/GENERATOR	115	Hours	No Min		
4122	All (4)	POST, PULLER, AUGER/TOOL KIT	97	Years	No Min		
4126	SPRTGM	SPREADER, TAILGATE MOUNT	75	Years	No Min		
4127	SPRIBA	SPREADER, 5CY IN BODY	751	Years	No Min		
4128	SNPLWA	PLOW, SNOW 10'	317	Years	No Min		
4136	FRKLFT	FORKLIFT	86	Hours	No Min		

Class	Functional Code	Description	Count	Units of Use	Economic Life	Age at Economic Life	Rate ($/unit)
4145	All (3)	TRAFFIC CONTROL DEVICES	290	Years	No Min		
4241	SWRROD	SEWER RODDER	15	Hours	No Min		
4254	All (2)	SKID STEER ATTACHMENTS	11	Years	No Min		
230R	All (4)	REAR MOUNT MOWER ATT	115	Years	No Min		
230S	All (2)	SIDE/MID MOWER ATT	83	Years	No Min		

Table 12: Summary of Forward Analysis Results for Classes without Estimated Economic Life – 100 to 80 Percent of Fleet

(Note: Based on 2011 data, 3% interest, 2% decline, 2.4% inflation)

Class	Functional Code	Description	100% Fleet / Limited Decline			90% Fleet / Limited Decline			80% Fleet / Limited Decline		
			Economic Life	Age at Economic Life	Rate	Economic Life	Age at Economic Life	Rate	Economic Life	Age at Economic Life	Rate
0202	GIMAPT	TRUCK, 7500 GVW	No Match			No Match			No Match		
0202	All (4)	TRUCK, 7500 GVW	20	368,200	$0.46	17	352,079	$0.46	17	386,852	$0.46
0206	GFUELT	TRUCK, 20000 - 33000 GVW	No Match			No Match			No Match		
0206	GASPC1	TRUCK, 20000 - 33000 GVW	No Match			No Match			No Match		
0227	TRUCK5	TRUCK, TRACTOR 70000 GVW	No Match			No Match			No Match		
0230	GCRAN1	TRUCK, 35000 - 50000 GVW	No Match			No Match			No Match		
0233	GMCHST	TRUCK, 17500 - 20000 GVW	No Match			No Match			No Match		
0236	All (2)	UTILITY VEHICLE	No Match			No Match			No Match		
1010	All (2)	ASPHALT PATCH MACHINE, TRAILER MTD	30		$2,231.87	30		$2,183.07	30		$2,127.61
1012	All (2)	ASPHALT PATCHER, TRUCK MTD	30		$3,111.02	30		$2,988.31	30		$2,855.11
1014	LOADRM	LOADER, SKID STEER	No Match			No Match			No Match		
1302	All (2)	DISTRIBUTOR, ASPHALT	No Match			No Match			No Match		
1404	SWEEPR	INTEGRAL SWEEPER	No Match			No Match			No Match		
1453	All (3)	PAINT MACHINE, PRELINE	30		$1,633.45	30		$1,605.50	30		$1,605.50
1601	STBRNP	SYSTEM, SALT BRINE PRODUCTION	30		$565.23	30		$548.86	30		$532.45
1602	STBRNT	TANK, SALT BRINE STORAGE	30		$119.91	30		$116.73	30		$113.49
1603	STBRNS	STATION, SALT BRINE FILL	30		$134.26	30		$132.28	30		$129.95
1604	STBRNA	SYSTEM, SALT BRINE APPLICATOR	30		$669.83	30		$655.73	30		$640.21
1703	TRCATT	TRACTOR IMPLEMENT / ATTACHMENT	30		$488.50	30		$472.27	30		$472.27
1802	All (2)	AERIAL DEVICE, TRUCK MTD	30		$3,142.35	29		$3,317.18	26		$3,532.47
1803	GAER3A	AERIAL DEVICE, BRIDGE INSPECTION	30		$6,293.98	30		$6,293.98	30		$6,171.05
1805	All (2)	AERIAL WORK PLATFORM	30		$5,031.54	30		$4,965.88	30		$4,886.56
1815	All (2)	CRANE, 16-18 TON	30		$4,561.09	30		$4,526.32	30		$4,475.71
1822	All (4)	CRANE, MECHANIC	30		$620.84	30		$606.56	30		$590.35
2013	All (2)	LOADER ATTACHMENT	30		$303.58	30		$295.51	30		$295.51
2101	GENRTR	GENERATOR/STANDBY POWER SYSTEM	No Match			No Match			No Match		
2205	MIXERM	MIXER, MASONRY/ASPHALT	30		$2,890.68	30		$2,890.68	30		$2,746.56
2215	All (2)	HYDRAULIC IMPACTOR	30		$1,274.30	30		$1,274.30	30		$1,227.78
2308	All (3)	A-BOOM MOWER ATTACHMENT	30		$3,598.13	30		$3,454.06	30		$3,279.34
2502	ROLLRM	ROLLER, TANDEM, STATIC	No Match			No Match			No Match		

Class	Functional Code	Description	100% Fleet / Limited Decline			90% Fleet / Limited Decline			80% Fleet / Limited Decline		
			Economic Life	Age at Economic Life	Rate	Economic Life	Age at Economic Life	Rate	Economic Life	Age at Economic Life	Rate
2703	CRANEM	CRANE, TRACK MOUNTED	No Match			No Match			No Match		
2850	SPRDRM	SPREADER, WIDENER	No Match			No Match			No Match		
2851	All (2)	SHOULDER MACHINE	30		$1,246.34	30		$1,233.44	30		$1,212.05
2853	SPRDRM	SPREADER, AGGREGATE	No Match			No Match			No Match		
3151	GFUELT	FUEL AND LUBE TANK, TRUCK MTD	30		$1,890.16	30		$1,880.79	30		$1,869.80
3203	TRALR4	TRAILER, MATERIAL TRANSPORT	30		$904.95	30		$879.84	30		$852.98
3205	TRALR5	TRAILER, SPECIAL PURPOSE	30		$1,150.37	30		$1,171.20	30		$1,199.14
3221	MODULR	MODULAR OFFICE, SINGLE	30		$1,294.84	30		$1,294.84	30		$1,249.67
3230	All (8)	TRUCK MOUNT ATTENUATOR	30		$978.32	30		$1,006.50	30		$1,044.73
3500	All (2)	PUMP, WATER	30		$631.65	30		$617.78	30		$597.91
3980	SNWEQA	PLOW, SNOW 10'	30		$240.37	30		$230.43	30		$219.35
4119	All (7)	WELDER/GENERATOR	No Match			No Match			No Match		
4122	All (4)	POST, PULLER, AUGER/TOOL KIT	30		$270.36	30		$266.66	30		$263.00
4126	SPRTGM	SPREADER, TAILGATE MOUNT	30		$214.27	30		$219.04	30		$226.18
4127	SPRIBA	SPREADER, 5CY IN BODY	30		$487.08	30		$497.44	30		$511.04
4128	SNPLWA	PLOW, SNOW 10'	30		$234.63	30		$227.46	30		$219.81
4136	FRKLFT	FORKLIFT	No Match			No Match			No Match		
4145	All (3)	TRAFFIC CONTROL DEVICES	30		$539.87	30		$545.47	30		$552.68
4241	SWRROD	SEWER RODDER	No Match			No Match			No Match		
4254	All (2)	SKID STEER ATTACHMENTS	30		$216.93	30		$222.22	30		$229.32
230R	All (4)	REAR MOUNT MOWER ATT	30		$479.88	30		$457.01	30		$429.97
230S	All (2)	SIDE/MID MOWER ATT	30		$1,323.18	30		$1,280.43	30		$1,224.76

Table 13: Summary of Forward Analysis Results for Classes without Estimated Economic Life – 70 to 50 Percent of Fleet

(Note: Based on 2011 data, 3% interest, 2% decline, 2.4% inflation)

Class	Functional Code	Description	70% Fleet / Limited Decline			60% Fleet / Limited Decline			50% Fleet / Limited Decline		
			Economic Life	Age at Economic Life	Rate	Economic Life	Age at Economic Life	Rate	Economic Life	Age at Economic Life	Rate
0202	GIMAPT	TRUCK, 7500 GVW	No Match			No Match			No Match		
0202	All (4)	TRUCK, 7500 GVW	13	338,455	$0.47	12	368,892	$0.47	10	367,030	$0.47
0206	GFUELT	TRUCK, 20000 - 33000 GVW	No Match			No Match			No Match		
0206	GASPC1	TRUCK, 20000 - 33000 GVW	No Match			No Match			No Match		
0227	TRUCK5	TRUCK, TRACTOR 70000 GVW	No Match			No Match			No Match		
0230	GCRAN1	TRUCK, 35000 - 50000 GVW	No Match			No Match			No Match		
0233	GMCHST	TRUCK, 17500 - 20000 GVW	No Match			No Match			No Match		
0236	All (2)	UTILITY VEHICLE	No Match			No Match			No Match		
1010	All (2)	ASPHALT PATCH MACHINE, TRAILER MTD	30		$2,041.03	30		$1,964.53	30		$1,876.04
1012	All (2)	ASPHALT PATCHER, TRUCK MTD	30		$2,784.49	30		$2,635.31	30		$2,476.31
1014	LOADRM	LOADER, SKID STEER	No Match			No Match			15	2,258	$69.03
1302	All (2)	DISTRIBUTOR, ASPHALT	No Match			No Match			No Match		
1404	SWEEPR	INTEGRAL SWEEPER	No Match			No Match			No Match		
1453	All (3)	PAINT MACHINE, PRELINE	30		$1,575.64	30		$1,544.15	30		$1,544.15
1601	STBRNP	SYSTEM, SALT BRINE PRODUCTION	30		$521.49	30		$505.06	30		$488.68
1602	STBRNT	TANK, SALT BRINE STORAGE	30		$110.21	30		$106.88	30		$103.53
1603	STBRNS	STATION, SALT BRINE FILL	30		$126.61	30		$123.04	30		$118.57
1604	STBRNA	SYSTEM, SALT BRINE APPLICATOR	30		$620.83	30		$599.01	30		$571.12
1703	TRCATT	TRACTOR IMPLEMENT / ATTACHMENT	30		$453.96	30		$453.96	30		$433.66
1802	All (2)	AERIAL DEVICE, TRUCK MTD	24		$3,797.93	21		$4,136.79	19		$4,526.32
1803	GAER3A	AERIAL DEVICE, BRIDGE INSPECTION	30		$6,171.05	30		$6,171.05	30		$6,171.05
1805	All (2)	AERIAL WORK PLATFORM	30		$4,789.00	30		$4,666.51	30		$4,666.51
1815	All (2)	CRANE, 16-18 TON	30		$4,423.63	30		$4,344.38	30		$4,258.30
1822	All (4)	CRANE, MECHANIC	30		$570.24	30		$546.76	30		$516.71
2013	All (2)	LOADER ATTACHMENT	30		$287.37	30		$287.37	30		$279.19
2101	GENRTR	GENERATOR/STANDBY POWER SYSTEM	No Match			No Match			No Match		
2205	MIXERM	MIXER, MASONRY/ASPHALT	30		$2,746.56	30		$2,598.12	30		$2,598.12
2215	All (2)	HYDRAULIC IMPACTOR	30		$1,227.78	30		$1,161.62	30		$1,161.62
2308	All (3)	A-BOOM MOWER ATTACHMENT	30		$3,089.10	30		$2,855.42	30		$2,598.43
2502	ROLLRM	ROLLER, TANDEM, STATIC	No Match			No Match			No Match		
2703	CRANEM	CRANE, TRACK MOUNTED	No Match			No Match			No Match		

Class	Functional Code	Description	70% Fleet / Limited Decline			60% Fleet / Limited Decline			50% Fleet / Limited Decline		
			Economic Life	Age at Economic Life	Rate	Economic Life	Age at Economic Life	Rate	Economic Life	Age at Economic Life	Rate
2850	SPRDRM	SPREADER, WIDENER	No Match			No Match			No Match		
2851	All (2)	SHOULDER MACHINE	30		$1,196.30	30		$1,170.26	30		$1,151.27
2853	SPRDRM	SPREADER, AGGREGATE	No Match			No Match			No Match		
3151	GFUELT	FUEL AND LUBE TANK, TRUCK MTD	30		$1,858.15	30		$1,842.72	30		$1,823.92
3203	TRALR4	TRAILER, MATERIAL TRANSPORT	30		$824.38	30		$794.13	30		$773.16
3205	TRALR5	TRAILER, SPECIAL PURPOSE	30		$1,238.53	30		$1,298.08	30		$1,298.08
3221	MODULR	MODULAR OFFICE, SINGLE	30		$1,249.67	30		$1,187.14	30		$1,187.14
3230	All (8)	TRUCK MOUNT ATTENUATOR	30		$1,099.32	28		$1,181.23	25		$1,291.73
3500	All (2)	PUMP, WATER	30		$581.95	30		$559.29	30		$541.34
3980	SNWEQA	PLOW, SNOW 10'	30		$206.98	30		$193.17	30		$177.94
4119	All (7)	WELDER/GENERATOR	No Match			No Match			No Match		
4122	All (4)	POST, PULLER, AUGER/TOOL KIT	30		$258.52	30		$253.59	30		$248.74
4126	SPRTGM	SPREADER, TAILGATE MOUNT	29		$234.55	25		$246.52	22		$259.92
4127	SPRIBA	SPREADER, 5CY IN BODY	30		$529.62	30		$556.47	27		$595.75
4128	SNPLWA	PLOW, SNOW 10'	30		$211.11	30		$201.55	30		$191.44
4136	FRKLFT	FORKLIFT	20	1,980	$34.66	18	1,926	$34.73	15	1,973	$34.86
4145	All (3)	TRAFFIC CONTROL DEVICES	30		$562.33	30		$575.87	30		$596.23
4241	SWRROD	SEWER RODDER	No Match			No Match			No Match		
4254	All (2)	SKID STEER ATTACHMENTS	30		$239.26	30		$254.08	28		$276.69
230R	All (4)	REAR MOUNT MOWER ATT	30		$403.18	30		$371.73	30		$340.97
230S	All (2)	SIDE/MID MOWER ATT	30		$1,167.00	30		$1,099.64	30		$1,020.59

6.3 Classes with Multiple Functional Codes

Several classes contain multiple functional codes. In some cases the actual use of the equipment varies significantly between functional codes and the economic life should be analyzed independently based on functional code. Tables 14, 15, and 16 show the results of the economic analysis for classes containing multiple functional codes and having sufficient numbers of equipment (> 20) to warrant stand alone analysis. For example, class code 0202 contains four functional codes; TRUCK1, GIMAPT, GMCHST, and PAINTM, but only TRUCK1 and GIMAPT have sufficient equipment count to be analyzed separately. Analyzed as an aggregate class, the economic life is not determined due to a low *Annual Operating Rate Factor*. However, when separated by functional code, TRUCK1 has an economic life of 18 years, but the economic life for GIMAPT was not determined due to a low *Annual Operating Rate Factor*. Referring to the modeling parameters shown in Table 14, it is quite evident that there is a significant operational, hence, economic difference between the TRUCK1 and GIMAPT. Thus from a modeling standpoint, these classes should be treated separately.

Table 14: Economic Life Model Input Parameters and Current Fleet Analysis Results for Classes with Multiple Functional Codes

(Note: Based on 2011 data, 3% interest, 2% decline, 2.4% inflation)

Class	Functional Code	Description	Units of Use	Count	Average Operating Rate ($/unit)	Average Unit Utilization	Average Age (Years)	Average Annual Usage	Annual Operating Rate Factor	Initial Usage	Annual Usage Decline	Current Fleet			Years Modeled
												Economic Life	Age at Economic Life	Rate ($/unit)	
0202	TRUCK1	TRUCK, 7500 GVW	Miles	268	$0.39	79%	6.5	14570	0.027	18,075	-538	18	238,128	$0.48	30
0202	GIMAPT	TRUCK, 7500 GVW	Miles	57	$0.50	98%	3.8	37155	-0.007	44,353	-1872	No Min			23
0202	All (4)	TRUCK, 7500 GVW	Miles	329	$0.41	82%	6.1	18408	0.01	28,145	-1609	No Min			17
0206	TRUCK2	TRUCK, 20000 - 33000 GVW	Miles	549	$1.32	45%	10	6916	0.038	10,914	-400	17	127,748	$1.30	27
0206	All (15)	TRUCK, 20000 - 33000 GVW	Miles	116	$1.45	40%	9.2	7755	0.046	11,899	-451	15	127,762	$1.43	26
0206	GFUELT	TRUCK, 20000 - 33000 GVW	Miles	95	$1.15	104%	7.5	5806	-0.002	7,171	-182	No Min			30
0206	GDIST1	TRUCK, 20000 - 33000 GVW	Miles	59	$1.67	39%	7.8	4897	0.043	6,339	-184	17	81,171	$2.09	30
0206	GASPC1	TRUCK, 20000 - 33000 GVW	Miles	27	$1.15	40%	7.8	8804	0.002	14,407	-722	No Min			19
0206	All (19)	TRUCK, 20000 - 33000 GVW	Miles	847	$1.34	51%	9.4	6819	0.031	9,991	-338	20	132,176	$1.37	29
0230	GCRAN2	TRUCK, 35000 - 50000 GVW	Miles	23	$4.38	21%	8	1788	0.126	2,445	-82	14	26,168	$5.07	29
0230	GCRAN1	TRUCK, 35000 - 50000 GVW	Miles	31	$1.95	26%	9	2510	-0.106	2,221	32	No Min			30
0230	All (5)	TRUCK, 35000 - 50000 GVW	Miles	72	$3.05	28%	8	3249	0.096	5,819	-320	13	48,617	$3.33	18
0233	TRUCK2	TRUCK, 17500 - 20000 GVW	Miles	59	$0.58	86%	3.5	17214	0.038	16,794	119	13	228,378	$0.76	30
0233	GTRFSV	TRUCK, 17500 - 20000 GVW	Miles	55	$0.65	85%	5.3	21478	0.028	33,875	-2360	11	229,838	$0.72	14
0233	GMCHST	TRUCK, 17500 - 20000 GVW	Miles	21	$0.68	105%	4.7	3801	-0.032	3,876	-16	No Min			30
0233	GAER1A	TRUCK, 17500 - 20000 GVW	Miles	42	$0.86	89%	5.6	18935	0.038	21,912	-532	11	208,858	$0.94	30
0233	All (7)	TRUCK, 17500 - 20000 GVW	Miles	183	$0.67	86%	4.8	16943	0.043	20,068	-646	11	181,685	$0.81	30

Table 15: Forward Analysis Results for Classes with Multiple Functional Codes – 100 to 80 Percent of Fleet

(Note: Based on 2011 data, 3% interest, 2% decline, 2.4% inflation)

Class	Functional Code	Description	100% Fleet / Limited Decline			90% Fleet / Limited Decline			80% Fleet / Limited Decline		
			Economic Life	Age at Economic Life	Rate	Economic Life	Age at Economic Life	Rate	Economic Life	Age at Economic Life	Rate
0202	TRUCK1	TRUCK, 7500 GVW	16	233,120	$0.48	14	226,814	$0.48	12	218,940	$0.48
0202	GIMAPT	TRUCK, 7500 GVW	No Match			No Match			No Match		
0202	All (4)	TRUCK, 7500 GVW	20	368,200	$0.46	17	352,079	$0.46	17	386,852	$0.46
0206	TRUCK2	TRUCK, 20000 - 33000 GVW	19	129,742	$1.29	17	129,107	$1.29	14	121,100	$1.30
0206	All (15)	TRUCK, 20000 - 33000 GVW	16	124,032	$1.42	14	121,114	$1.42	13	124,306	$1.42
0206	GFUELT	TRUCK, 20000 - 33000 GVW	No Match			No Match			No Match		
0206	GDIST1	TRUCK, 20000 - 33000 GVW	16	78,304	$2.08	14	76,300	$2.08	13	78,988	$2.09
0206	GASPC1	TRUCK, 20000 - 33000 GVW	No Match			No Match			No Match		
0206	All (19)	TRUCK, 20000 - 33000 GVW	19	128,041	$1.37	17	127,398	$1.37	15	126,315	$1.38
0230	GCRAN2	TRUCK, 35000 - 50000 GVW	14	24,990	$5.05	13	25,123	$5.05	11	24,844	$5.06
0230	GCRAN1	TRUCK, 35000 - 50000 GVW	No Match			No Match			No Match		
0230	All (5)	TRUCK, 35000 - 50000 GVW	15	49,343	$3.33	14	50,344	$3.32	12	48,372	$3.34
0233	TRUCK2	TRUCK, 17500 - 20000 GVW	13	226,408	$0.76	12	229,920	$0.76	10	216,100	$0.76
0233	GTRFSV	TRUCK, 17500 - 20000 GVW	11	233,646	$0.72	10	236,260	$0.72	9	238,986	$0.73
0233	GMCHST	TRUCK, 17500 - 20000 GVW	No Match			No Match			No Match		
0233	GAER1A	TRUCK, 17500 - 20000 GVW	11	205,959	$0.93	10	209,290	$0.92	9	208,211	$0.92
0233	All (7)	TRUCK, 17500 - 20000 GVW	11	184,278	$0.80	9	170,982	$0.80	8	169,888	$0.80

Table 16: Forward Analysis Results for Classes with Multiple Functional Codes – 70 to 50 Percent of Fleet

(Note: Based on 2011 data, 3% interest, 2% decline, 2.4% inflation)

Class	Functional Code	Description	70% Fleet / Limited Decline			60% Fleet / Limited Decline			50% Fleet / Limited Decline		
			Economic Life	Age at Economic Life	Rate	Economic Life	Age at Economic Life	Rate	Economic Life	Age at Economic Life	Rate
0202	TRUCK1	TRUCK, 7500 GVW	11	225,907	$0.48	9	215,924	$0.48	7	206,192	$0.49
0202	GIMAPT	TRUCK, 7500 GVW	No Match			No Match			No Match		
0202	All (4)	TRUCK, 7500 GVW	13	338,455	$0.47	12	368,892	$0.47	10	367,030	$0.47
0206	TRUCK2	TRUCK, 20000 - 33000 GVW	13	127,056	$1.30	11	125,565	$1.31	9	122,922	$1.31
0206	All (15)	TRUCK, 20000 - 33000 GVW	11	120,786	$1.43	9	116,928	$1.44	8	124,080	$1.45
0206	GFUELT	TRUCK, 20000 - 33000 GVW	No Match			No Match			No Match		
0206	GDIST1	TRUCK, 20000 - 33000 GVW	11	76,643	$2.10	9	73,508	$2.11	8	77,064	$2.13
0206	GASPC1	TRUCK, 20000 - 33000 GVW	No Match			No Match			No Match		
0206	All (19)	TRUCK, 20000 - 33000 GVW	13	125,210	$1.38	11	123,657	$1.39	9	121,275	$1.40
0230	GCRAN2	TRUCK, 35000 - 50000 GVW	10	25,710	$5.11	8	23,496	$5.09	6	20,562	$5.03
0230	GCRAN1	TRUCK, 35000 - 50000 GVW	No Match			No Match			No Match		
0230	All (5)	TRUCK, 35000 - 50000 GVW	11	50,886	$3.35	9	48,429	$3.35	7	45,003	$3.36
0233	TRUCK2	TRUCK, 17500 - 20000 GVW	9	220,496	$0.76	7	205,328	$0.77	6	203,130	$0.77
0233	GTRFSV	TRUCK, 17500 - 20000 GVW	7	214,340	$0.73	7	247,898	$0.73	6	253,128	$0.74
0233	GMCHST	TRUCK, 17500 - 20000 GVW	No Match			No Match			No Match		
0233	GAER1A	TRUCK, 17500 - 20000 GVW	7	189,935	$0.93	6	190,866	$0.94	No Match		
0233	All (7)	TRUCK, 17500 - 20000 GVW	7	167,773	$0.80	6	169,122	$0.82	No Match		

7 Conclusions and Recommendations

The project was successful in adapting, expanding, and enhancing the economic analysis model from the initial study to analyze the additional equipment classes in the NCDOT fleet. The improvements resulted in a more robust modeling approach which can be more efficiently executed and analyzed, and provide the ability to make data driven decisions in the management of the fleet and significantly reduce the analytical effort.

Key points in the project modeling effort include:

- Although utilization is an important metric of performance, it is limited in ability to reflect the actual wear and tear experienced by equipment in the various classes. Consequently, model options were provided which reflect both utilization and equipment usage (hours or miles per year) since this parameter more directly reflects operating costs (fuel, maintenance and repairs) and cost related trends. In the long term, it is likely utilization will become a less important measurement tool and more emphasis will be given to actual equipment usage.
- A second approach to economic life modeling, based on dividing the present value of the life-to-date cost by usage (cost/mile or cost/hour) was also integrated into the modeling capability, in addition to the equipment analysis model employing equivalent uniform annual cost. This rate model provides a second economic measure which presents an alternative perspective for the optimal life of some classes with high data variability in the NCDOT fleet.
- An additional technique was developed to determine optimal life for NCDOT classes which have no usage data (odometer or hour meter), such as various attachments. These classes are analyzed on an annual cost basis.
- For the range of diverse equipment, it was not possible to use market data to model depreciation across all these assets. To provide a consistent and time effective alternative, a method was developed to model decline in value based on the sum of the years' digits depreciation.
- The management analysis capabilities have been expanded and automated. The developed spreadsheet analysis and modeling application automates basic steps such as development of utilization and fleet age histograms and also automates calculations of economic life based on both the EUAC and rate models. Most importantly, it provides management with the capability to examine "what if" scenarios based on various levels of fleet reduction.

7.1 Conclusions

Over the course of this project, economic analyses were conducted on all equipment class codes based on data from the 2011 calendar year. Additionally, a subset of class codes was studied for multiple years to include the six classes studied in the original report. The following conclusions are based on analysis of the raw data and the results of the economic analyses.

- NCDOT maintains a large and substantial data base that allows for the development of the economic models for most classes of equipment. For some classes, the number of

pieces of equipment is too low to draw a statistically significant conclusion regarding the economic performance of that class.

- There is significant variability of the cost and usage data for some classes of equipment. The variability is from equipment to equipment, year to year, and across functional location for classes which contain multiple functional locations.
- The EUAC model and rate model provide consistent results for classes in which the variability in annual usage is low. For classes with high variability of the data, the preferred method of determining economic life is the rate model.
- The sum of the years' digits method is an appropriate depreciation methodology to be applied across all NCDOT class codes.
- An economic life was determined for a majority of the NCDOT equipment class codes. However, for equipment for which usage was not measured in hours or miles, and therefore was analyzed with usage based on a year, a majority of these classes did not have a determinable economic life.

7.2 Recommendations

Based on our analysis and experience with the NCDOT data, we make the following recommendations.

- Class codes with multiple functional locations should be separated by functional location and from an economic standpoint, analyzed by functional location.
- Given the variability of the usage and operating cost data within a class code from year to year, a cumulative cost model should be explored.
- The automated modeling capabilities developed by this project provide NCDOT a powerful tool to consider many economic aspects of equipment fleet management, including owning costs, operating costs, economic life, fleet age, usage, and utilization as well as "what if" studies to understand the ramifications of fleet size reduction. NCDOT should develop equipment management strategies that incorporate the economic data analysis along with operational requirements and constraints in order to more effectively manage their equipment fleet.

Appendix A Annotated Bibliography

In the initial stage of the study, a search of relevant literature was conducted to update any additional findings since the first report. This section provides the additional literature found and does not duplicate the original study. Although these are important references, this study was unique in that we could not find a parallel work complete by another state DOT.

A.1 Literature Search Summary

During the literature search, our task was to develop a list of potential reference sources to offer support for the research. The first step was to formulate a list of keywords that could be manipulated during the search to procure different results. The list is attached following this summary. These words were entered into several databases to identify relevant material. These databases include Compendex, Applied Science Full Text, Science Direct, JSTOR, and Geobase. Additional material was found by examining the references of an already accepted source. Once a potential source document was located, the citation and abstract was reviewed to determine the relevance of the material. If the material was deemed pertinent to the study, the full text was acquired and an annotated bibliography entry was written for each reference item.

A.2 Keyword List

The following keywords were employed in the data base searches:

Vehicle replacement, Transportation replacement, System life cycle cost, Cost responsibilities, Post-Manufacturing Product Cost (PMPC), Ownership costs, Operating costs, Motor Carriers, Equipment replacement, Optimization model, Transportation, Vehicle Utilization, Replacement, Strategic planning, Integer programming, Cost management, Repair limit, Fleet management, Depreciated life, Disposal points, Utilization rates, Operational and Maintenance Costs, NCDOT, Cost effective life, Equipment maintenance, Cost equipment lifecycle, Integrated operational cost, Depreciation, Replacement analysis, Economic life, Salvage values, Equipment Age, Operational hours, Sudden failure, Failure rates, Capital recovery, Vehicle fleet, Cost effectiveness, Vehicle maintenance, Construction/construction equipment, Engineering economics, and vehicle retirement

A.3 Abstract Summary

Bibona, Sal. Establishing a Cost Effective Fleet Replacement Program. Fleet Financials, Jan/ Feb 2003.

Provides a general overview of key issues to be considered for a fleet replacement management decision. Items are discussed in general terms to provide broad management guidance.

Chen, C., & Lin, J. (2006). Making an Informed Vehicle Scrappage Decision. *Transportation Reviews , 26* (6), 731-748.

A survival model is introduced in this study to quantify the impact of alternative fuel on the survival probability. This paper applies an objective and probabilistic method to a vehicle

dataset; A Weibull form survival model with time-varying covariate and unobserved heterogeneity was estimated on the dataset. It was found that a vehicle's age is negatively related to the vehicle's survival probability along with other variables. It was also found that the survival probabilities of alternative fuel vehicles are similar to those of reformulated unleaded gasoline vehicles.

Cho, S., & Rust, J. (2010, April). The Flat Rental Puzzle. *Review of Economic Studies, 77*(2), 560-594. Retrieved June 14, 2011, from Business Source Premier.

This article presents a model to predict the costs incurred by car rental companies that rapidly buy and sell relatively new automobiles. The rental car companies buy automobiles from manufacturers and do not keep those cars for very long. The goal was to mathematically validate the claim that holding onto an automobile (specifically a new automobile) for a longer period of time will increase revenue at rental car companies. A discontinuous function was created to represent vehicle market value using a steep decline early in life followed by a much shallower decline late in life.. There was also a large amount of variability in the data used for this project similar to the data provided by the NCDOT. This research is particularly valuable for the NCDOT fleet management project because it provides insight on how to approach the early years of an automobiles life and also provides alternative mathematical approaches to a similar problem.

Demirdache, A. R., Howell, A. B., & Fowler, T. R. (1967). Mathematical Models for Motor Vehicle Replacement Policies in the Federal Government. INFOR Journal: Information Systems and Operational Research , 1-19.

The focus of this project was to find the optimum mean life of motor vehicles, defined as the average service life which minimizes annual cost of ownership and operation. Pragmatic and analytical approaches to constructing a Vehicle Cost Model are introduced. The pragmatic approach can be used with minimum background experience data while the analytical model requires a large fund of background experience data. The analytical model considers costs classified under depreciation and operating expenses that are as a rate of time and mileage.

Dietz, D. C., & Katz, P. A. (2001). US West Implements a Cogent Analytical Model for Optimal Vehicle Replacement. Interfaces , 31 (5), 65-73.

US WEST is a major telecommunications company that has a diverse fleet. The model implemented in this research considers relevant age-dependent factors, including annual maintenance cost, opportunity cost of downtime, depreciation, and salvage value. The model assigns a replacement score to each candidate vehicle based on age, type, estimated replacement cost, and estimated maintenance cost in the next year of operation. it then rank-orders the vehicles by score and identifies them for replacement subject to a budget constraint on fleet capital expenditure. The model used was called VaRooM, which computes value of replacement as the positive difference between current and optimal cost.

Drickhamer, D. (2005, June). Frontiers of Fleet Management. *Material Handling Management, 60*(6), 21-22. Retrieved June 17, 2011, from Applied Science and Technology.

The article explains the importance of fleet management particularly how it pertains to forklifts. It also mentions the use of technology to track forklift users to make sure that they are certified to operate the forklift. The article supports the utilization of fleet management

systems to lower costs and improve profitability specifically by reducing the overall number of pieces of equipment.

Fan, David, Randy B. Machemehl, and Katherine Kortum. Equipment Replacement Optimization, *Transportation Research Record: Journal of the Transportation Research Board, No. 2220,* Transportation Research Board of the National Academies, Washington, D.C., 2011, pp. 88–98.

This paper provides a comprehensive literature review of the state of the art and state of the practice of equipment replacement optimization (ERO). A comprehensive dynamic programming (DP)–based optimization solution methodology is then proposed and implemented for ERO. The developed ERO software consists of three main components: a SAS macro-based data cleaner and analyzer, which undertakes the tasks of raw data reading, cleaning, and analyzing, as well as cost estimation and forecasting; a DP-based optimization engine that minimizes the total cost over a defined horizon; and a Java-based graphical user interface (GUI) that takes parameters selected by users and inputs from users, and coordinates the optimization engine and SAS macro-based data cleaner and analyzer. The first component (i.e., the SAS macro-based data cleaner and analyzer) is presented in detail. Preliminary numerical results of the SAS data analysis, estimation, and forecasting of several costs are also discussed. In a later report of research, the DP-based optimization engine and ERO software development (including the Java GUI) will be presented in detail, and comprehensive ERO numerical results will be given.

Feng, Wei, Miguel Figliozzi. Bus Fleet Type and Age Replacement Optimization: A Case Study Utilizing King County Metro Fleet Data. Oregon Transportation Research and Education Consortium (OTREC).

Bus fleet data have consistently shown that vehicle operating and maintenance costs increase as vehicles age. A fleet manager has to deal with the tradeoff between the lower operating and maintenance costs of newer fleets and their higher initial capital costs as well as the tradeoff between conventional and fuel efficient bus technologies. This study formulates and implements a fleet replacement optimization framework that is applied to a case study that compares two bus types: a conventional diesel and a hybrid bus. Employing real-world bus fleet data from King County Metro (Washington State, USA) multiple scenarios are examined to account for uncertainty and variability in the model parameters. In addition sensitivity analyses are performed to study the impacts of parameter values on optimal replacement policies and the per-mile costs. Key findings include: the Federal Transit Administration (FTA) purchase cost subsidy has the highest impact on the optimal replacement policies; without FTA subsidy it is always cost effective to adopt diesel buses and replace them every 20 years. With an 80% purchase cost FTA subsidy, hybrid buses are the best choice; the optimal hybrid bus replacement cycle decreases from 18 to 14 years with increasing annual utilizations and operating and maintenance costs or decreasing hybrid purchase price and fuel economy. Fuel price, emissions costs, and initial bus age have little impact on optimal replacement policies. However, discount rate and diesel bus price, annual utilization (in 0% FTA subsidy scenario) and fuel price (in 80% FTA subsidy scenario) have the highest impacts on per-mile costs

Figliozzi Miguel A., Jesse A. Boudart, Wei Feng. Economic and Environmental Optimization of Vehicle Fleets: A Case Study of the Impacts of Policy, Market, Utilization, and Technological Factors, Paper Presented at the 90th Annual Meeting of the Transportation Research Board, January 23–27, 2011

This paper focuses on the economic and environmental optimization of vehicle replacement decisions from a fleet manager's perspective. An integer programming vehicle replacement model (VRM) is utilized to evaluate current environmental and policy issues such as greenhouse gas (GHG) taxes and fiscal incentives for electric vehicle purchases. In addition, this research analyzes the impacts of utilization (mileage per year per vehicle) and gasoline prices on vehicle purchasing decisions. Energy and emissions reductions for a variety of scenarios using real-world data in the United States are presented as well as breakeven points where electric vehicles are competitive. Findings include: (a) fuel efficient vehicles such as hybrid and electric vehicles are purchased only in scenarios with high gasoline prices and/or utilization, (b) current European CO2 cap and trade emissions price (around $18.7/ton) do not significantly alter fleet management decisions, and (c) electric vehicle incentives (i.e., tax credits) do increase the rate of purchases of hybrid or electric vehicles in scenarios with high gasoline prices and vehicle utilization. This research indicates that the proposed model can be effectively used to inform environmental and fiscal policies regarding vehicle regulations, tax incentives, and GHG emissions.

Goghrod, H., Martel, J., & Aouni, B. (2003, February). Vehicle park management through the goal programming model. INFOR, 41(1), 93-104. Retrieved August 6, 2011, from ABI/INFORMS Complete.

This group of analysts were attempting to decrease the fleet size by 20% while maintaining an optimal performance on other levels. The fleet consisted of approximately 8,000 vehicles (broken down into 26 categories) that were used to manage roads. They used Goal Programming (an extension of linear programming) to maximize the satisfaction of the decision maker (fleet manager). To perform this optimization, the team took three constraints into account: the budgetary constraints, the 20% reduction constraints, and the customers' needs constraint. This model could be particularly useful when it comes to the utilization analysis and recommendations on where and by how much to cut the fleet sizes. The programming can be used as a tool for fleet managers to manage fleet size within a given budget while maintaining a desired level of customer satisfaction.

Harbuck, R. H. (2009). Life Cycle Cost Analysis for Transportation Projects. AACE International Transactions , RISK (05), 1-13.

Transportation agencies rank among the top institutions in public spending and the impacts of their investment decisions affect almost every member of society. This research describes life-cycle cost analysis as a tool in decision-making and management of our transportation system; it is an economic assessment technique that is used to evaluate competing infrastructure alternatives based on estimated total cost of ownership. Life cycle cost analysis is a process that is performed by summing up the monetary equivalency of all benefits and costs tat their respective time of occurrence throughout the analysis period. This is a tool to

assess estimated uniform annual costs, net present value, benefit-cost ratio, and internal rate of return.

Ireland, B. (2009, October). Keeping Track: the Benefits of Implementing Mobile Resource Management (MRM). *Electrical Construction & Maintenance*, *108*(10). Retrieved June 28, 2011, from Applied Science and Technology.

This article highlights the benefits of mobile resource management for fleet managers. This technology, which consists mainly of GPS units, allows managers to track vehicles and equipment. The data collected from these devices can be used to determine what equipment is underutilized, where the equipment is on its route, which drivers speed, brake excessively, and leave the automobile idling for long periods of time. All of this information can then be used to decrease operating costs and increase profitability.

Kim, H. C., Keoleian, G. A., Grande, D. E., & Bean, J. C. (2003). Life Cycle Optimization of Automobile Replacement: Model and Application. Environmental Science and Technology , 37 (23), 5407-5413.

This paper examines a life cycle optimization model to analyze the use of inefficient, higher-polluting old cars and to determine the optimal vehicle lifetimes, accounting for technology improvements of new models while considering deteriorating efficiencies of existing models. This model was applied to mid-sized passenger car models between 1985-2020. The input data to the life cycle optimization model consist of a collection of single-year environmental profiles for five life cycle phases: materials production, manufacturing, use, maintenance, and end-of-life. The research found the optimal time to keep a vehicle according to its environmental impact and costs.

Klopchic, Peter (2003)

Downloaded from http://www.fleet-central.com/fleet_costs.pdf

This paper focuses on analysis of a motor vehicle fleet and replacement policy. Depreciation and maintenance are two direct costs that should be considered when deciding when to replace a vehicle. Indirect costs such as perk value, corporate image, and downtime should also be considered. One of the debated issues among fleet managers and leasing companies is when to sell a unit to maximize returns and minimize lifecycle costs. To perform a thoughtful analysis of this issue, it is important to consider all direct (hard) costs, including depreciation and maintenance, as well as indirect (soft) costs, including perk value, corporate image, downtime, and feature upgrades.

Lin, J., Chen, C., & Niemeier, D. A. (2008). An analysis on long term emission benefits of a government vehicle fleet replacement plan in northern Illinois . Transportation , 35, 219-235.

This study focused on the efficacy of a fleet replacement program for a local government agency in Northern Illinois, the Forest Preserve of DuPage County. A probabilistic vehicle survival model was used that accounts for time-varying covariates such as vehicle age and gasoline price. Older vehicles constitute a small portion of the entire vehicle fleet, and yet, contribute to a disproportionate amount of motor vehicle emissions. This paper evaluates the long-term emission benefits of a fleet replacement program implemented by a local government agency. With a probabilistic model specified to capture the agency's fleet

replacement pattern, the forecasted survival probabilities are used to calculate the vehicle lifetime operating emissions. The study finding provide insight in developing proactive, long-term strategic plans to optimally reduce vehicle operating emissions, which account for over 80% of the vehicle lifecycle energy consumption emissions.

Mitchell, Z., J. Hildreth, and M. Vorster. "Using the Cumulative Cost Model to Forecast Equipment." *Journal of Construction Engineering and Management.* 2011, 137, pp. 817-822

Professionals in the construction industry must be able to accurately forecast costs. Doing so not only helps assure reasonable profits for companies, but it can also help ensure that projects are delivered within budget for clients. Forecasting of equipment repair costs is one element of the larger problem of predicting overall costs. The cumulative cost model can provide construction engineers with a valuable tool for better understanding the nature of repair costs as they relate to production fleets. Data that are being collected (or that could be collected) can assist in the determination of the rate of accumulation of repair costs for a machine for a given period of use or the estimation of fleet repair budgets for a job or period. There are two different methodologies for constructing the repair cost portion of the cumulative cost model: life-to-date (LTD) repair costs and the period-cost-based (PCB) model. This paper will provide the steps and background for each of these two methodologies and compare them using a practical example.

Smith, V. L. (1958). Economic Equipment Policies: An Evaluation. Management Science , 4 (1), 20-37.

This paper summarizes the results of a detailed empirical investigation of the theory of economic equipment policy as applied to one important kind of industrial equipment (line-haul truck-tractor power units). The objective of this research was to ascertain the quantitative importance to the firm of the following optimal policies in replacement and in the choice of equipment type. The research attempts to carefully estimate the obsolescence and deterioration components of truck-tractor revenues and costs on the assumption of continuity in the development of these components. The results indicate an approximate general forecast of the optimal economic life of the equipment.

Simao, H., Day, J., George, A., Gifford, T., Nienow, J., & Powell, W. B. (2009, May). An Approximate Dynamic Programming Algorithm for Large-Scale Fleet Management: A Case Application. *Transportation Science, 43*(2), 178-197. Retrieved June 17, 2011, from Academic Search Premiere.

The goal of this research project was to minimize the amount of "empty" miles driven by truckload drivers while maximizing the movement of the most profitable loads. This study took into account many different parameters including location, domicile, capacity type, scheduled time at home, days away from home, available time, geographical constraints, DOT duty hours, and eight-day duty hours. The study focused very closely on variables related to the truckload drivers. The article shows the simulation that was created using an extremely complex algorithm that took all of these variables into account.

Spitzley, D. V., Grande, D. E., & Kim, H. C. (2005). Life cycle optimization of ownership costs and emissions reduction in US vehicle retirement decisions. Transportation Research Part D , 10, 161-175.

This research considers the optimal intervals for vehicle replacement over a 36-year period that minimize life cycle economic and emissions burdens. Comparisons are made between the optimal product replacement intervals based on explicit private costs, estimated pollution damage costs, carbon dioxide emissions, energy use, and criteria air pollutant emissions. This study provides a framework for understanding overall vehicle economics and key economic variables in relation to individual ownership cots, operating decisions and replacement intervals. The study compiled a dynamic life cycle economic and environmental inventory for a generic North American sedan. The input data to the final life cycle optimization (LCO) model consist of a collection of environmental and economic profiles for five life cycle phases: materials production, manufacturing, use, maintenance, and end-of-life; these provide the economic and environmental performance of the vehicle at any point in time as a function of the model year and age. The research found that the optimal economic life of vehicles extends well beyond 10 years of use.

Sussams, J. E. (1984, March). Vehicle Replacement [Electronic version]. *Management Services*, *28*(3), 8-14.

The methodology used to conduct the research described in this article is similar to that used in the NCDOT vehicle disposal optimization project. Many of the same parameters, including depreciation costs and maintenance costs, were used to find the optimal disposal year for vehicles within a certain fleet. However, inflation is not taken into account. The article offers different approaches to calculating depreciation – the sum of years digits method, 10% of original price method, and the reducing balance method. All of these depreciation methods result in a salvage value of 10% of the original price. The article also highlights that theoretical solutions are best only in the absence of practical objections. Management should use theoretical solutions and their knowledge of practical objections to implement a pragmatic solution. In regards to the disposal point, the article suggests that a repair limit be made so that the money spent on repairs never exceeds the vehicle's worth and states that major vehicle repairs late in the vehicle's life need to be given critical consideration. Also, the article points out that driver error can attribute to maintenance costs, whether they be positive or negative. Similar to the project for the NCDOT, this researcher suggests that it might be beneficial to subcontract all of part of transportation requirements to a third party. The article also introduces the mileage life approach where a vehicle life is measured by miles instead of years. In this approach, depreciation per mile and cost per mile are compared which eliminates the need to factor in inflation.

Weissman, Jose, Weissman, Angela J. Development of an Automated Fleet-Level Equipment Replacement Methodology. Texas Department of Transportation, 2003.

The primary function of equipment management is to provide the proper equipment at the right time and at the lowest possible 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. Economic equipment replacement is a complex portion of the this process and the main thrust of this research report is to develop an automated computer software to assist in the replacement decisions and prioritize units for replacement.

Weissman, Angela J Weissman, Jose,. Analysis of cost data and Development of Equipment Replacement Framework. Texas Department of Transportation, 2002.

Report describes a replacement methodology developed to assist the equipment replacement process at TxDot which includes life cycle cost history as one of the criteria. This method uses the Equipment Operating System database of TxDot. It produces a prioritized list of replacement units based on ranking the condition with respect to the condition of all other units in the class.

Yeh, L. (1995). An Optimal Inspection-Repair-Replacement Policy for Standby Systems. Journal of Applied Probability , 32 (1), 212-223.

In this paper, an optimal maintenance model for standby systems is studied. An inspection-repair-replacement policy is employed. The problem is to determine an optimal policy so that the availability of the system is high enough at any time and the long-run expected cost per unit time is minimized. An explicit expression for the long-run expected cost per unit time is derived. For a geometric model, a simple algorithm for the determination of an optimal solution is suggested. An optimal maintenance model was studied for a spare or standby system, which the availability of the system is seriously taken into account. The paper describes the assumptions taken to use the model and how it is utilized. The model tells times to inspect a system with a repair and when to replace a system as a function of time.

Appendix B Procedure Manual for Assembling Data

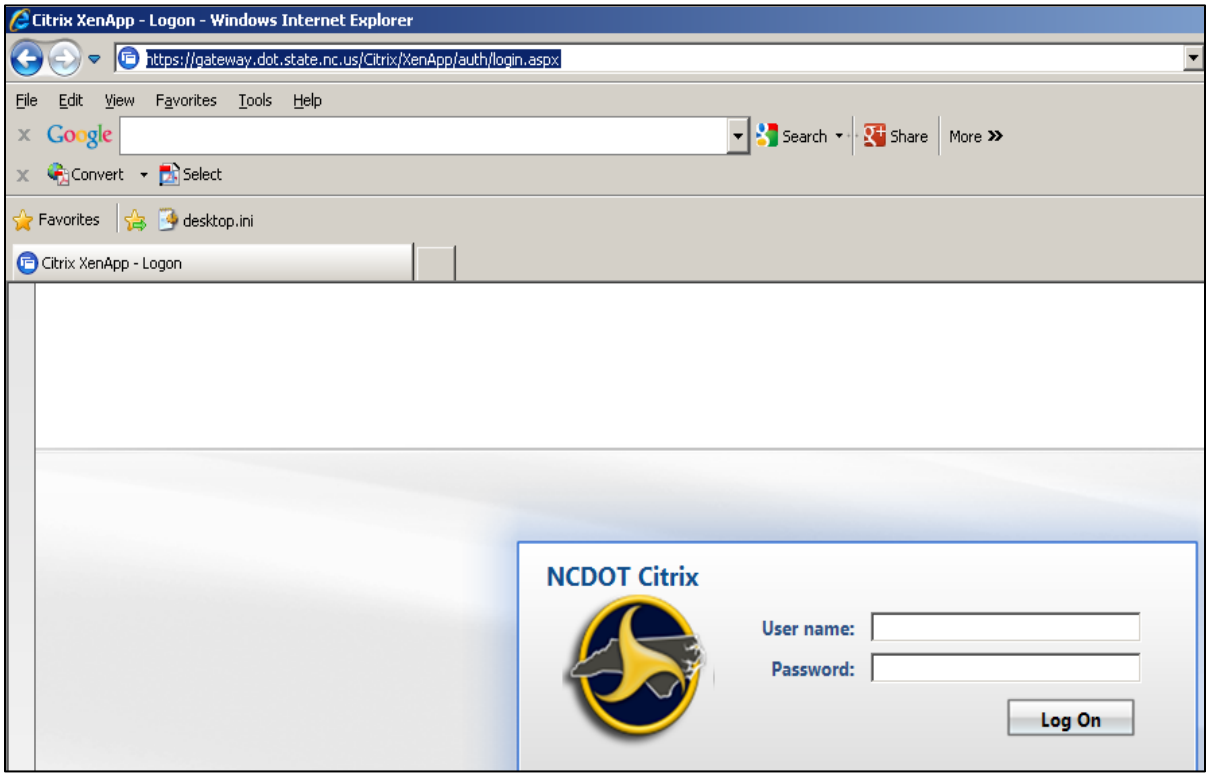
Procedure Manual for Assembling NCDOT Fleet Performance Data for Economic Analysis

This research was funded by the North Carolina Department of Transportation

B.1 Section 1: Logging In and Downloading Application

Note: NCDOT employees should skip to step 6 on page 4.

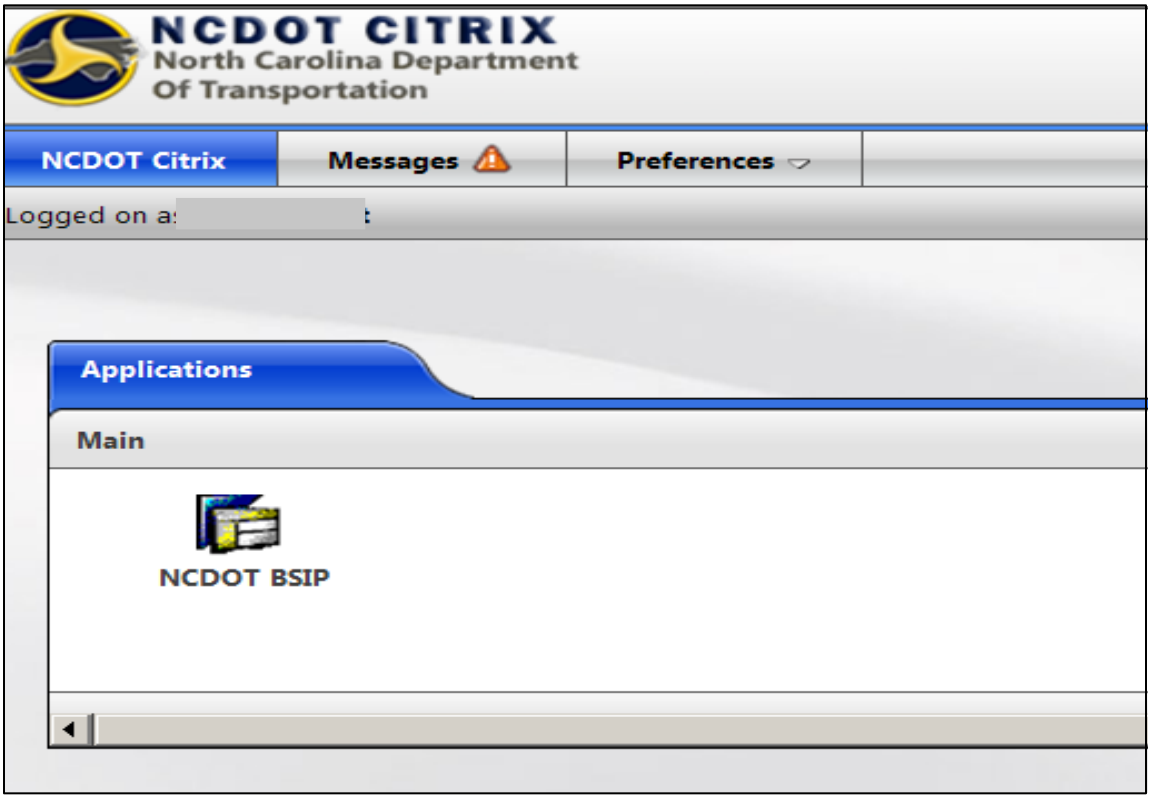
Step# 1. Open a web browser and enter the Citrix Secure Database address into the address box.



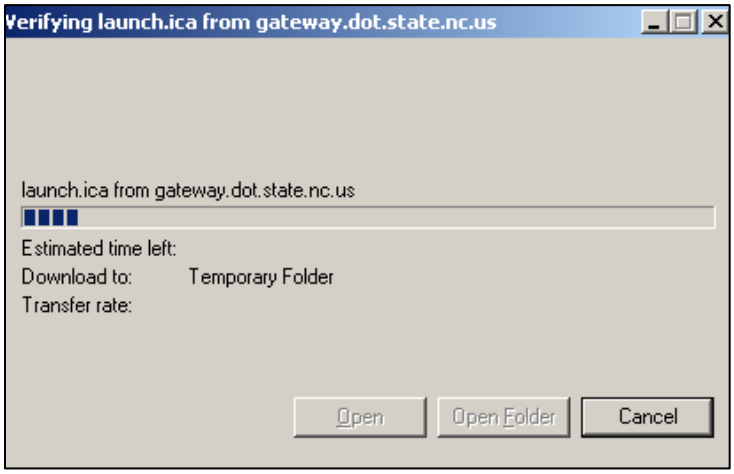
https://gateway.dot.state.nc.us/Citrix/XenApp/auth/login.aspx

Step# 2. Once the page has loaded, log into NCDOT Citrix using provided username and password.

Step# 3. Click on the app named **NCDOT BSIP.**

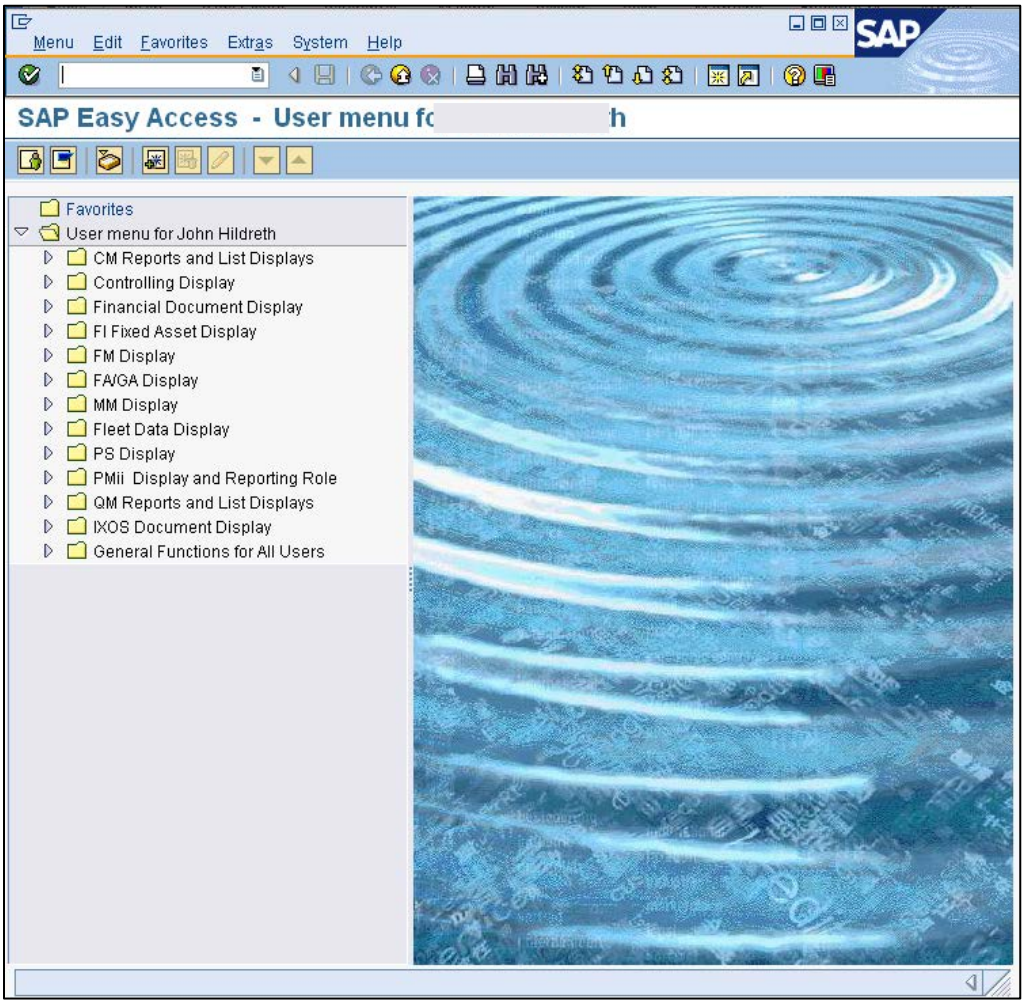


Step# 4. If the application has not been downloaded, this will initiate the download window.



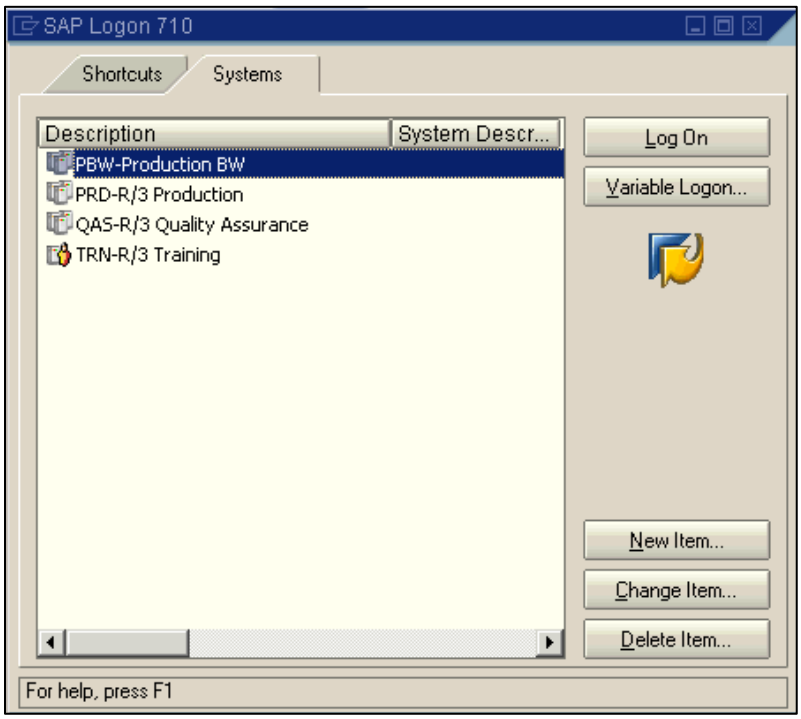
Step# 5. The user will then be asked to sign into the SAP system using a given username and password.

Step# 6. Once the correct username and password has been entered two new windows will become available. One window is **SAP Easy Access User menu** (shown below). This menu houses some of the necessary data folders as can be seen listed on the left.



Step# 7. Ensure a second window appears entitled "**SAP Logon 710**". This menu will be required later in the process.

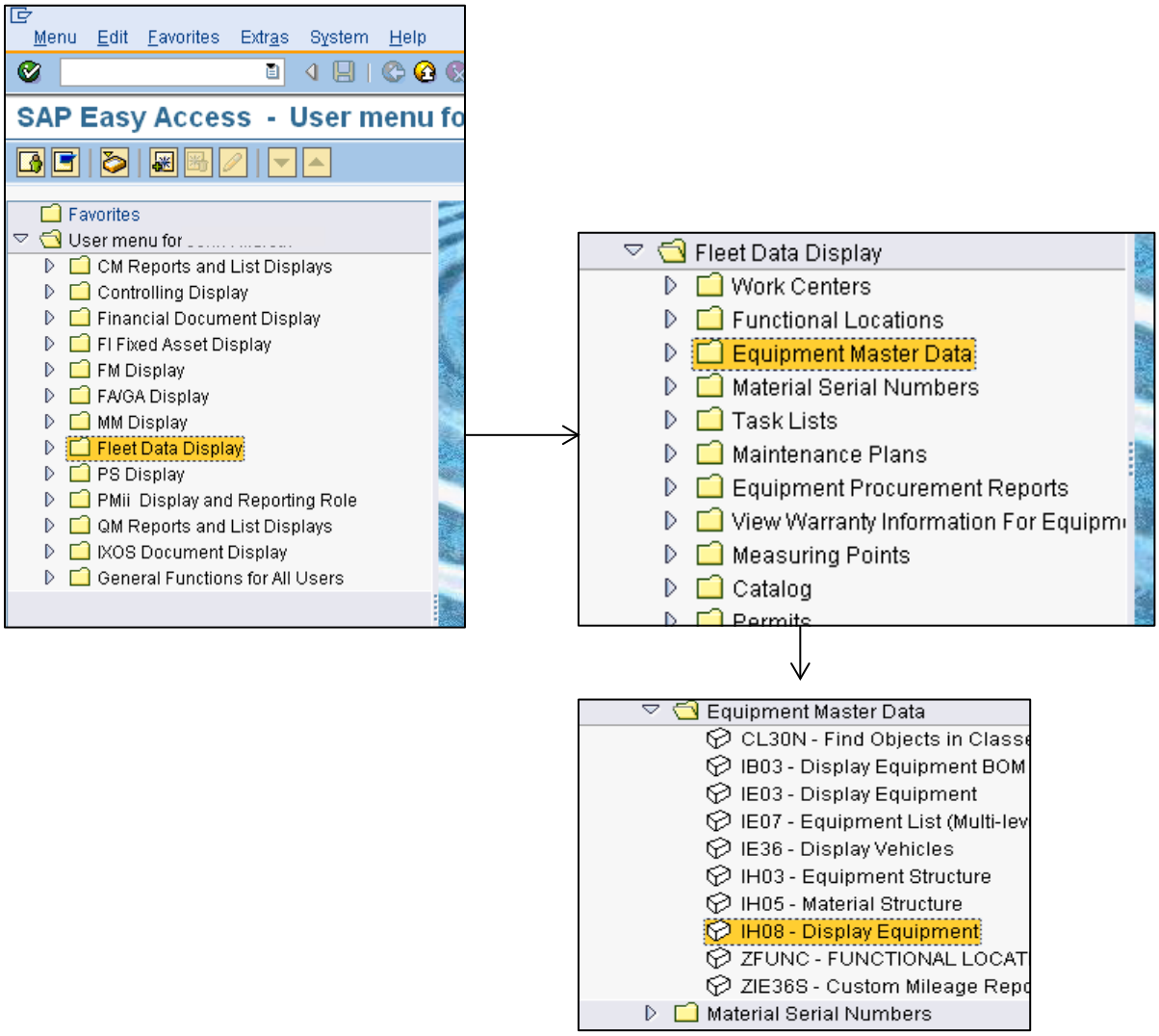
Note: This second window will not appear for NCDOT employees, rather employees should log into Production BW.



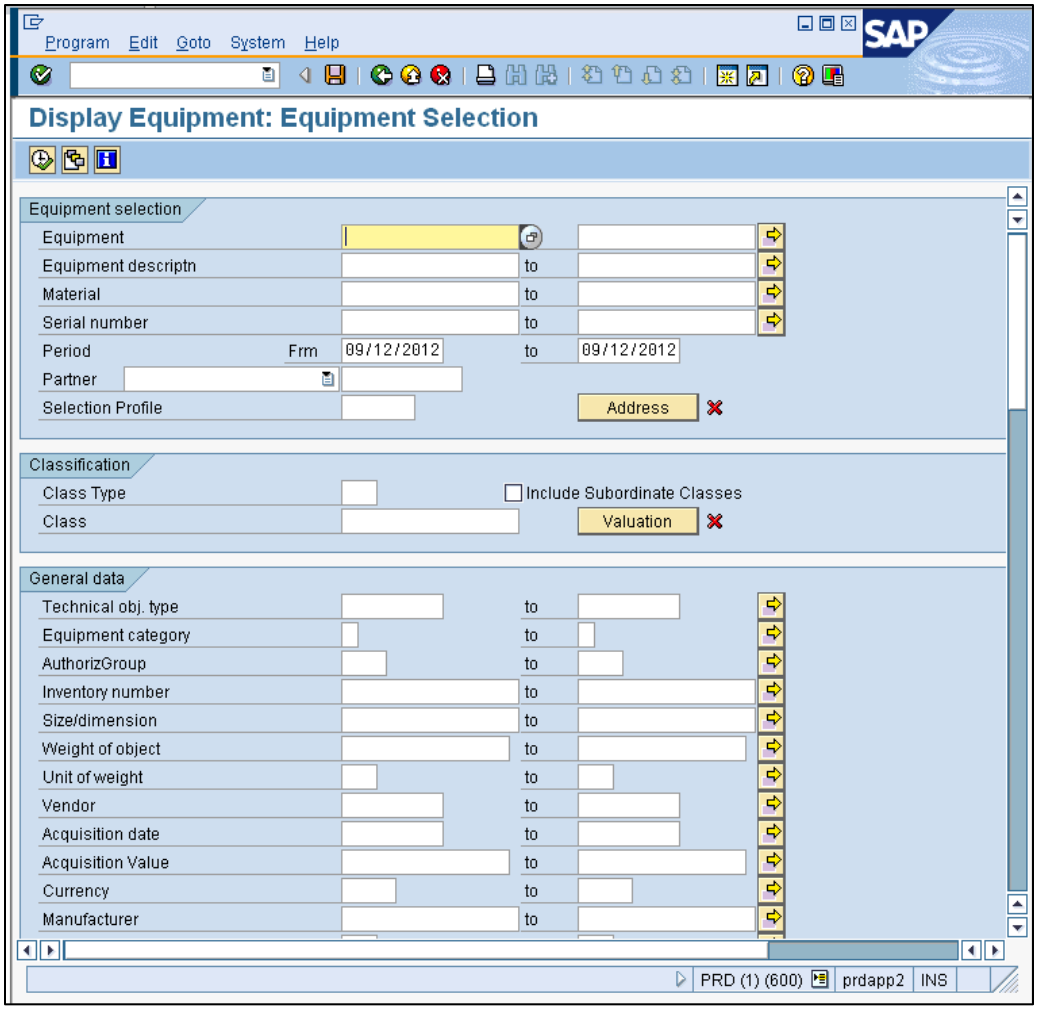
B.2 Section 2: Creating Equipment Identification Sheet

Step# 1. From the **SAP Easy Access User menu** find **Fleet Data Display**

Step# 2. Click on the expanding arrow and find **Equipment Master Data.**



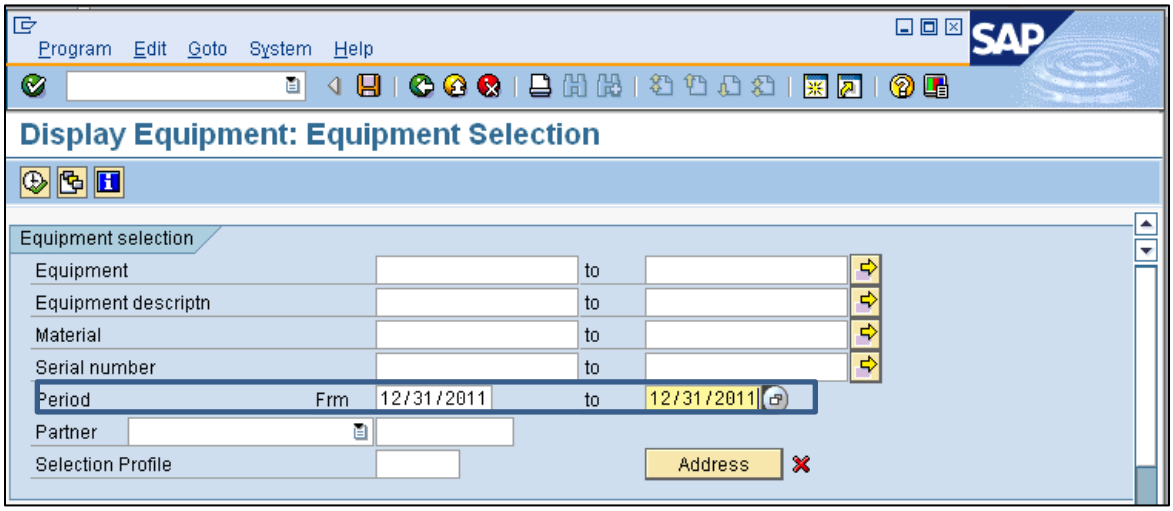
Step# 3. Click on "**IH08 Display Equipment**." This action will bring up the next screen entitled **"Display Equipment: Equipment Selection."** This window is where the data fields will be accessed and used.



Within the page entitled **"Display Equipment: Equipment Selection"**, several blank areas must be filled in with the correct information in order to produce the desired data output.

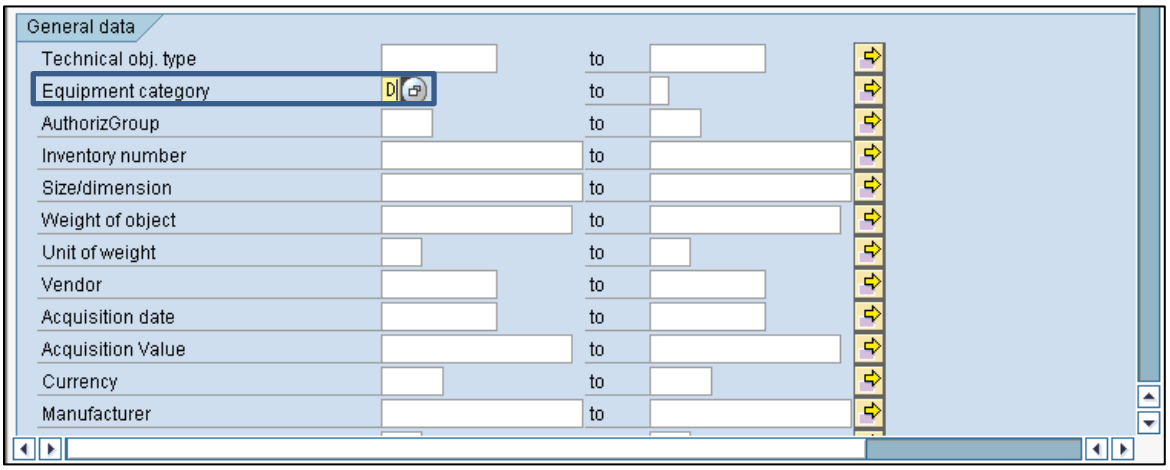
The following are pre-determined fields with the data entries listed below, along with a completed entry of each type.

Step# 4. **Period:** 12/31/yyyy (Ex. If the data being analyzed was in 2011, then “12/31/2011” to “12/31/2011” should be the entries).



Step# 5. Under the *General data* section of this form, fill in the following field:

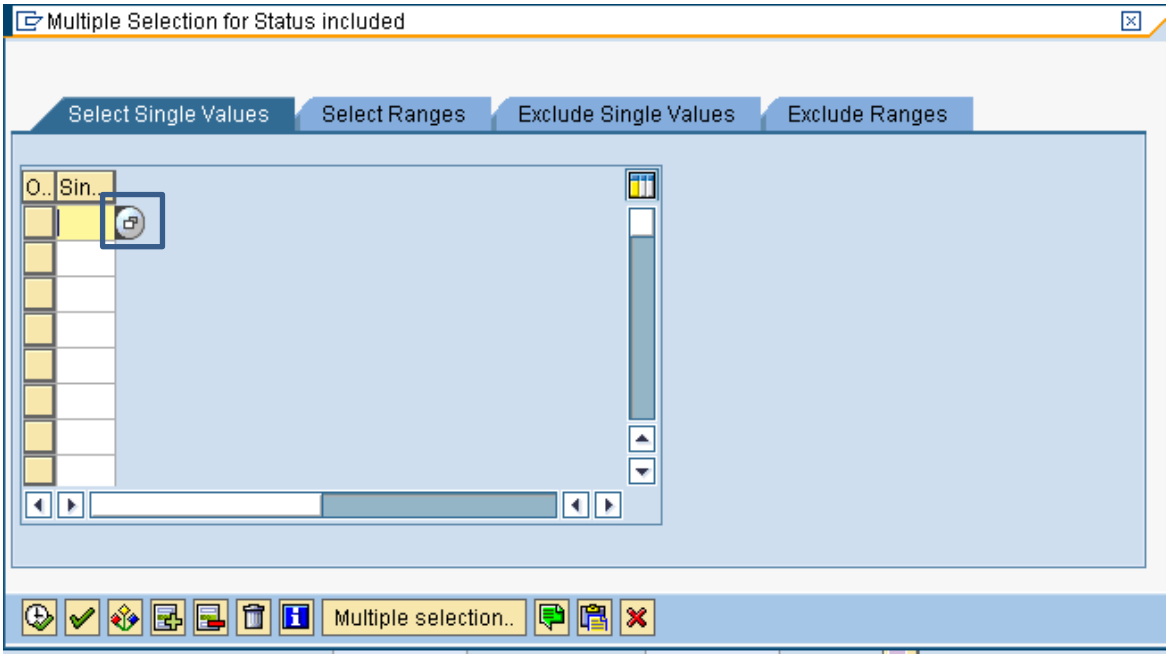
- **Equipment Category:** D



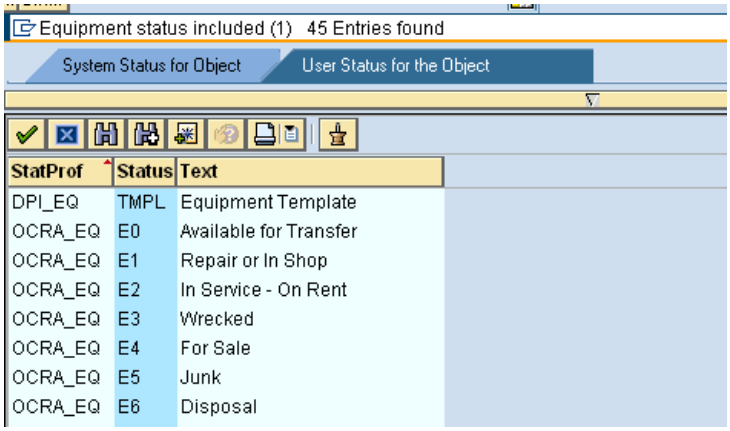
Step# 6. Further down the *General data* section, locate the **Status Included** field. Click on the right pointing yellow arrow at the far right side of this field, shown in the figure below:

Step# 7. Clicking this arrow will open another form for Multiple Selection for Status Included.

Step# 8. By clicking the edit icon next to the Status Included list, a list of available statuses will be displayed



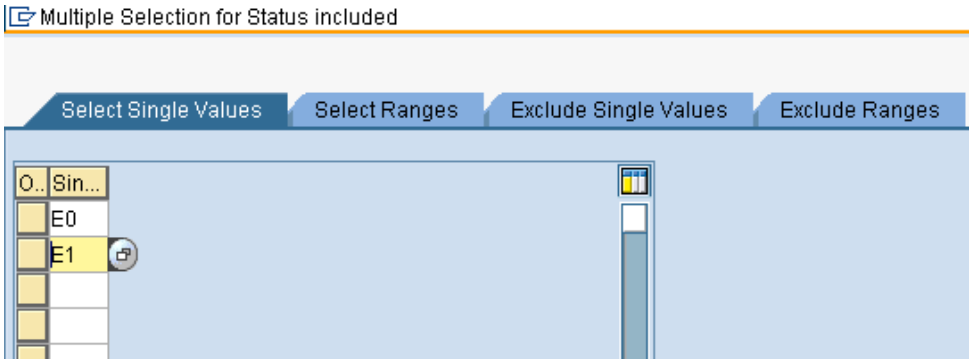
Step# 9. Displayed below is the list of included statuses.



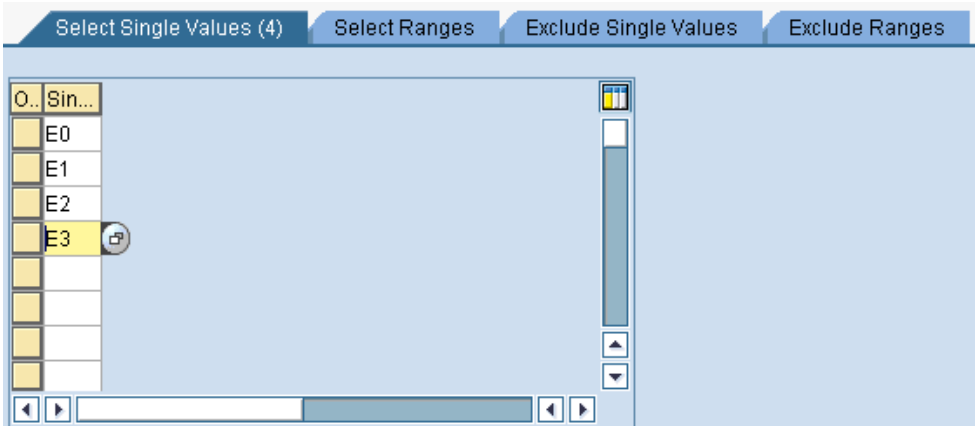
Each status should be selected in order to populate the Status Included List.

Each status must be selected and added to an individual cell in the Status Included List.

Step# 10. Start by selecting Status E0 (OCRA _EQ) for “Available to Transfer”

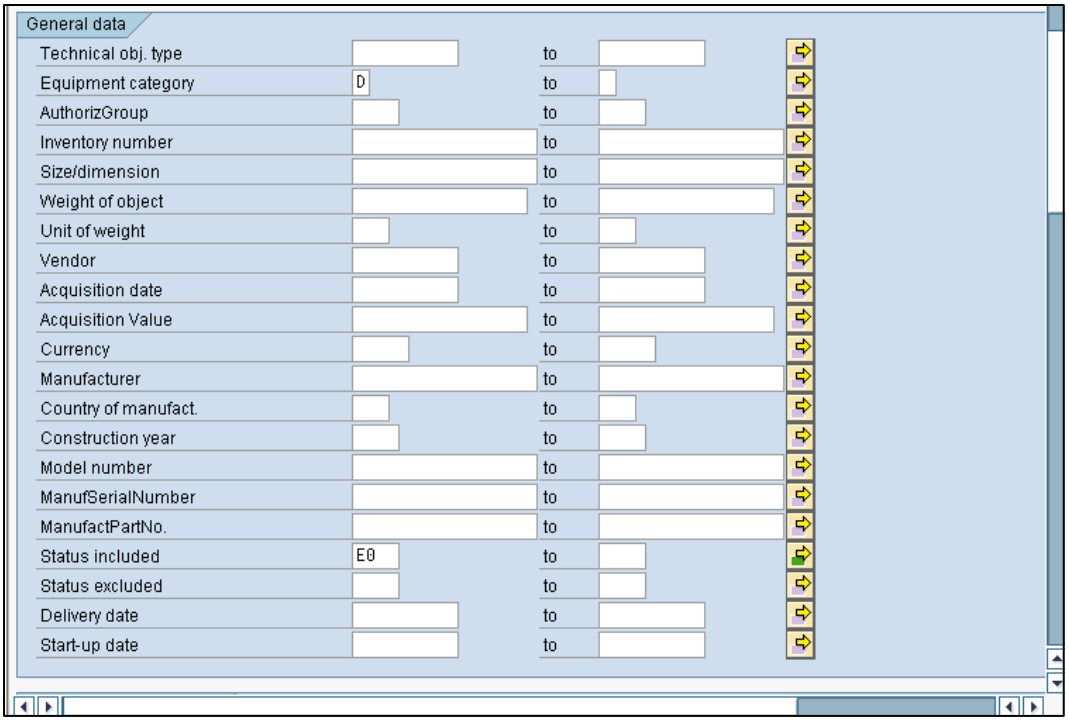


Step# 11. Continue the Process until statuses (OCRA _EQ) E0, E1, E2, and E3 are in the list.



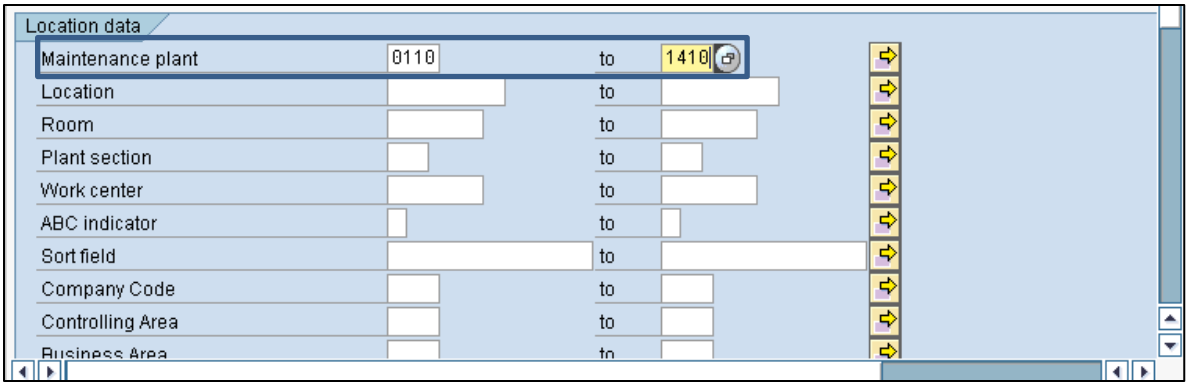
Step# 12. Press **F8** when finished entering the values, which will copy it back onto the **Display Equipment** page. There is also a copy button that you can press. This button looks like this. Both actions will produce the same result.

Step# 13. The ending result should be the following:

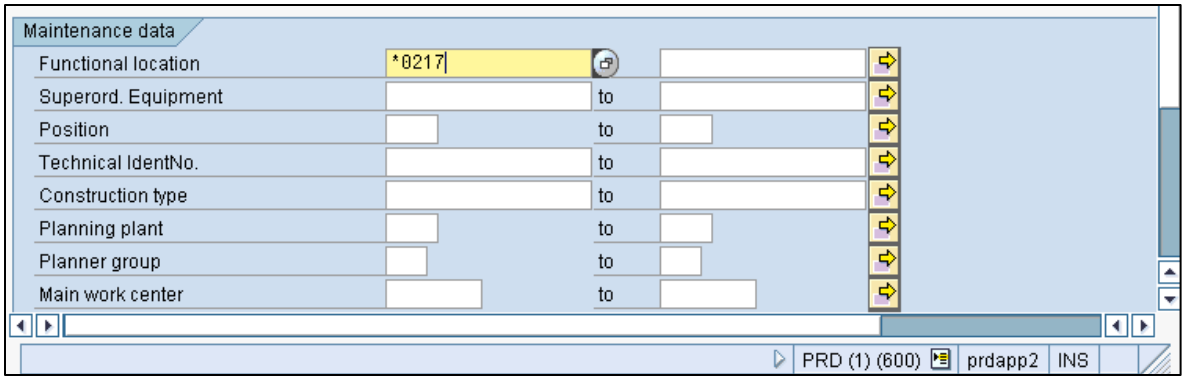


Step# 14. Under the *Location data* section of this form input the following:

- Maintenance Plant: 0110 to 1410



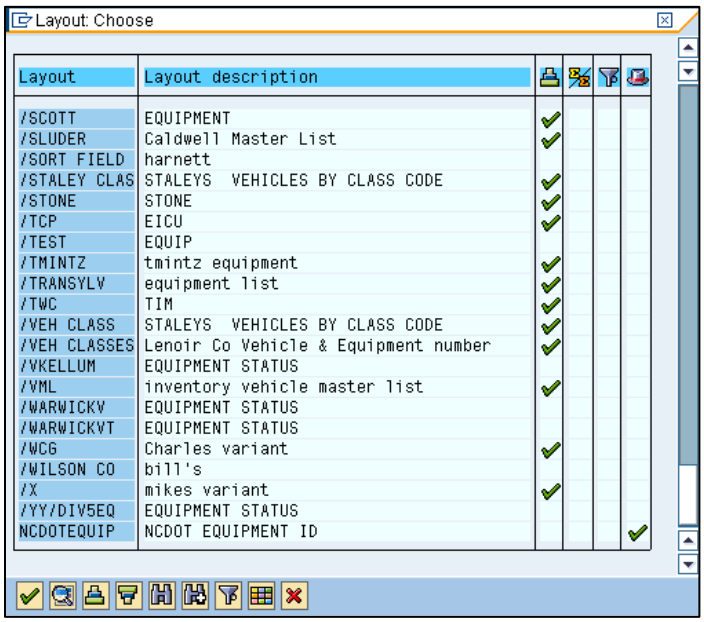
Step# 15. Under the *Maintenance data* section of the form input the following data: **Functional Location**: the four digit class code proceeded by an asterisk. (Ex: *0217)



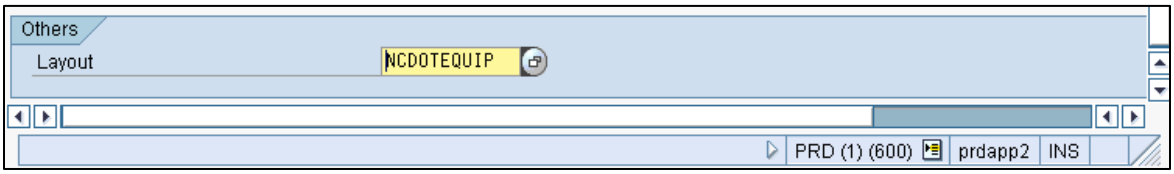
Step# 16. At the end of the form in the *Others* section click the edit field button (shown below) to display the list of available layouts.

Step# 17. Layout: Go to the bottom of the list of available layouts and select **NCDOT EQUIPMENT ID** as the layout.

*Note: If the Layout **NCDOT EQUIPMENT ID** has not been created, go to **Section 6: Creating a Report Layout** of this document.



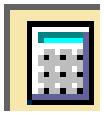
Step# 18. Select **NCDOT EQUIP ID** by double clicking on the Layout Description.



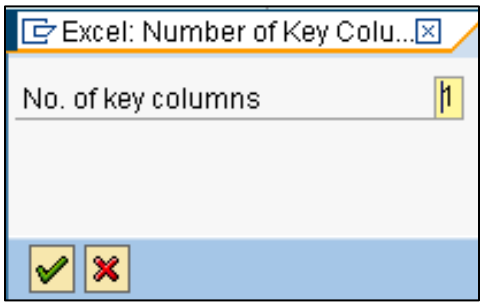
B.3 Section 3: Importing/ Setting up the Spreadsheet in Excel

Step# 1. After completing **Section 2** press **F8**. This will generate a spread sheet displaying the previously requested data. To transfer this data into Excel carry out the following steps:

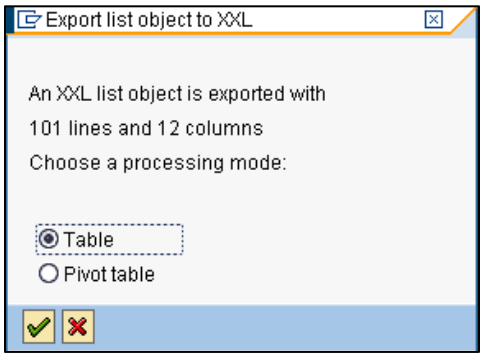
Step# 2. First click on the **Spreadsheet** button or press (shift+F4). The **Spreadsheet** button looks like:



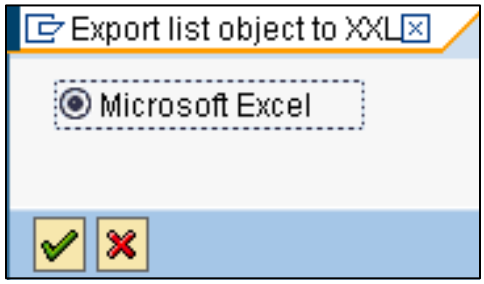
Step# 3. Next confirm the "No. of key columns" then click on the green check. This should be 1 and should not need to be altered.



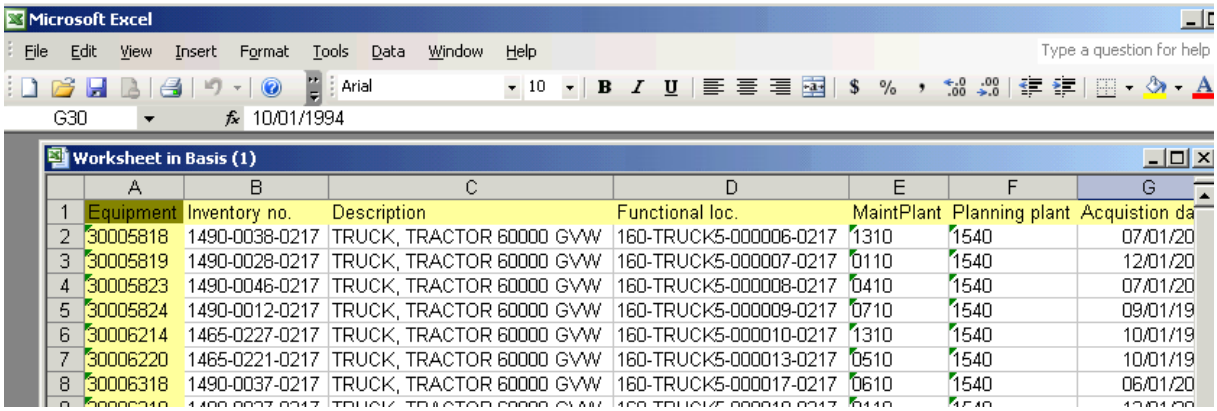
Step# 4. Then select "Table" and click the green check.



Step# 5. Finally, confirm that you want it imported into “Microsoft Excel” by clicking the green check again.



An Excel spreadsheet will generate and be pushed to the front of all the windows (Shown Below).

- 

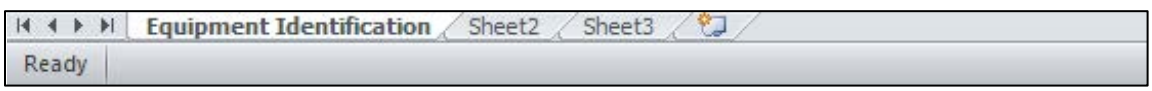
	A	B	C	D	E	F	G
1	Equipment	Inventory no.	Description	Functional loc.	MaintPlant	Planning plant	Acquistion da
2	30005818	1490-0038-0217	TRUCK, TRACTOR 60000 GVW	160-TRUCK5-000006-0217	1310	1540	07/01/20
3	30005819	1490-0028-0217	TRUCK, TRACTOR 60000 GVW	160-TRUCK5-000007-0217	0110	1540	12/01/20
4	30005823	1490-0046-0217	TRUCK, TRACTOR 60000 GVW	160-TRUCK5-000008-0217	0410	1540	07/01/20
5	30005824	1490-0012-0217	TRUCK, TRACTOR 60000 GVW	160-TRUCK5-000009-0217	0710	1540	09/01/19
6	30006214	1465-0227-0217	TRUCK, TRACTOR 60000 GVW	160-TRUCK5-000010-0217	1310	1540	10/01/19
7	30006220	1465-0221-0217	TRUCK, TRACTOR 60000 GVW	160-TRUCK5-000013-0217	0510	1540	10/01/19
8	30006318	1490-0037-0217	TRUCK, TRACTOR 60000 GVW	160-TRUCK5-000017-0217	0610	1540	06/01/20

Step# 6. Select all of the information (press Ctrl+a) and copy that information (press Ctrl+c).

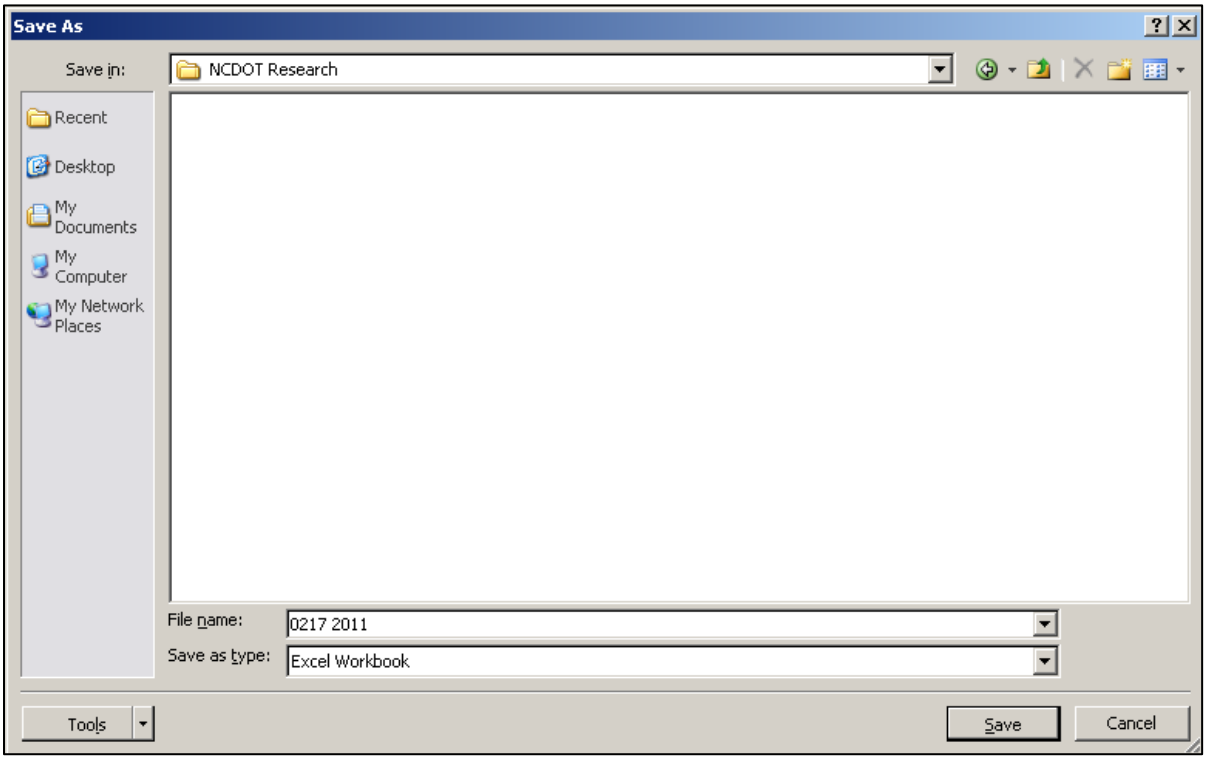
Step# 7. Now open a new spreadsheet, in a separate Excel workbook.

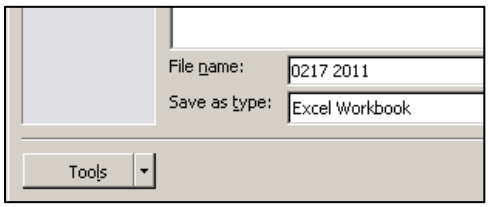
Step# 8. Paste the data into the new spreadsheet (press Ctrl+v)

Step# 9. Rename “Sheet1” of the workbook “Equipment Identification.” This should be the first sheet of the workbook.



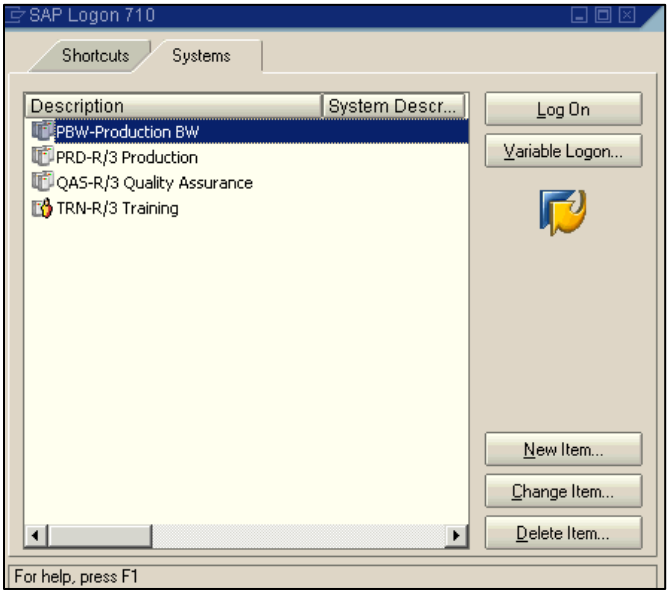
Step# 10. Save the Excel workbook with the formatted name as (class year). For our example, for class 0217 in 2011, this would be “0217 2011”. This would look like the following:



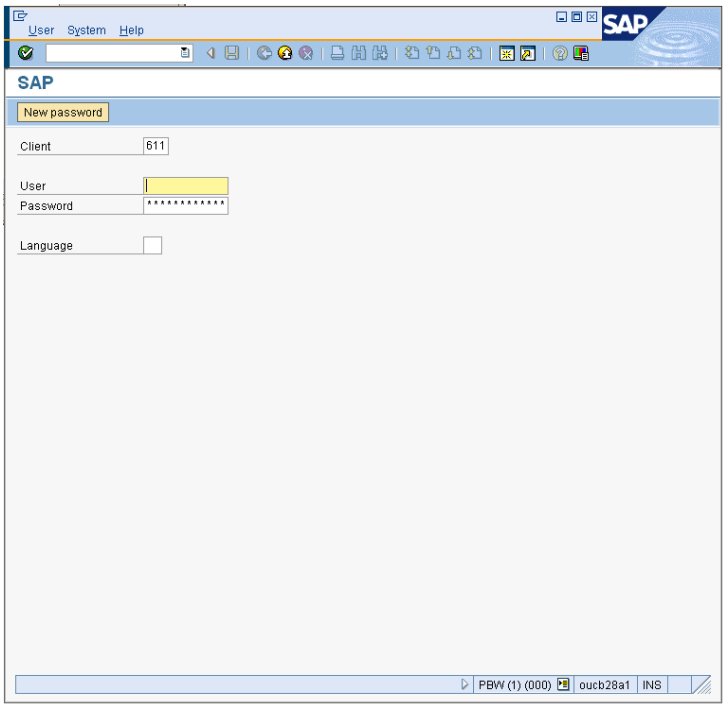


B.4 Section 4: Creating Equipment Utilization Sheet

Step# 1. Pull up the **SAP Logon** menu. Highlight **PBW-Production BW**, and select log on.

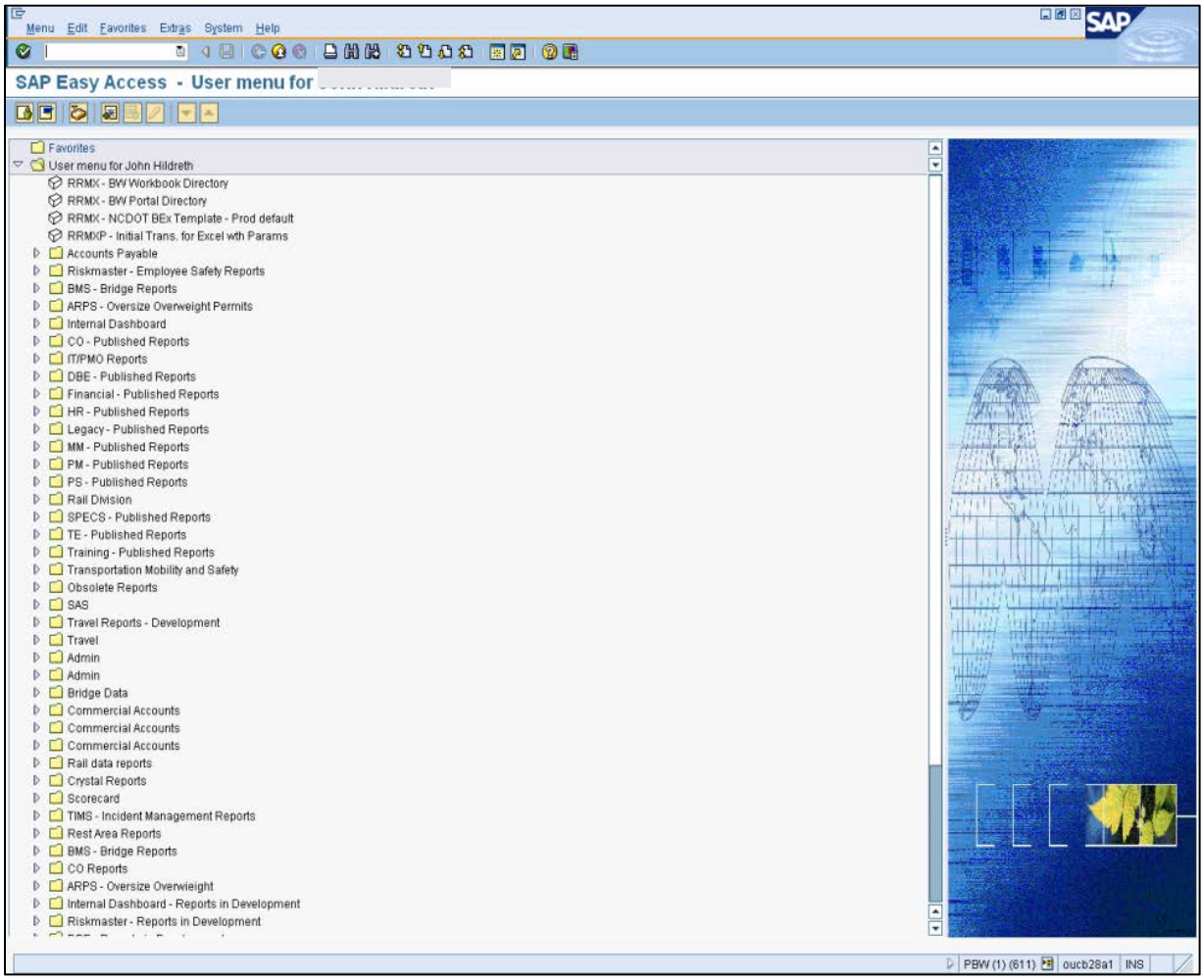


Step# 2. The user will be prompted again to enter the correct credentials. Fill out these fields with the given username and password.

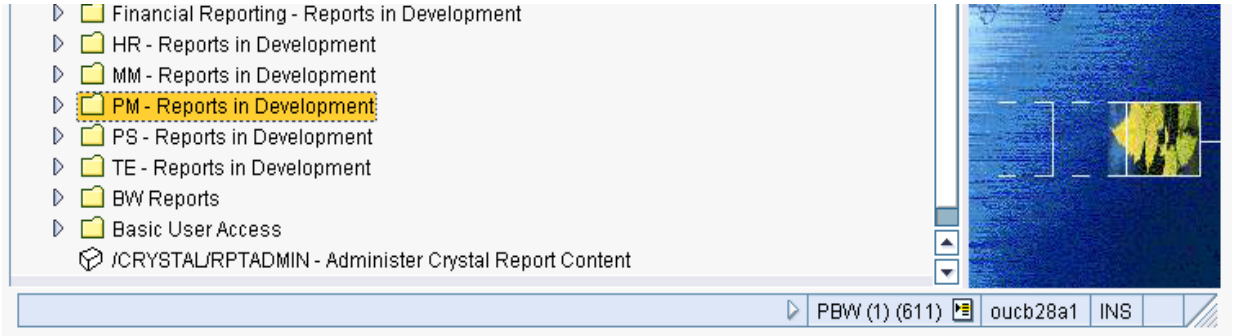


Step# 3. Once logged in another **SAP Easy Access** menu will be displayed. This menu is the opening screen to Business Warehouse.

-

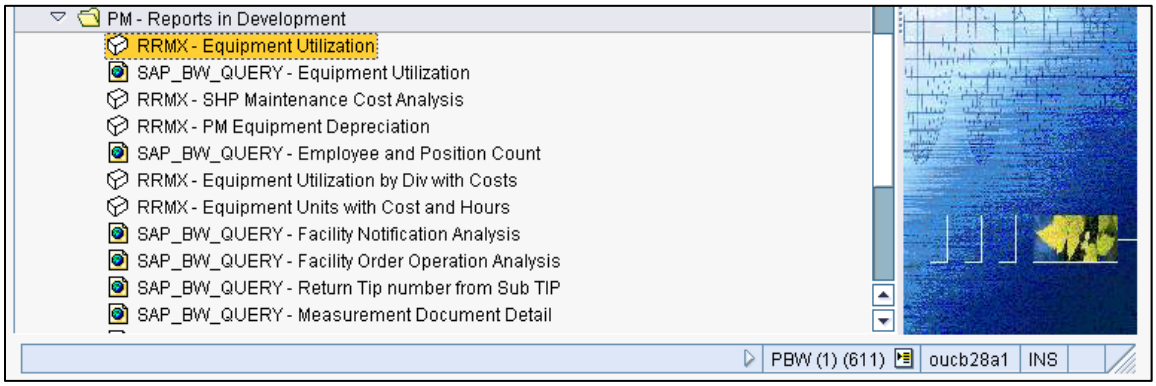


Step# 4. Find **PM-Reports in Development** in the list down the left of the page and click on the expanding arrow.

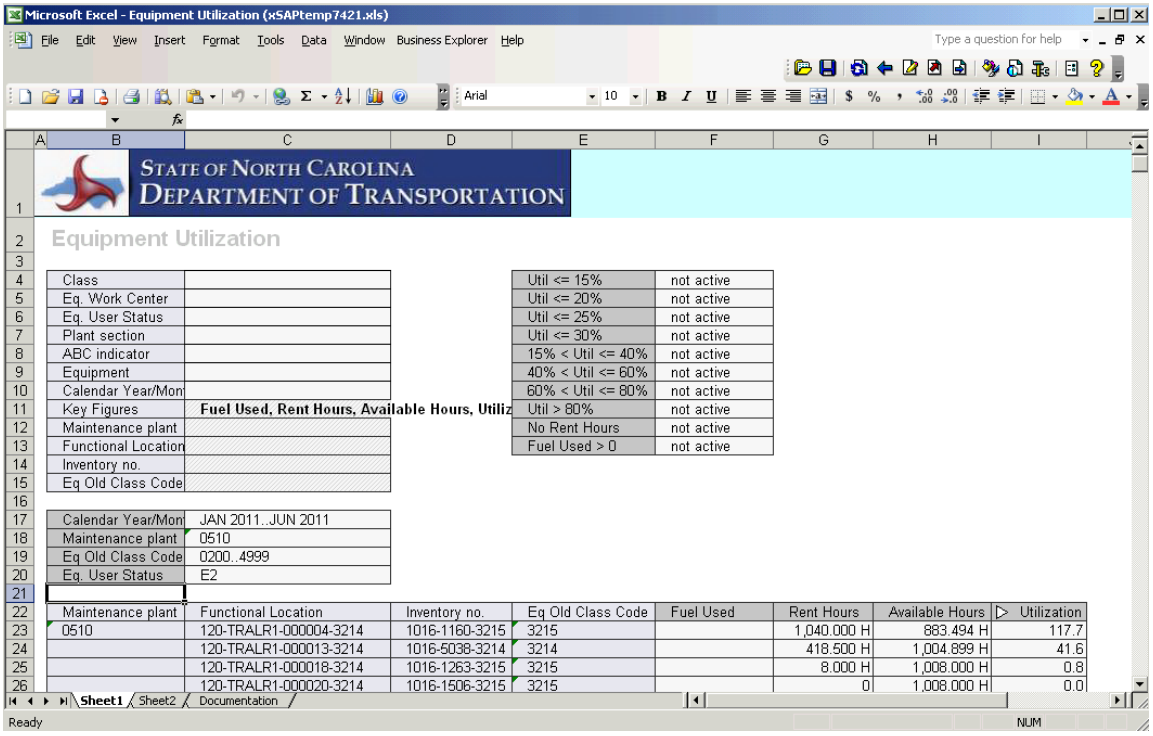


Step# 5. Then click **RRMX - Equipment Utilization**, which is the first item when the folder has been expanded.

-



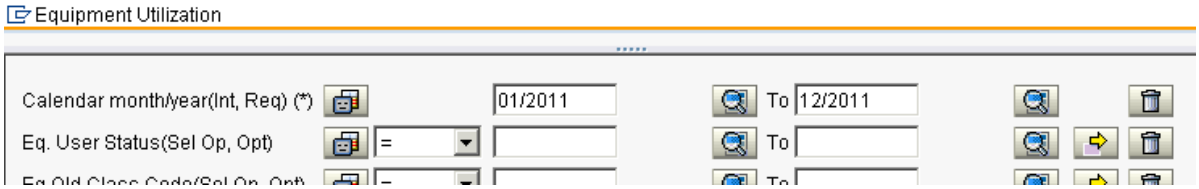
The following Excel spreadsheet will generate:



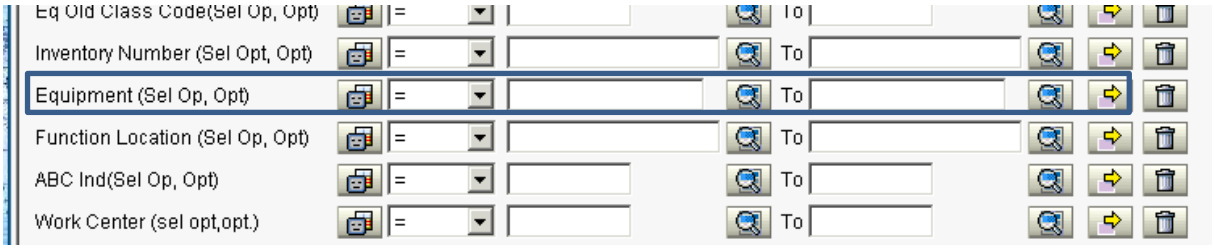
Step# 6. Before reviewing the information on this spreadsheet, click on the button **Refresh Query** (Shown Below):

Step# 7. Pressing this button will make a new window pop up. When this window pops up enter the following information into the required fields.

Calendar month/year in the format 01/yyyy to 12/yyyy. (Ex. “01/2011” to “12/2011”) as shown below:

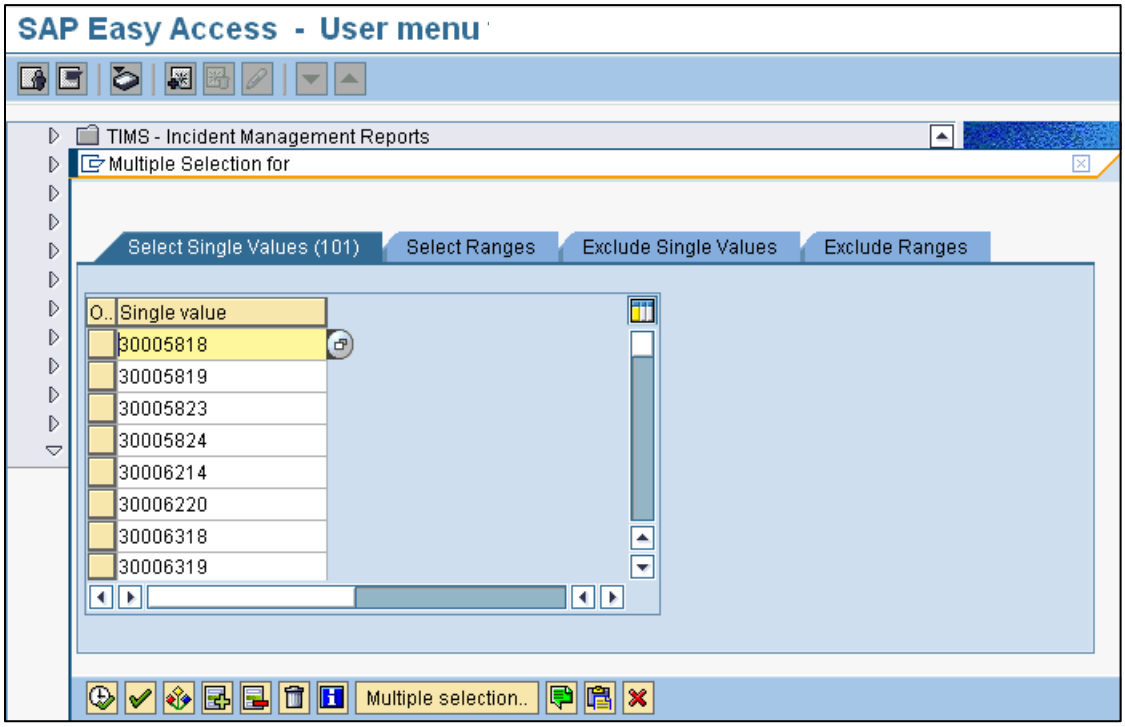


Step# 8. Equipment: Press the yellow arrow corresponding to Equipment.



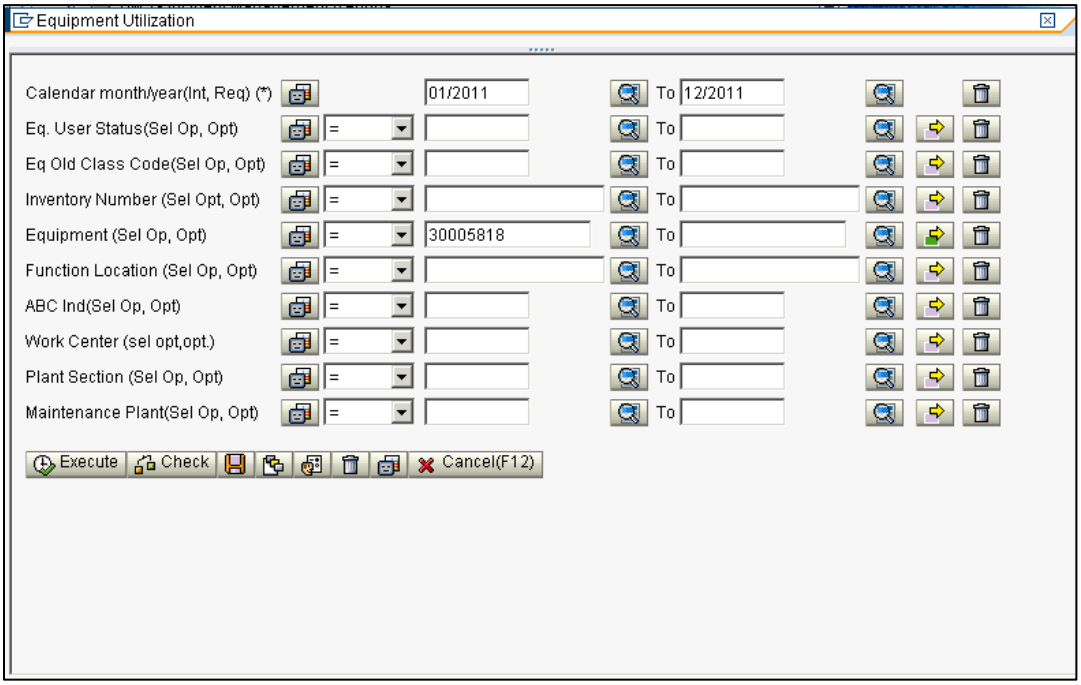
Step# 9. Copy the equipment ID’s into the cells by highlighting column A from the Equipment Identification tab of the separate Excel file generated during Section 3. Once copied the equipment ID’s can be pasted by pressing the button **upload from clipboard** or by pressing (shift+F12) while in the Equipment data field.

Step# 10. When uploaded into the page, the data should resemble the image below.



Step# 11. Click on the Copy button to copy the information to the Equipment Utilization Page (previous page).The copy button looks like the following image.

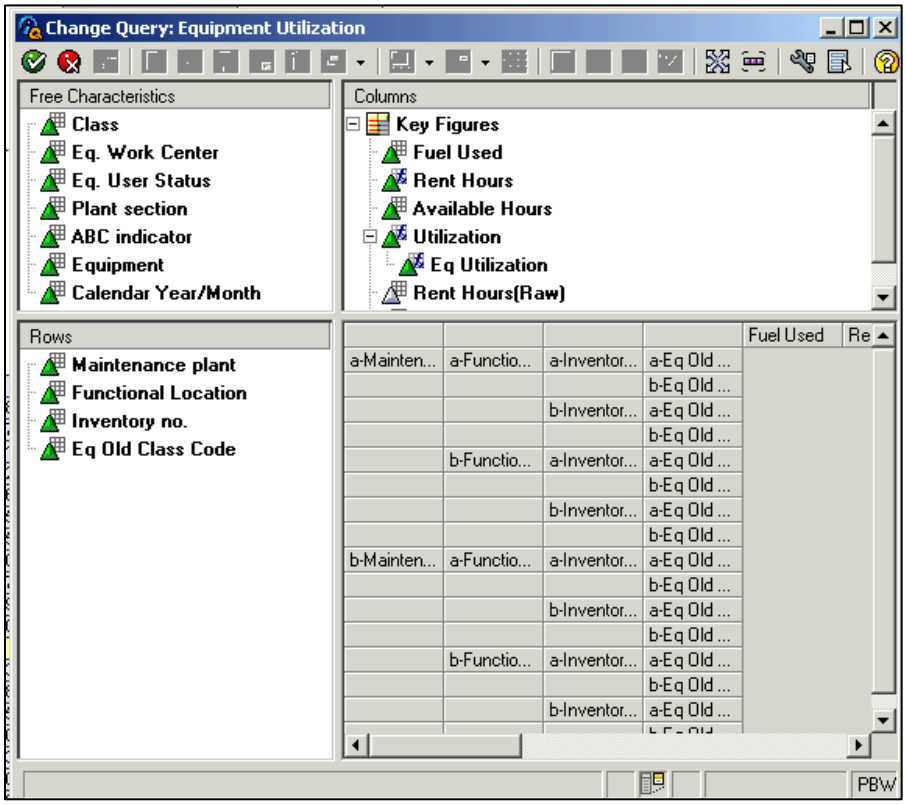
Step# 12. The finished **Equipment Utilization** page should look like the image below.



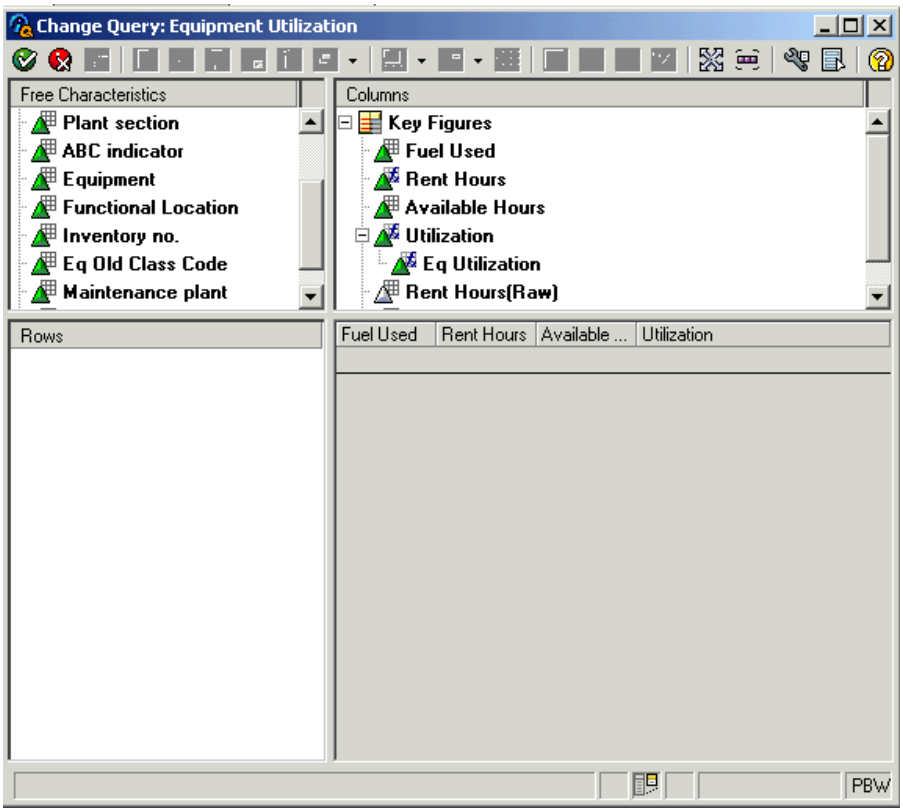
Step# 13. At this point the execute button should be selected in the lower left corner of the window above. This will give you a new spreadsheet.

Step# 14. To obtain the correct information the user must first click on the **Change Query** button. This button looks like the following image and will be near the top of the page 2 positions to the right of the **Refresh Query** button.

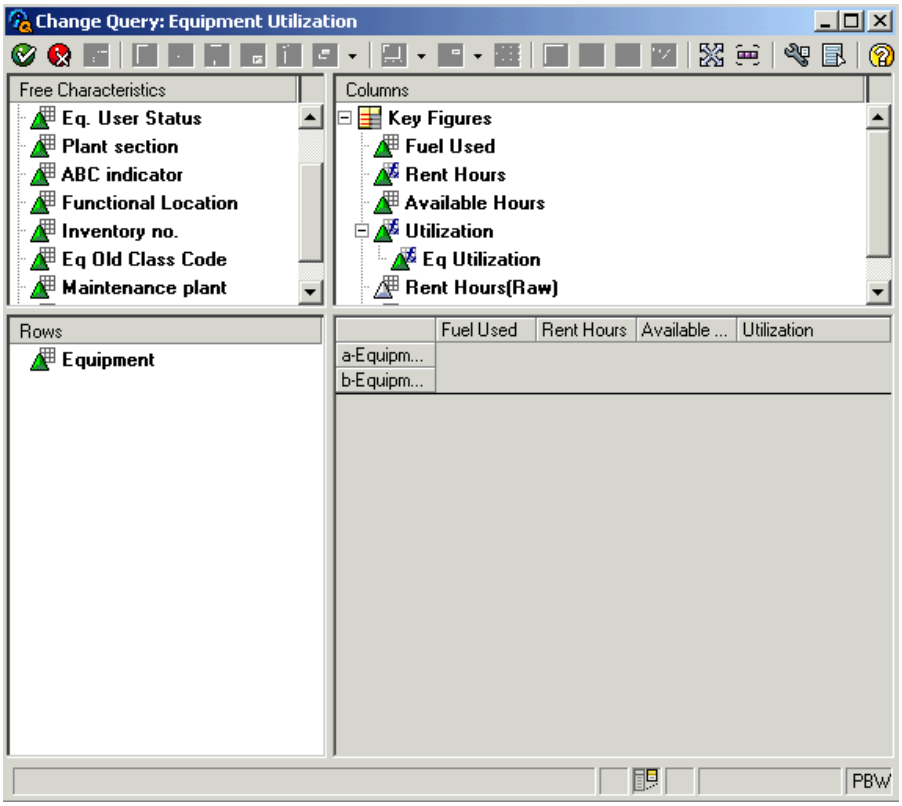
Step# 15. Once the **Change Query** button is selected, a drop down menu will appear. When this happens click on the **Change Query (local view)**. The following window will appear.



Step# 16. From this screen, drag all of the characteristics in the **Rows** window up to the **Free Characteristics** Window. When this is completed it should look like the following. **Rows** should be empty.



Step# 17. Now move the **Equipment Characteristic** into the **Row** window. When completed your window should have the following appearance.

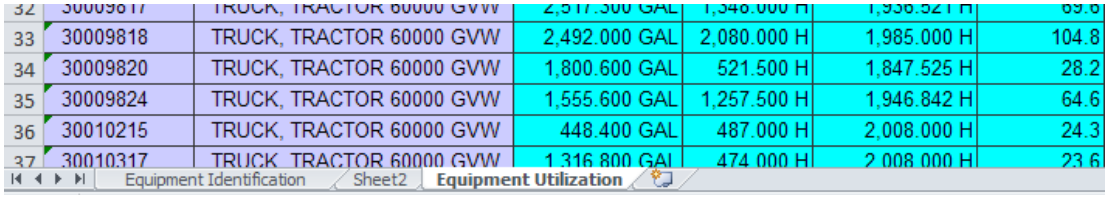


Step# 18. Click on the check in the top left corner to execute the program.

At this time wait for the new spreadsheet to appear. The time required will vary depending on the size of the equipment class.

Step# 19. When the new spreadsheet does appear copy it into the created separate Excel file in a new tab. Do this by opening the previous Excel file from Section 3. Our example is named 0217 2011.xlsx. Then copy all of the new spreadsheet and paste it into the Sheet3 of the workbook. Select all(press Ctrl+a), then copy the information (press Ctrl+c). Then click over to the separate Excel workbook and paste the data (press Ctrl+v).

Step# 20. Finally rename the 3rd worksheet as **Equipment Utilization**. The following is an example of what this should look like.



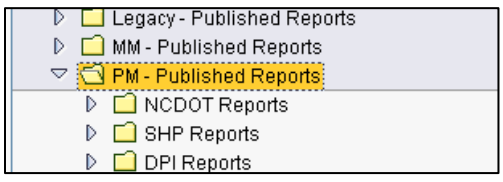
32	30009817	TRUCK, TRACTOR 60000 GVW	2,517.300 GAL	1,348.000 H	1,936.521 H	69.6
33	30009818	TRUCK, TRACTOR 60000 GVW	2,492.000 GAL	2,080.000 H	1,985.000 H	104.8
34	30009820	TRUCK, TRACTOR 60000 GVW	1,800.600 GAL	521.500 H	1,847.525 H	28.2
35	30009824	TRUCK, TRACTOR 60000 GVW	1,555.600 GAL	1,257.500 H	1,946.842 H	64.6
36	30010215	TRUCK, TRACTOR 60000 GVW	448.400 GAL	487.000 H	2,008.000 H	24.3
37	30010317	TRUCK, TRACTOR 60000 GVW	1,316.800 GAL	474.000 H	2,008.000 H	23.6

Equipment Identification | Sheet2 | Equipment Utilization

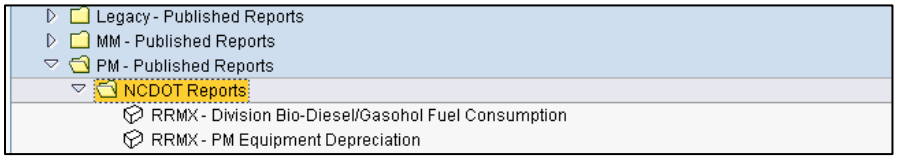
Step# 21. Recopy the equipment ID's from the Equipment Identification page. This data is needed in the next section.

B.5 Section 5: Creating Equipment Rental Income Page

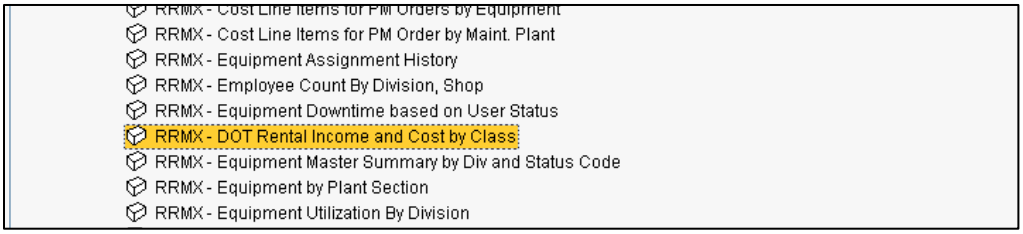
Step# 1. At the **SAP Easy Access Menu** with the world map on it, find the folder on the left side labeled **PM- Published Reports**. Expand this folder.



Step# 2. Once the folder is expanded find the **NCDOT Reports** folder and expand this one as well.



Step# 3. Next find the **RRMX - DOT Rental Income and Cost by Class** folder. Once this has been selected, open by double clicking on the name of the folder. A new spreadsheet will be generated.



The new spreadsheet should look like the following:

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

Equipment Rental Income vs Cost

Run Date = 9/17/2012

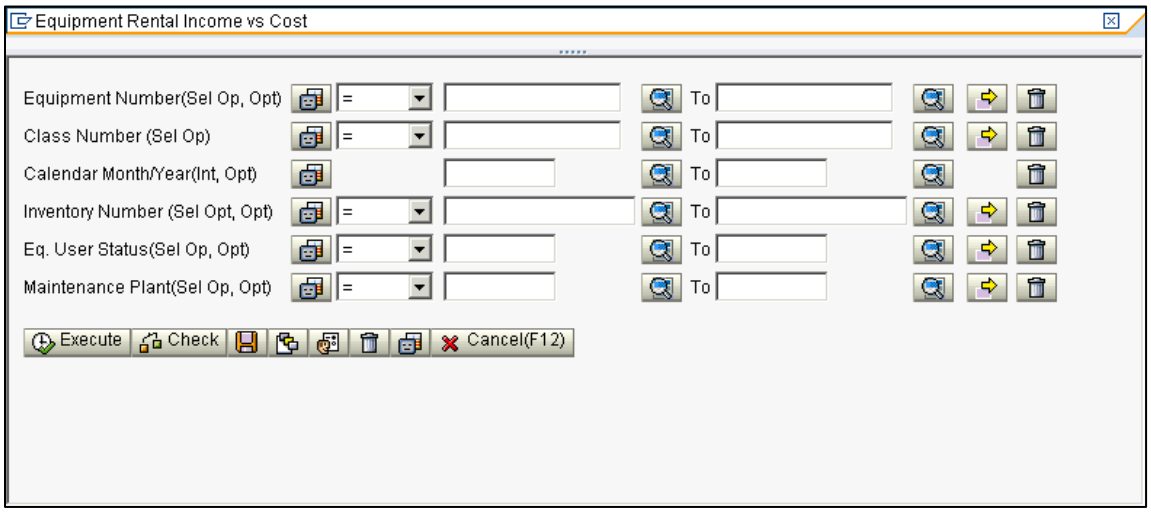
Controlling are		Key figure type	
Cost Element		Value Type	
Equipment		Detail for valueT	
Inventory Numl		Class type	
MaintenancePl		Equip Work Ctr F	
Plant Section		Eq. Work Center	
Cal. Year/Mont		Eq. Const Yr	
Key Figures	Rental Income	Model Number	
Class	<= 5000	Eq. User Status	

Cal. Year/Month APR 2012

Class	Rental Income	PM Labor Cost	Repair Labor Cost	PM Parts Cost	Repair Parts Cost	Cost of Fuel	Cost of Oil	Cost of Tires	Total Cost	Profit/Loss	Rent Hou
002/0010			$ 2,292.05		$ 797.71				$ 3,089.76	-$ 3,089.76	
002/0020			$ 7,290.08		$ 4,289.76				$ 11,579.84	-$ 11,579.84	
002/0030			$ 1,427.22		$ 1,739.60				$ 3,166.82	-$ 3,166.82	
002/0040			$ 947.43		$ 180.81				$ 1,128.24	-$ 1,128.24	
002/0050		$ 9,479.04	$ 4,162.91	$ 1,591.94	$ 3,009.49				$ 18,243.38	-$ 18,243.38	
002/0200	$ 291,173.18	$ 6,397.01	$ 14,729.99	$ 549.29	$ 5,671.19	$ 73,916.78	$ 1,007.68	$ 4,173.50	$ 106,445.44	$ 184,727.74	30,082.8
002/0201	$ 2,127,356.63	$ 54,857.47	$ 120,715.44	$ 5,737.78	$ 74,074.74	$ 577,339.00	$ 8,082.17	$ 27,768.38	$ 868,374.98	$ 1,258,981.65	288,308.4
002/0202	$ 498,646.58	$ 5,421.62	$ 34,891.31	$ 4,863.92	$ 16,074.17	$ 175,995.92	$ 3,182.83	$ 11,863.25	$ 252,293.02	$ 246,353.56	49,981.9
002/0203	$ 713,454.75	$ 9,077.94	$ 70,788.56	$ 3,463.27	$ 38,181.27	$ 160,052.74	$ 2,244.19	$ 9,554.58	$ 293,362.55	$ 420,092.20	58,310.6
002/0204	$ 719,383.44	$ 13,622.18	$ 59,931.04	$ 4,094.91	$ 36,027.07	$ 215,806.20	$ 3,453.52	$ 17,323.28	$ 350,258.20	$ 369,125.24	63,688.4
002/0205	$ 1,952,051.61	$ 49,299.73	$ 367,543.90	$ 17,783.70	$ 194,552.06	$ 653,625.21	$ 25,743.99	$ 65,212.34	$ 1,373,760.93	$ 578,290.68	94,862.7
002/0206	$ 991,678.98	$ 25,552.28	$ 131,331.73	$ 7,829.40	$ 79,017.97	$ 275,825.84	$ 9,671.43	$ 23,685.99	$ 552,914.64	$ 438,764.34	74,677.0
002/0208	$ 957.60	$ 87.73	$ 35.09			$ 61.05			$ 183.87	$ 773.73	40.0
002/0212	$ 313,484.31	$ 4,803.86	$ 24,482.50	$ 2,402.65	$ 8,402.95	$ 109,560.32	$ 3,889.75	$ 9,225.52	$ 162,767.55	$ 150,716.76	10,370.9
002/0214	$ 119,344.30	$ 1,835.24	$ 9,557.07	$ 544.93	$ 5,111.76	$ 45,546.09	$ 1,170.59	$ 574.96	$ 64,340.64	$ 55,003.66	6,372.0
002/0217	$ 67,166.75	$ 456.17	$ 3,551.70	$ 170.69	$ 1,124.20	$ 28,695.95	$ 681.48	$ 367.33	$ 35,047.52	$ 32,119.23	2,895.9
002/0227	$ 9,771.27	$ 421.08	$ 315.82	$ 91.57	$ 16.90	$ 2,831.23	$ 110.87		$ 3,787.47	$ 5,983.80	535.5
002/0230	$ 82,428.50	$ 708.83	$ 7,601.03	$ 466.00	$ 5,443.46	$ 21,293.54	$ 395.95	$ 1,709.53	$ 37,618.34	$ 44,810.16	3,833.6
002/0232	$ 63,525.39	$ 2,308.93	$ 10,154.58	$ 846.09	$ 5,731.75	$ 23,319.97	$ 1,243.64	$ 1,837.84	$ 45,442.80	$ 18,082.59	2,118.5
002/0233	$ 356,857.17	$ 7,032.13	$ 28,575.42	$ 4,606.77	$ 15,517.10	$ 126,279.63	$ 2,225.77	$ 13,577.82	$ 197,814.64	$ 159,042.53	26,867.2
002/0235	$ 16,988.00	$ 70.18	$ 456.19	$ 54.33	$ 186.20	$ 6,801.87	$ 54.08		$ 7,622.85	$ 9,365.15	1,651.0
002/0236	$ 7,987.19	$ 343.88	$ 1,821.14	$ 134.24	$ 991.80	$ 115.34	$ 11.42		$ 3,417.82	$ 4,569.37	2,930.9
002/0270	$ 23,036.18									$ 23,036.18	15,120.7
002/0271	$ 383.85									$ 383.85	281.0
002/0272	$ 261,118.27									$ 261,118.27	65,882.3
002/0273	$ 17,868.36									$ 17,868.36	38,320.1
002/0274	$ 63,335.02									$ 63,335.02	52,564.4
002/0300	$ 453,127.44	$ 10,014.90	$ 52,738.72	$ 7,631.64	$ 41,324.12	$ 70,794.29	$ 4,855.53	$ 11,004.01	$ 198,363.21	$ 254,764.23	17,261.6
002/0314	$ 534,671.88	$ 9,274.38	$ 99,343.73	$ 6,737.27	$ 61,845.06	$ 59,284.49	$ 5,790.81	$ 8,014.67	$ 250,290.41	$ 284,381.47	19,888.6

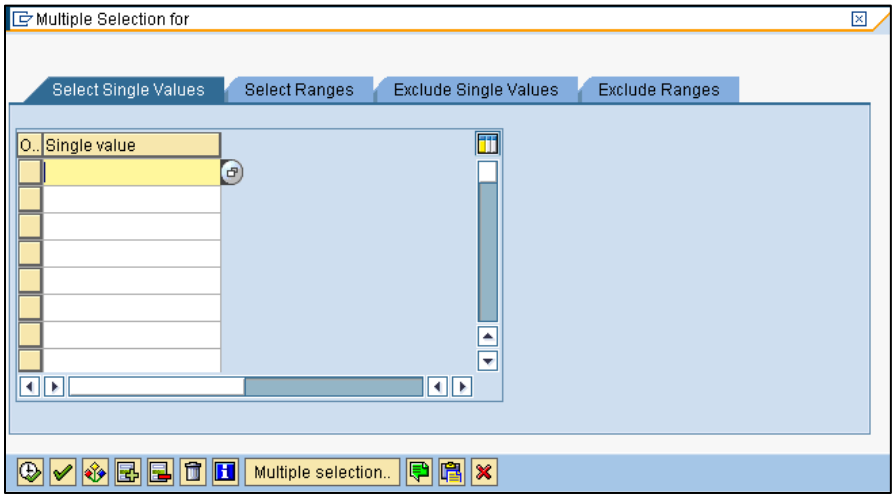
Step# 4. On this spreadsheet select the **Refresh Query** button.

Step# 5. After selecting the **Refresh Query** button the **Equipment Rental Income vs. Cost** will appear.



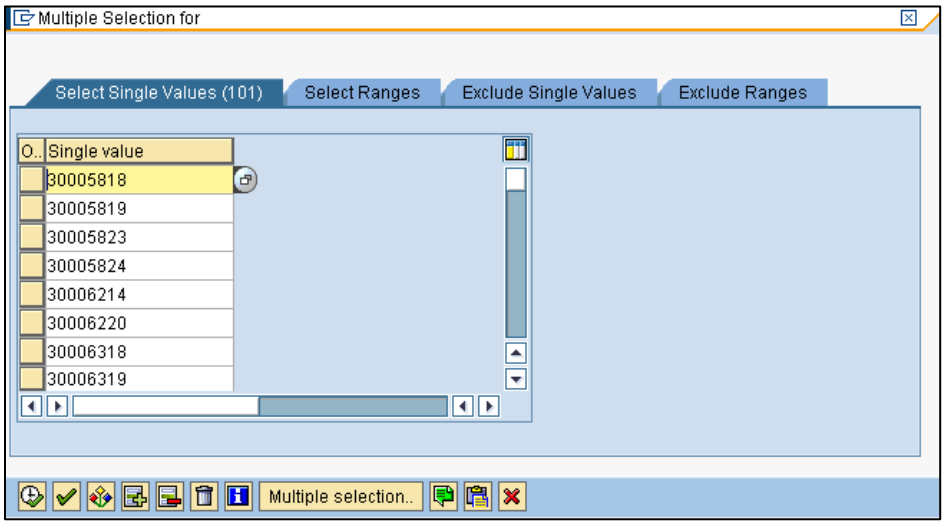
Step# 6. From this window select the yellow arrow beside the **Equipment Number** in order to paste the **Equipment ID** numbers into the **Equipment Rental Income vs. Cost** window.

Step# 7. After clicking the yellow arrow the following should pop up.



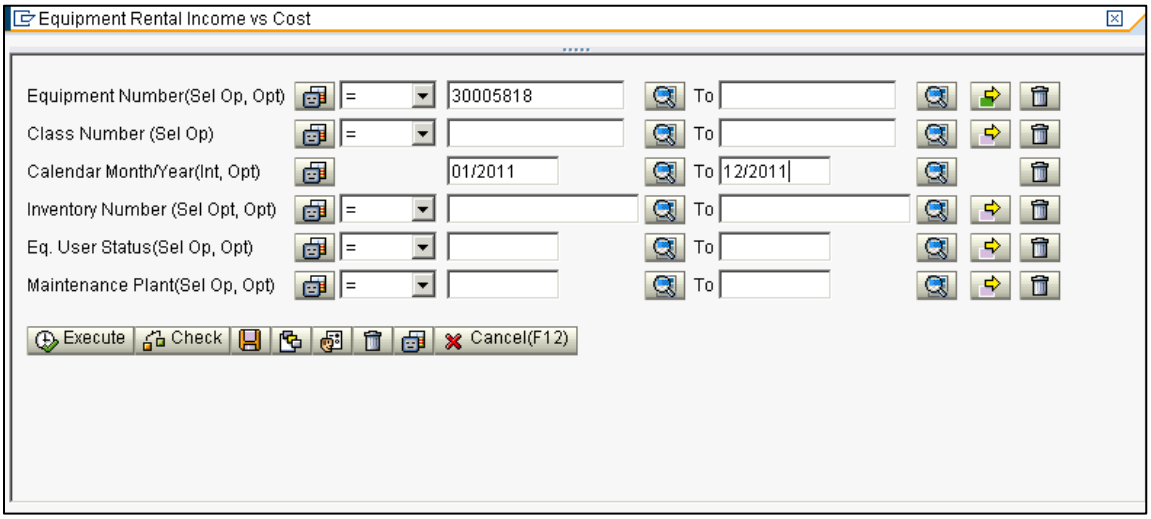
Step# 8. Now paste all the **Equipment ID** numbers into the column by clicking the **Copy from Clipboard** button or pressing (Shift+F12). The **Copy from Clipboard** button looks like.

Step# 9. Once the Equipment ID numbers are pasted into the column the window should look like the following:



Step# 10. From here, press F8 to copy this information onto the **Equipment Rental Income vs. Cost** window, or click on the copy button, which looks like the following image.

Step# 11. In the Calendar month/year section enter the desired dates following the 01/yyyy to 12/yyyy format. (Ex: “01/2011” to “12/2011”). This is also shown below.



Step# 12. Now that the desired data has been entered into the fields, click the execute button in the lower left corner of the **Equipment Rental Income vs. Cost** window.

Step# 13. Once executed, a spreadsheet similar to the one below will appear.

Step# 14.

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

Equipment Rental Income vs Cost

Run Date = 9/17/2012

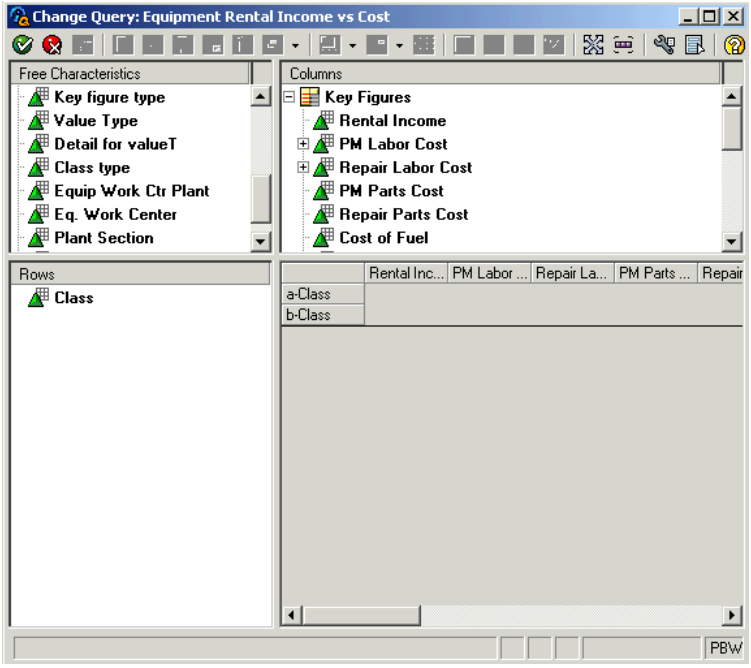
Controlling are		Key figure type	
Cost Element		Value Type	
Equipment		Detail for valueT	
Inventory Numl		Class type	
MaintenancePl		Equip Work Ctr F	
Plant Section		Eq. Work Center	
Cal. Year/Mont		Eq. Const Yr	
Key Figures	Rental Income	Model Number	
Class	<= 5000	Eq. User Status	

Cal. Year/Month JAN 2011..DEC 2011

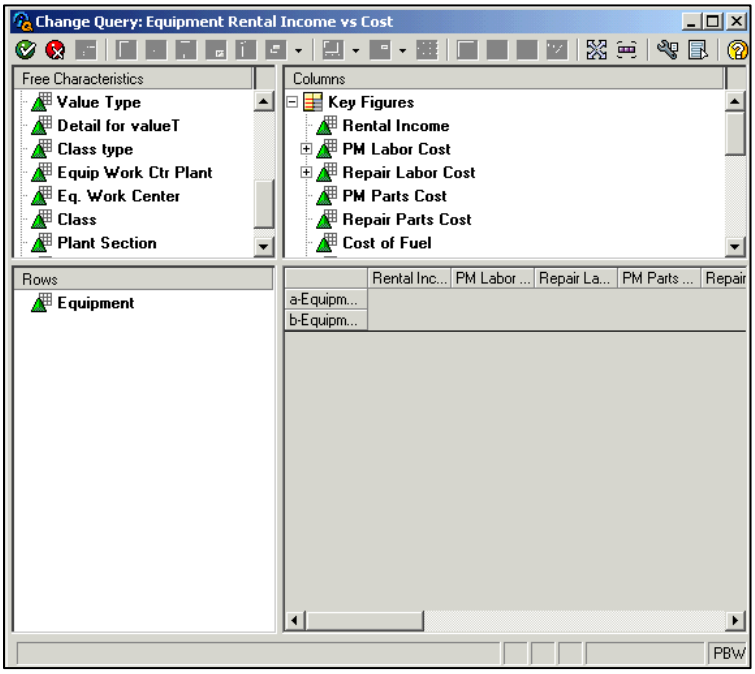
Class	Rental Income	PM Labor Cost	Repair Labor Cost	PM Parts Cost	Repair Parts Cost	Cost of Fuel	Cost of Oil	Cost of Tires	Total Cost	Profit/Loss	Rent Hours
002/0214	$ 975,187.83	$ 19,841.60	$ 92,290.05	$ 5,999.13	$ 57,015.10	$ 316,802.99	$ 9,469.26	$ 31,420.46	$ 532,838.59	$ 442,349.24	51,048.920 H
002/0217	$ 765,493.00	$ 10,951.71	$ 35,564.65	$ 4,771.17	$ 20,601.84	$ 285,175.16	$ 6,323.49	$ 34,401.04	$ 397,789.06	$ 367,703.94	31,784.850 H
Overall Result	**$ 1,740,680.83**	**$ 30,793.31**	**$ 127,854.70**	**$ 10,770.30**	**$ 77,616.94**	**$ 601,978.15**	**$ 15,792.75**	**$ 65,821.50**	**$ 930,627.65**	**$ 810,053.18**	**82,833.770 H**

Step# 15. Now format the spreadsheet to present the data. To do so, first click the **Change Query** button. This should activate a drop down menu where you will select **Change Query (local view)**. The **Change Query** button looks like the following.

Step# 16. When electing the **Change Query (local view)** option the following window should pop up.



Step# 17. Clear the Rows column of characteristics and put equipment into this column. After this is completed it should resemble the following.

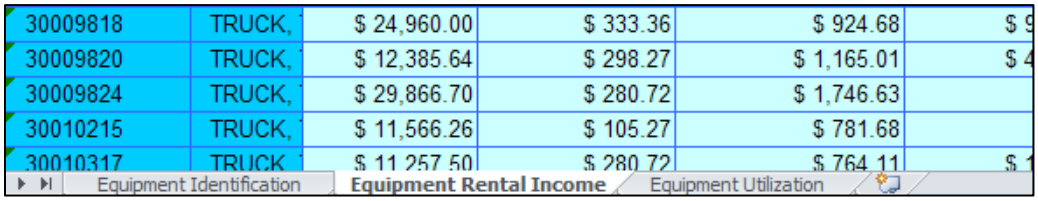


Step# 18. Select the Quit and Use Query button in the top left corner of the window. This button looks like.

Step# 19. A new spreadsheet will be generated with the desired data. Select all the data (press Ctrl+a) and copy the data (press Ctrl+c).

Step# 20. After selecting and copying that data to the clipboard, return to the Excel workbook with the previous information in it (Equipment Identification and Equipment Utilization) and paste (press Ctrl+v) this new information in Sheet2 of the workbook.

Step# 21. Rename the sheet **Equipment Rental Income**. This should look like the following.



30009818	TRUCK,	$ 24,960.00	$ 333.36	$ 924.68	$ 9
30009820	TRUCK,	$ 12,385.64	$ 298.27	$ 1,165.01	$ 4
30009824	TRUCK,	$ 29,866.70	$ 280.72	$ 1,746.63	
30010215	TRUCK,	$ 11,566.26	$ 105.27	$ 781.68	
30010317	TRUCK	$ 11,257.50	$ 280.72	$ 764.11	$ 1

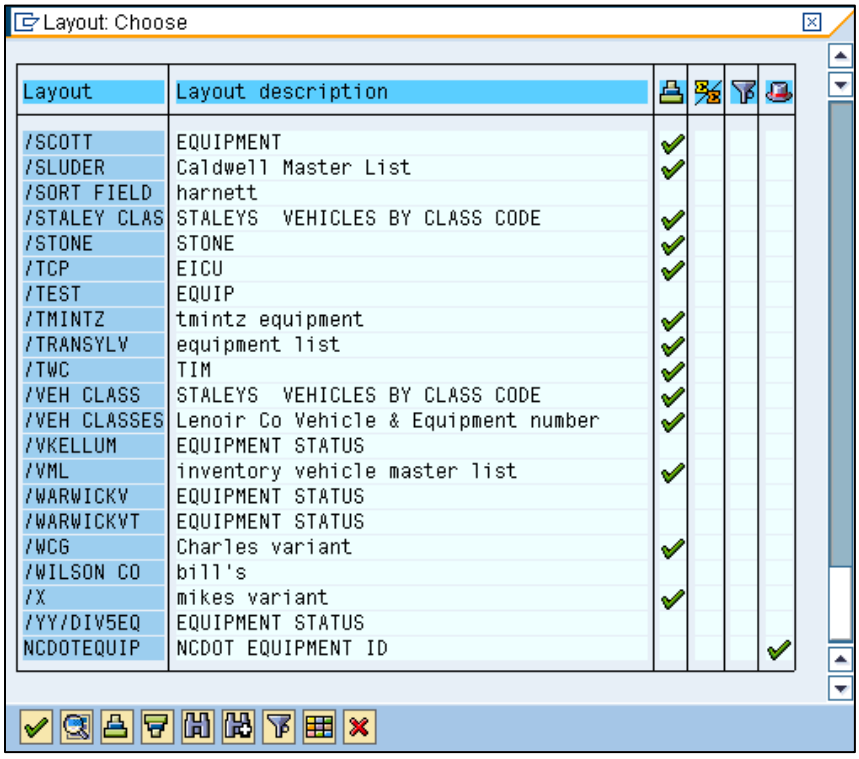
Equipment Identification | **Equipment Rental Income** | Equipment Utilization

Step# 22. Save the Excel workbook. The workbook for this particular class of equipment is now complete.

B.6 Section 6: Creating a Report Layout

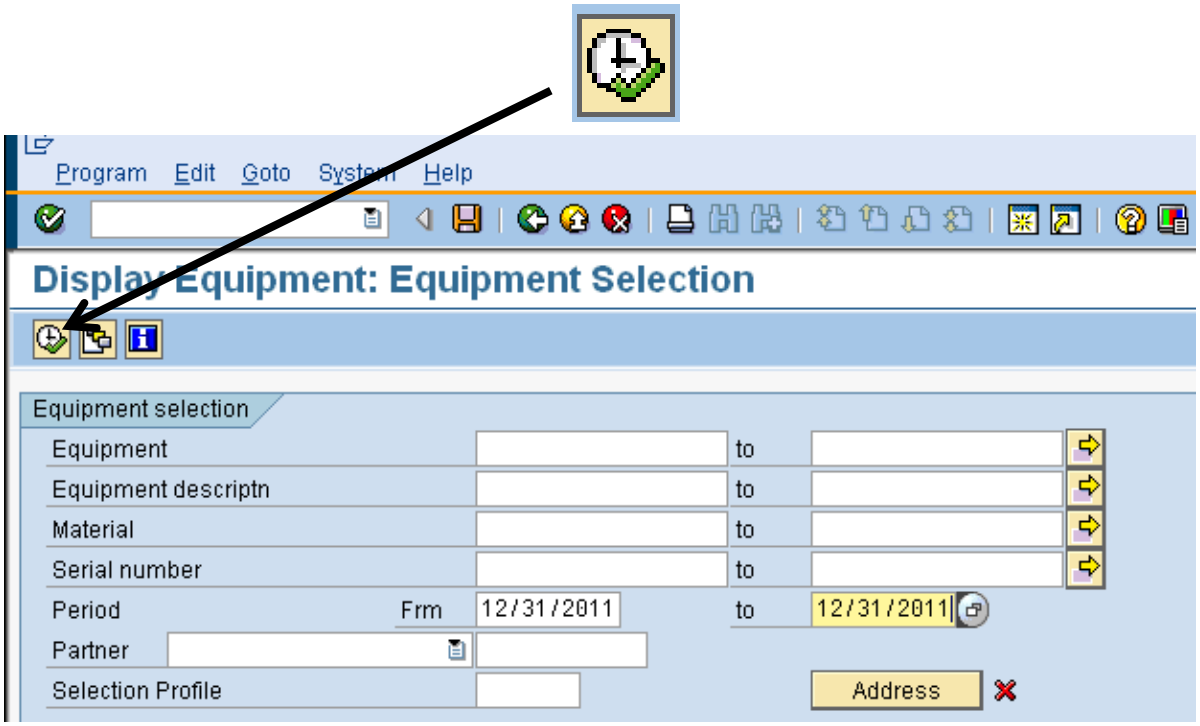
This is only an extension of Step# 18 in **Section 2: Creating Equipment Identification Sheet.** This section is not required at the end of each data extraction.

If the user has arrived at the screen shown below and the **NCDOT EQUIPMENT ID** has not been created, a process is required to create the appropriate report layout.

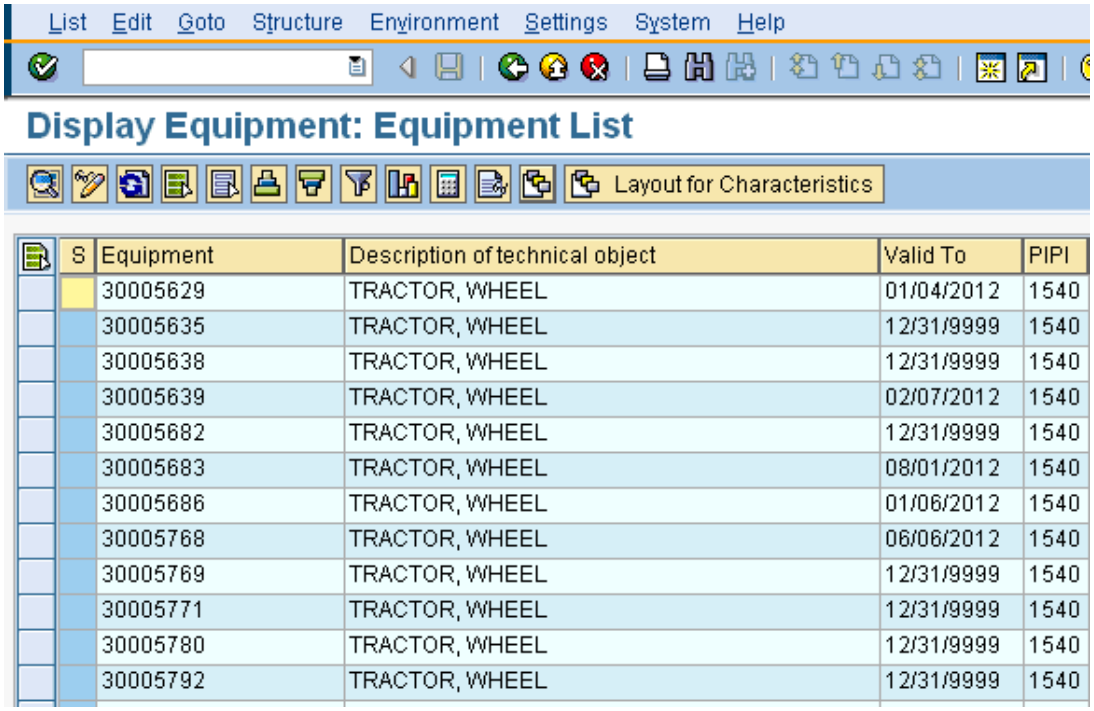


Step# 1. After entering the **Layout Choose** screen and realizing that the necessary layout is not listed; exit the screen by clicking the x in the top right corner of the box.

Step# 2. Proceed back to the top of the **Display Equipment** screen and select the execute button (shown below).

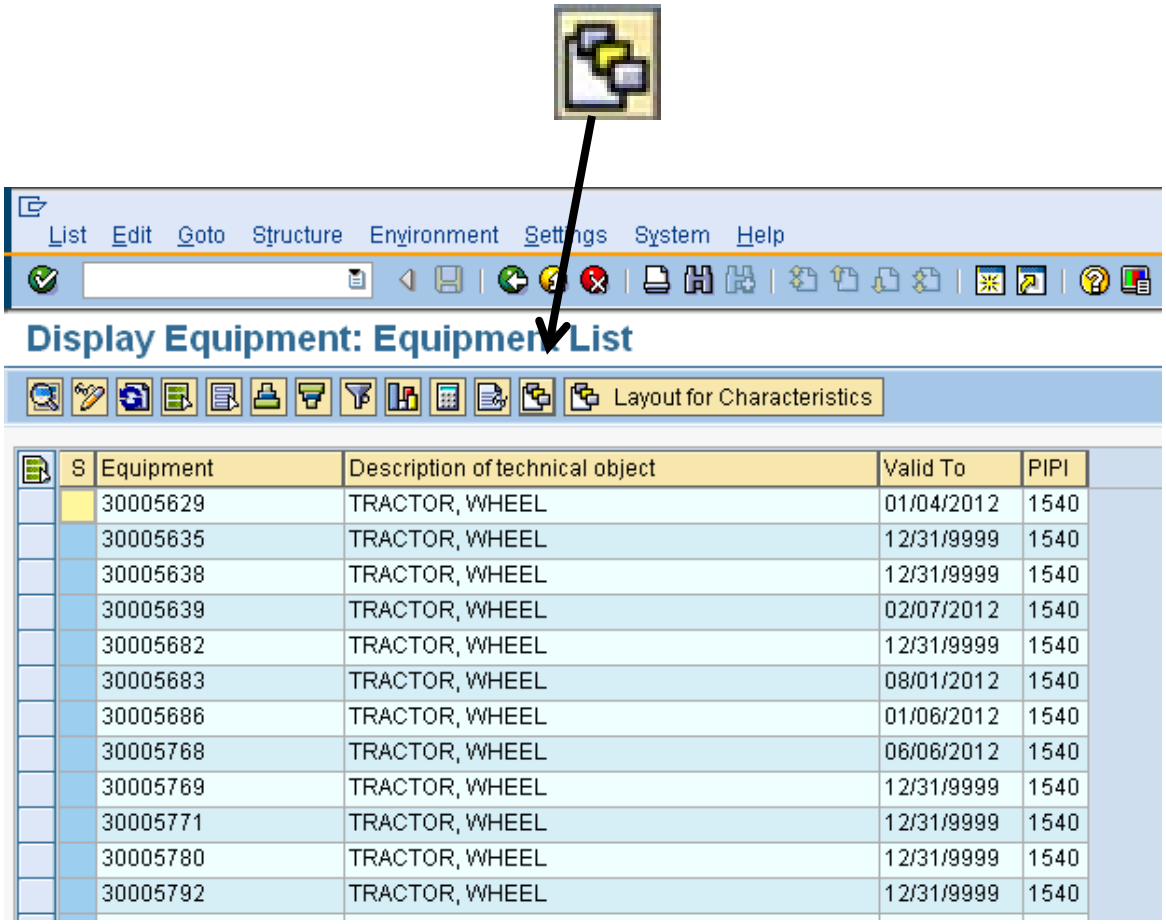


Step# 3. A new screen, showing a list of machines in the requested class, will become available after executing Step#4 (shown below).



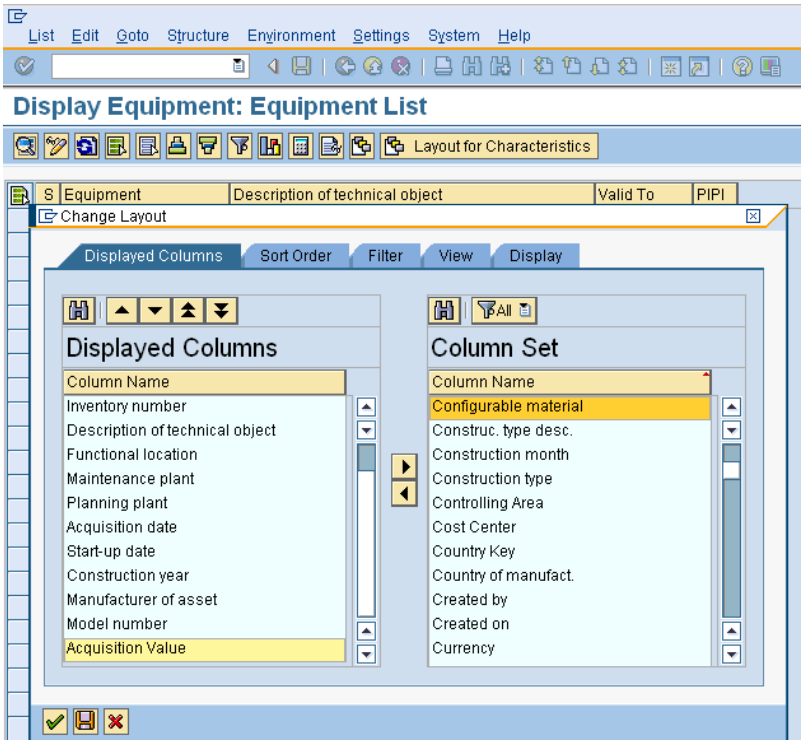
S	Equipment	Description of technical object	Valid To	PIPI
	30005629	TRACTOR, WHEEL	01/04/2012	1540
	30005635	TRACTOR, WHEEL	12/31/9999	1540
	30005638	TRACTOR, WHEEL	12/31/9999	1540
	30005639	TRACTOR, WHEEL	02/07/2012	1540
	30005682	TRACTOR, WHEEL	12/31/9999	1540
	30005683	TRACTOR, WHEEL	08/01/2012	1540
	30005686	TRACTOR, WHEEL	01/06/2012	1540
	30005768	TRACTOR, WHEEL	06/06/2012	1540
	30005769	TRACTOR, WHEEL	12/31/9999	1540
	30005771	TRACTOR, WHEEL	12/31/9999	1540
	30005780	TRACTOR, WHEEL	12/31/9999	1540
	30005792	TRACTOR, WHEEL	12/31/9999	1540

Step# 4. Once the new screen is displayed, select the current layout button at the top of the screen (shown below).



S	Equipment	Description of technical object	Valid To	PIPI
	30005629	TRACTOR, WHEEL	01/04/2012	1540
	30005635	TRACTOR, WHEEL	12/31/9999	1540
	30005638	TRACTOR, WHEEL	12/31/9999	1540
	30005639	TRACTOR, WHEEL	02/07/2012	1540
	30005682	TRACTOR, WHEEL	12/31/9999	1540
	30005683	TRACTOR, WHEEL	08/01/2012	1540
	30005686	TRACTOR, WHEEL	01/06/2012	1540
	30005768	TRACTOR, WHEEL	06/06/2012	1540
	30005769	TRACTOR, WHEEL	12/31/9999	1540
	30005771	TRACTOR, WHEEL	12/31/9999	1540
	30005780	TRACTOR, WHEEL	12/31/9999	1540
	30005792	TRACTOR, WHEEL	12/31/9999	1540

Step# 5. By completing the process described in Step#6 a new option box will be displayed allowing the user to **Change Layout**



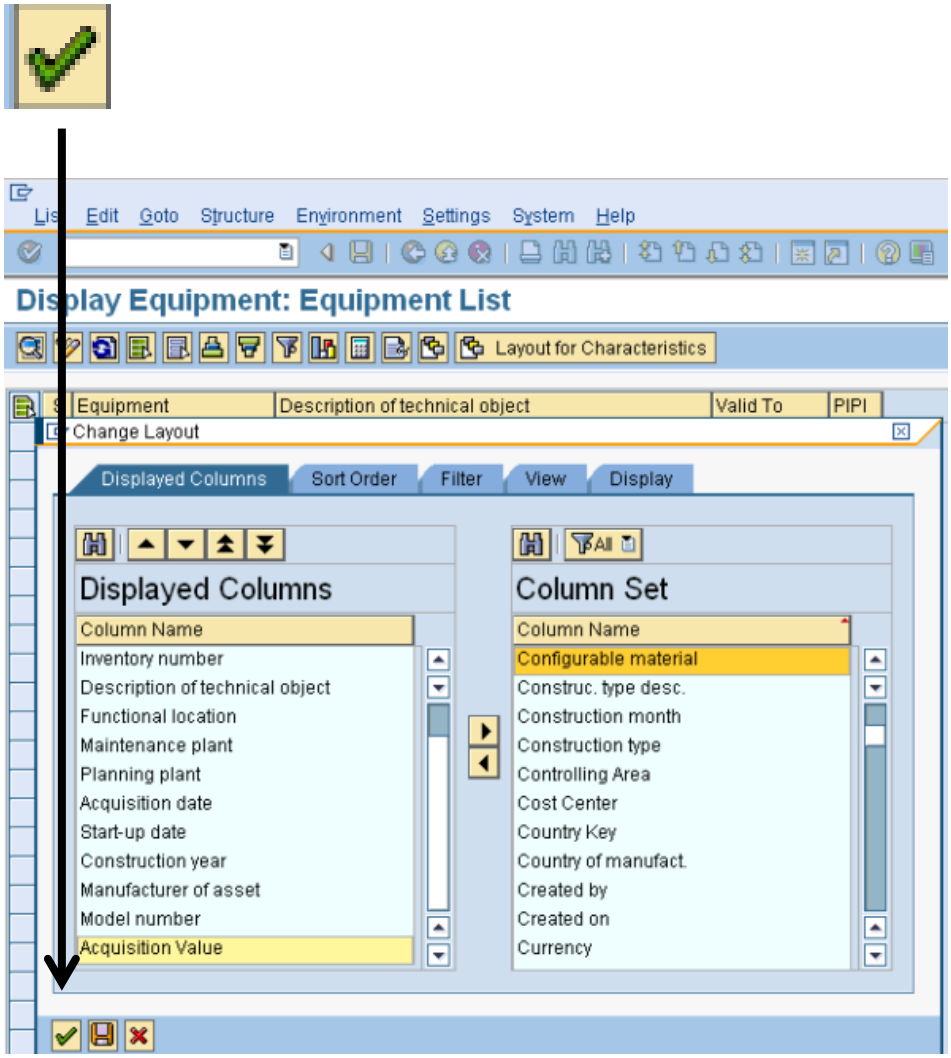
Step# 6. While still in the **Change Layout** option box, move columns names to or from the two displayed lists until the list below is displayed on the left.

*Note the column names in the list on the left **MUST BE IN ORDER**.

Required Displayed Column Names

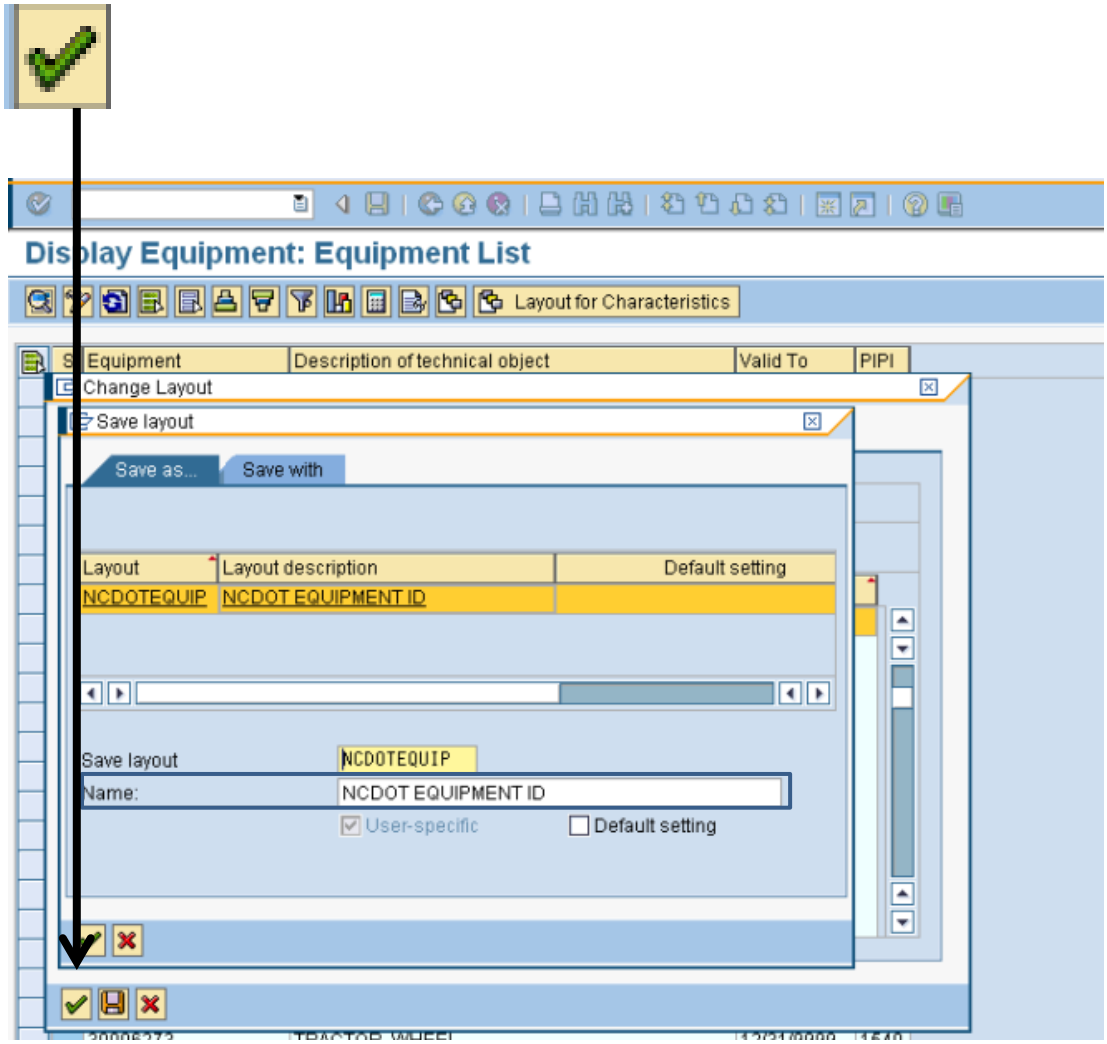
1. Select Line
2. Equipment
3. Inventory number
4. Description of technical object
5. Functional location
6. Maintenance plant
7. Planning plant
8. Acquisition date
9. Start-up date
10. Construction year
11. Manufacturer of asset
12. Model number
13. Acquisition Value

Step# 7. Once the required column names are displayed in the list on the left side of the page, select the save button and the bottom of the screen (shown below).



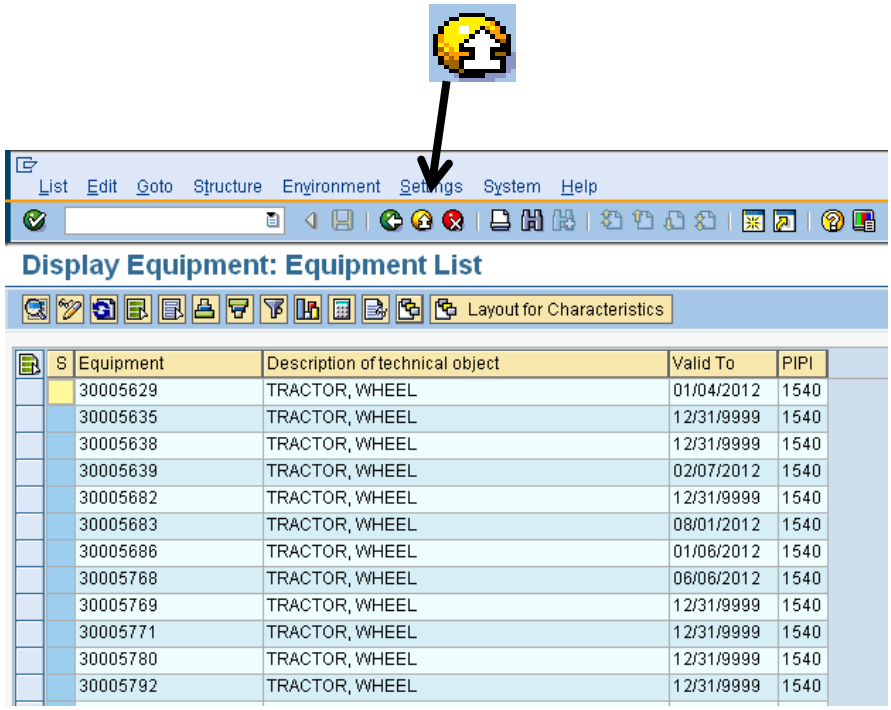
Step# 8. Selecting the save button will cause a new option box to be displayed requesting a name for the layout to be saved as.

Step# 9. In the **Name:** field enter NCDOT EQUIPMENT ID and select the check box (shown below) at the bottom of the screen when finished.



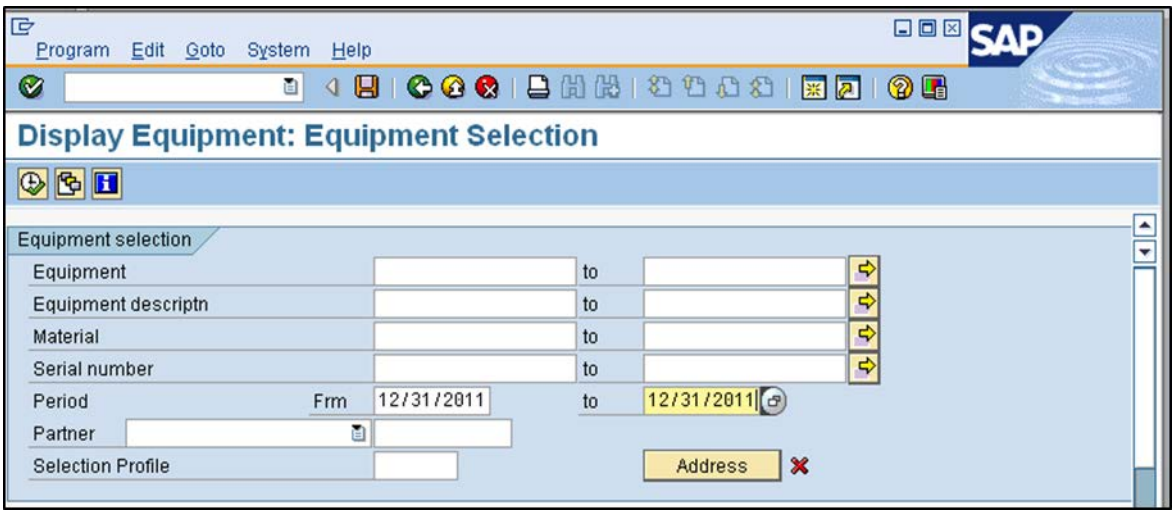
Step# 10. After completing the save process, the user will be returned to the screen from Step#6.

Step# 11. To return to Equipment Identification Sheet process, select the yellow return button at the top of the screen (shown below).

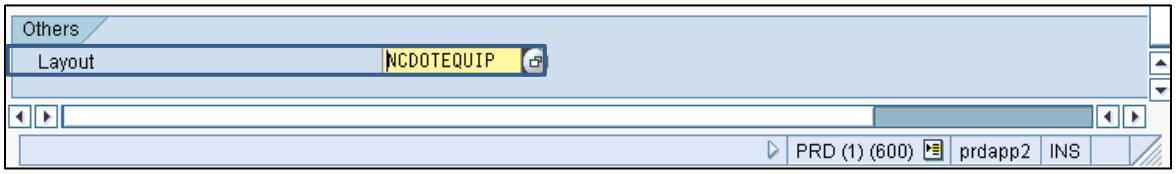


S	Equipment	Description of technical object	Valid To	PIPI
	30005629	TRACTOR, WHEEL	01/04/2012	1540
	30005635	TRACTOR, WHEEL	12/31/9999	1540
	30005638	TRACTOR, WHEEL	12/31/9999	1540
	30005639	TRACTOR, WHEEL	02/07/2012	1540
	30005682	TRACTOR, WHEEL	12/31/9999	1540
	30005683	TRACTOR, WHEEL	08/01/2012	1540
	30005686	TRACTOR, WHEEL	01/06/2012	1540
	30005768	TRACTOR, WHEEL	06/06/2012	1540
	30005769	TRACTOR, WHEEL	12/31/9999	1540
	30005771	TRACTOR, WHEEL	12/31/9999	1540
	30005780	TRACTOR, WHEEL	12/31/9999	1540
	30005792	TRACTOR, WHEEL	12/31/9999	1540

Step# 12. Executing Step#13 properly will return the user to the **Display Equipment** screen (shown below).



Step# 13. After arriving at the **Display Equipment** screen, ensure that NCDOTEQUIP is shown under the *Others* section of the screen for Layout.



Step# 14. Once this process is complete, **Section 2: Creating Equipment Identification Sheet** process can continue.

Appendix C Procedure Manual for Analyzing Fleet Economic Data

Procedure Manual for Analyzing Fleet Economic Data

This research was funded by the North Carolina Department of Transportation

C.1 Navigating the Fleet Analysis & Economic Modeling Application

C.1.1 Overview

The Fleet Analysis & Economic Modeling Application is a spreadsheet application designed and developed for the NCDOT Fleet and Material Management Unit to analyze fleet data. The application includes a Main worksheet and supporting worksheets that contain data required for analysis and provide brief instructions to the user.

C.1.2 Main Page

The main page of the Fleet Analysis and Economic Modeling Application is shown in Figure 2.2.1 and is where the user starts when analyzing equipment data.

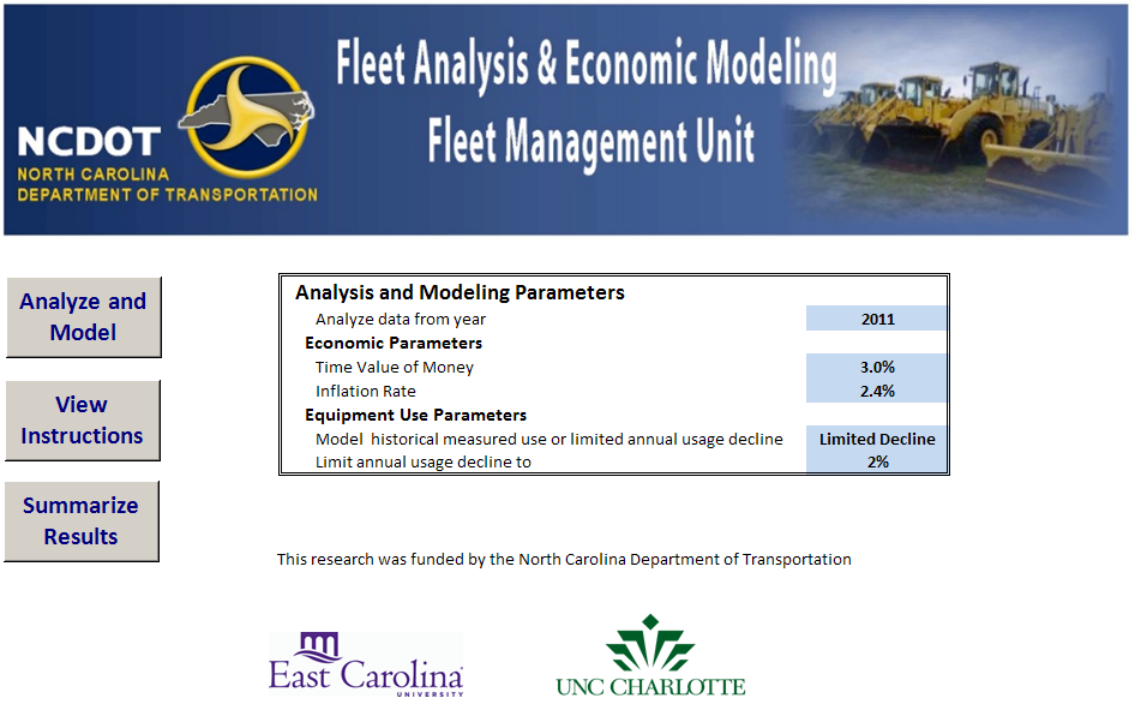


Figure 1 - Application Main Worksheet

The application home page includes buttons along the right side to initiate various functions and user defined analysis and modeling parameter values in center of the page.

Selecting the *Analyze and Model* button will begin the fleet modeling process. The user will be prompted to select the raw data file and analysis will be performed based on the analysis and modeling parameter values.

Seleting the *View Instructions* button causes the Instructions worksheet to appear.

The *Produce Data Summary* button creates a separate summary workbook of all analyzed files in a user selected folder.

C.1.3 Supporting Worksheets

There are three (3) supporting worksheets:

CPI – contains consumer price index (CPI) data and is discussed and described in section 2.2

MV Model – contains data regarding the rate of depreciation for equipment classes and is discussed and described in section 2.3

Instructions – provides brief instructions and information regarding the equipment analysis and results

C.2 Preparing for Data Analysis

Prior to performing the data analysis, there are four items that should be reviewed by the user:

1. Analysis and modeling parameter values
2. CPI data and base year
3. Market value model data
4. Raw data format

C.2.1 Analysis and Modeling Parameters

The equipment data analysis and modeling is based on economic and equipment use parameters set by the user. These are shown in Figure 3.1.1.

Analysis and Modeling Parameters	
Analyze data from year	**2011**
Economic Parameters	
Time Value of Money	**3.0%**
Inflation Rate	**2.4%**
Equipment Use Parameters	
Model historical measured use or limited annual usage decline	**Limited Decline**
Limit annual usage decline to	**2%**

Figure 2 – Analysis and Modeling Parameters

Analyze data from year –the calendar year for which equipment data has been collected. The value is used to label charts, tables, and data.

Time Value of Money – the annual rate at which the value of money is discounted.

Inflation Rate – the annual rate at which costs, in general, increase

Model historical measured use or limited annual usage decline – user selects either "Measured Use" or "Limited Decline" as the method for modeling annual equipment use.

Measured Use – annual equipment use is based solely on the historical data provided

Limited Decline – annual equipment use is adjusted to limit the year-over-year decline in use to the specified value

Limit annual usage decline to – the year-over-year decrease in equipment use specified as a percentage of the annual use when the machine is new

C.3 Consumer Price Index (CPI) Worksheet

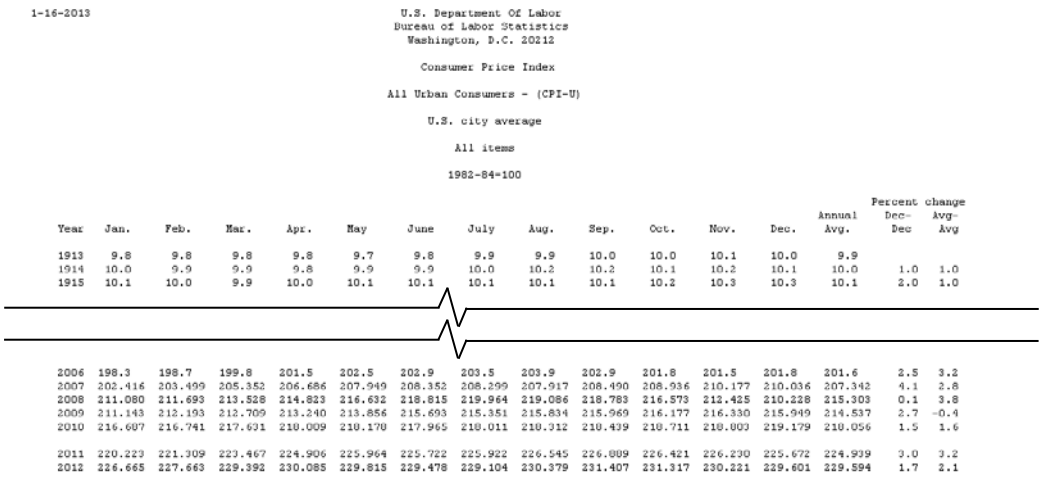
The Consumer Price Index (CPI) is used to convert equipment acquisition costs to an equivalent value in the year for which data is being analyzed. CPI data within the application must be kept current by updating the data annually with data from the US Bureau of Labor Statistics.

To update the CPI data:

1. Navigate to the Bureau of Labor Statistics list of tables:
   http://www.bls.gov/cpi/tables.htm

Figure 3 – Bureau of Labor Statistics List of Tables (http://www.bls.gov/cpi/tables.htm)

2. Select the link to *Tables Containing History of CPI-U U.S. All Items Indexes and Annual Percent Changes from 1913 to Present* (shown above)
3. Read the Annual Average CPI value corresponding to the year for which data being updated. For example, the average annual CPI value for 2012 was 229.594, as shown in Figure 4.



1-16-2013

U.S. Department Of Labor
Bureau of Labor Statistics
Washington, D.C. 20212

Consumer Price Index

All Urban Consumers - (CPI-U)

U.S. city average

All items

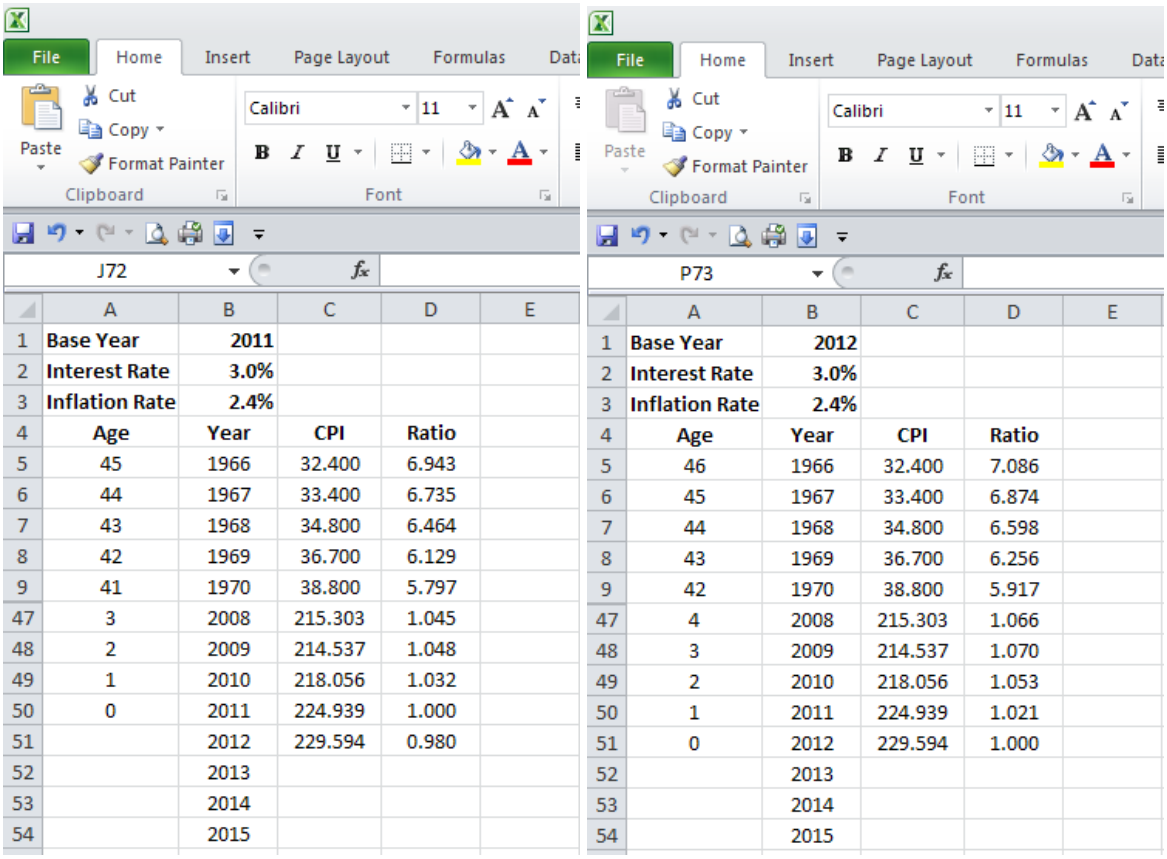
1982-84=100

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Annual Avg.	Percent change Dec-Dec	Percent change Avg-Avg
1913	9.8	9.8	9.8	9.8	9.7	9.8	9.9	9.9	10.0	10.0	10.1	10.0	9.9		
1914	10.0	9.9	9.9	9.8	9.9	9.9	10.0	10.2	10.2	10.1	10.2	10.1	10.0	1.0	1.0
1915	10.1	10.0	9.9	10.0	10.1	10.1	10.1	10.1	10.1	10.2	10.3	10.3	10.1	2.0	1.0
2006	198.3	198.7	199.8	201.5	202.5	202.9	203.5	203.9	202.9	201.8	201.5	201.8	201.6	2.5	3.2
2007	202.416	203.499	205.352	206.686	207.949	208.352	208.299	207.917	208.490	208.936	210.177	210.036	207.342	4.1	2.8
2008	211.080	211.693	213.528	214.823	216.632	218.815	219.964	219.086	218.783	216.573	212.425	210.228	215.303	0.1	3.8
2009	211.143	212.193	212.709	213.240	213.856	215.693	215.351	215.834	215.969	216.177	216.330	215.949	214.537	2.7	-0.4
2010	216.687	216.741	217.631	218.009	218.178	217.965	218.011	218.312	218.439	218.711	218.803	219.179	218.056	1.5	1.6
2011	220.223	221.309	223.467	224.906	225.964	225.722	225.922	226.545	226.889	226.421	226.230	225.672	224.939	3.0	3.2
2012	226.665	227.663	229.392	230.085	229.815	229.478	229.104	230.379	231.407	231.317	230.221	229.601	229.594	1.7	2.1

Figure 4: Published Annual CPI Values

4. Within the Fleet Analysis and Economic Modeling Application, select the CPI worksheet and scroll down to locate the row with the year for which CPI data is being updated.
5. Enter the average annual CPI value for the year in the column titled CPI (column C).

Notice that a value appeared in the column titled Ratio (column D) when the CPI value was entered. This value is the ratio of the CPI value in that year to the CPI value in the base year, which is defined by the user at the top of the worksheet. It will likely be appropriate to update the base year at this time as well. ***The base year should match the year for which data has been collected and is being analyzed.*** Figure 5 shows the CPI worksheet after CPI data has been updated, and before and after the base year has been updated.



	A	B	C	D	E
1	**Base Year**	**2011**			
2	**Interest Rate**	**3.0%**			
3	**Inflation Rate**	**2.4%**			
4	**Age**	**Year**	**CPI**	**Ratio**	
5	45	1966	32.400	6.943	
6	44	1967	33.400	6.735	
7	43	1968	34.800	6.464	
8	42	1969	36.700	6.129	
9	41	1970	38.800	5.797	
47	3	2008	215.303	1.045	
48	2	2009	214.537	1.048	
49	1	2010	218.056	1.032	
50	0	2011	224.939	1.000	
51		2012	229.594	0.980	
52		2013			
53		2014			
54		2015			

	A	B	C	D	E
1	**Base Year**	**2012**			
2	**Interest Rate**	**3.0%**			
3	**Inflation Rate**	**2.4%**			
4	**Age**	**Year**	**CPI**	**Ratio**	
5	46	1966	32.400	7.086	
6	45	1967	33.400	6.874	
7	44	1968	34.800	6.598	
8	43	1969	36.700	6.256	
9	42	1970	38.800	5.917	
47	4	2008	215.303	1.066	
48	3	2009	214.537	1.070	
49	2	2010	218.056	1.053	
50	1	2011	224.939	1.021	
51	0	2012	229.594	1.000	
52		2013			
53		2014			
54		2015			

Figure 5: Updated CPI Data

C.4 Market Value (MV) Model Worksheet

The market value (MV) model worksheet contains information regarding each equipment class that is necessary to model equipment depreciation. An example of the data contained is provided as Figure 6.

A	B	C	D	E	F
Class	Depreciation Term	Residual Value	Usage Metric	Maximum Age	Description
0200	5	20%	Miles	13	TRUCK,MISC SPCL USE 5000 GVW
0201	5	20%	Miles	13	TRUCK,PICKUP 5000 GVW
0202	5	20%	Miles	13	TRUCK,PICKUP 7500 GVW
0203	5	20%	Miles	13	TRUCK,UTILITY BODY 15000 GVW

Figure 6: Market Value Model Data

Specifically, the data contained on the worksheet are:

Class – the equipment class code

Depreciation Term – the period in years over which the resale value of the equipment declines from the acquisition cost to the residual value

Residual Value – the ultimate resale value of the equipment expressed as a percentage of the original acquisition cost

Usage Metric – the units used to measure use of the equipment; can hours, miles, or years

Maximum Age – This age is roughly 2.5 times the depreciation term and is the maximum age of equipment included in the analysis (equipment older than the maximum age will be excluded from the analysis)

Description – the NCDOT description of the equipment class

Only equipment classes listed on the MV Model worksheet can be analyzed. Additional equipment classes may be added, but must be added prior to analyzing data. Therefore, it is recommended that the user review the MV Model list and confirm that the required data is listed before initiating the analysis.

C.5 Raw Data Format

The contents and format of the raw data collected should be verified prior to initiating analysis. The raw data file must have 3 separate worksheets:

4. Equipment Identification
5. Equipment Rental Income
6. Equipment Utilization

Each work sheet must be correctly named and contain the appropriate data. The processes for collecting the raw data are described in the **Procedure Manual for Assembling NCDOT Fleet Performance Data for Economic Analysis**.

Samples of the raw data worksheets in the appropriate format are provided as Figures 7, 8, and 9.

	A	B	C	D	E	F	G	H	I	J	K	L
1	Equipment	Inventory no.	Description	Functional loc.	MaintPlant	Planning plant	Acquistion date	Start-up date	ConstructYear	Manufacturer	Model number	AcquistnValue
2	30011935	1462-8584-0200	TRUCK, MISCELLANEOUS	1N1-TRKMIS-000007-0200	0210	1540	5/1/1998	5/1/1998	1998	FORD	CLUBWAGON	21,138.03
3	30011938	1462-8588-0200	TRUCK, MISCELLANEOUS	1N1-TRKMIS-000008-0200	0610	1540	5/1/1998	5/1/1998	1998	FORD	CLUBWAGON	21,138.03
4	30014938	1462-8592-0200	TRUCK, MISCELLANEOUS	1N1-TRKMIS-000011-0200	1110	1540	6/1/1998	6/1/1998	1998	FORD	CLUBWAGON	20,417.50
5	30015316	1152-0176-0200	TRUCK, MISCELLANEOUS	1N1-TRKMIS-000012-0200	0210	1540	8/1/2002	8/1/2002	1992	CHEVROLET	SUBURBAN2500	18,500.00
6	30017146	1462-7865-0200	TRUCK, MISCELLANEOUS	1N1-TRKMIS-000026-0200	0210	1540	7/1/1997	7/1/1997	1997	FORD	CLUBWAGON	18,604.37
7	30020098	1462-7340-0200	TRUCK, MISCELLANEOUS	1N1-TRKMIS-000039-0200	0510	1540	3/1/1995	3/1/1995	1995	FORD	E350	19,746.91
8	30020536	1092-7932-0200	TRUCK, MISCELLANEOUS	1N1-TRKMIS-000043-0200	0610	1540	6/1/1999	6/1/1999	1999	DODGE	D3500	17,843.38
9	30020538	1092-7958-0200	TRUCK, MISCELLANEOUS	1N1-TRKMIS-000045-0200	1210	1540	8/1/2001	8/1/2001	2001	DODGE	D1500	20,523.78
10	30020599	1062-0868-0200	TRUCK, MISCELLANEOUS	1N1-TRKMIS-000051-0200	0810	1540	6/1/1998	6/1/1998	1999	CHEVROLET	SUBURBAN2500	26,798.58
11	30020606	1062-1183-0200	TRUCK, MISCELLANEOUS	1N1-TRKMIS-000052-0200	1410	1540	9/1/2001	9/1/2001	2001	CHEVROLET	SUBURBAN2500	28,707.36
12	30020611	1062-1167-0200	TRUCK, MISCELLANEOUS	1N1-TRKMIS-000054-0200	0710	1540	9/1/2000	9/1/2000	2000	CHEVROLET	SUBURBAN2500	30,114.21
13	30020612	1062-1157-0221	TRUCK, MISCELLANEOUS	1N1-TRKMIS-000055-0200	1010	1540	9/1/2000	9/1/2000	2000	CHEVROLET	SUBURBAN2500	32,310.64
14	30020614	1062-1064-0200	TRUCK, MISCELLANEOUS	1N1-TRKMIS-000057-0200	0510	1540	11/1/1999	11/1/1999	1999	CHEVROLET	SUBURBAN2500	27,826.30
15	30020637	1062-0430-0200	TRUCK, MISCELLANEOUS	1N1-TRKMIS-000066-0200	0710	1540	6/1/1993	6/1/1993	1993	CHEVROLET	SUBURBAN2500	18,880.93
16	30020703	1062-1189-0221	TRUCK, MISCELLANEOUS	1N1-TRKMIS-000077-0200	1410	1540	9/1/2001	9/1/2001	2001	CHEVROLET	SUBURBAN2500	31,272.88
17	30020723	1062-1480-0221	TRUCK, MISCELLANEOUS	1N1-TRKMIS-000079-0200	0710	1540	6/1/2002	6/1/2002	2002	CHEVROLET	SUBURBAN2500	28,941.79
18	30021105	1062-1187-0221	TRUCK, MISCELLANEOUS	1N1-TRKMIS-000086-0200	1010	1540	9/1/2001	9/1/2001	2001	CHEVROLET	SUBURBAN2500	31,272.88
19	30021152	1062-0781-0200	TRUCK, MISCELLANEOUS	1N1-TRKMIS-000107-0200	1210	1540	4/1/1997	4/1/1997	1997	CHEVROLET	SUBURBAN2500	26,554.20
20	30021223	1062-1489-0200	TRUCK, MISCELLANEOUS	1N1-TRKMIS-000115-0200	0410	1540	7/1/2002	7/1/2002	2002	CHEVROLET	SUBURBAN2500	25,849.00
21	30021537	1092-7883-0200	TRUCK, MISCELLANEOUS	1N1-TRKMIS-000118-0200	0110	1540	7/1/1993	7/1/1993	1993	DODGE	B350	15,269.24
22	30021605	1062-1181-0200	TRUCK, MISCELLANEOUS	1N1-TRKMIS-000123-0200	1210	1540	10/1/2001	10/1/2001	2001	CHEVROLET	SUBURBAN2500	28,707.36

Figure 7: Equipment Identification Worksheet in Raw Data File

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Equipment		Rental Income	PM Labor Cost	Repair Labor Cost	PM Parts Cost	Repair Parts Cost	Cost of Fuel	Cost of Oil	Cost of Tires	Total Cost	Profit/Loss	Rent Hours	Operating Hours	Odometer (Miles/Kms)	Cost per Rent Hour	Revenue Per hr	Profit/Loss per hr
2	30011935	TRUCK, MISCELLANEOUS	$ 324.00	$ 87.73	$ 1,122.71	$ 6.54	$ 802.71	$ 604.73	$ 5.62	$ 425.23	$ 3,055.27	-$ 2,731.27	40.000 H		2,503.000 MI	$ 76.38 /H	$ 8.10 /H	-$ 68.28 /H
3	30011938	TRUCK, MISCELLANEOUS	$ 8,650.80	$ 122.82	$ 480.32	$ 7.55	$ 112.63	$ 2,448.72	$ 29.15	$ 99.25	$ 3,300.44	$ 5,350.36	1,050.000 H		10,783.000 MI	$ 3.14 /H	$ 8.24 /H	$ 5.10 /H
4	30014938	TRUCK, MISCELLANEOUS	$ 1,652.40	$ 105.27	$ 1,047.61	$ 53.47	$ 338.07	$ 1,349.43	$ 30.81	$ 418.63	$ 3,343.29	-$ 1,690.89	204.000 H		5,120.000 MI	$ 16.39 /H	$ 8.10 /H	-$ 8.29 /H
5	30015316	TRUCK, MISCELLANEOUS	$ 13,312.00	$ 35.09	$ 929.56	$ 4.55	$ 431.87	$ 1,047.86	$ 8.47	$ 81.99	$ 2,539.39	$ 10,772.61	2,080.000 H		5,255.000 MI	$ 1.22 /H	$ 6.40 /H	$ 5.18 /H
6	30017146	TRUCK, MISCELLANEOUS		$ 175.45	$ 431.11	$ 7.05	$ 356.57	$ 120.34		$ 0.22	$ 1,090.74	-$ 1,090.74			462.000 MI		X	X
7	30020098	TRUCK, MISCELLANEOUS	$ 13,312.00	$ 228.09	$ 386.03	$ 29.06	$ 64.82	$ 1,237.14	$ 31.65	$ 201.63	$ 2,178.42	$ 11,133.58	2,080.000 H		5,997.000 MI	$ 1.05 /H	$ 6.40 /H	$ 5.35 /H
8	30020536	TRUCK, MISCELLANEOUS	$ 4,342.80	$ 298.27	$ 627.71	$ 11.46	$ 280.85	$ 2,766.08	$ 36.68	$ 191.70	$ 4,212.75	$ 130.05	652.000 H		12,810.000 MI	$ 6.46 /H	$ 6.66 /H	$ 0.20 /H
9	30020538	TRUCK, MISCELLANEOUS	$ 3,252.15	$ 140.36	$ 2,017.79	$ 6.25	$ 574.40	$ 2,385.52	$ 18.67		$ 5,142.99	-$ 1,890.84	401.500 H		7,845.000 MI	$ 12.81 /H	$ 8.10 /H	-$ 4.71 /H
10	30020599	TRUCK, MISCELLANEOUS	$ 6,491.55	$ 344.01	$ 1,618.79	$ 43.59	$ 377.59	$ 3,250.09	$ 80.10		$ 5,714.17	$ 777.38	842.250 H		14,059.000 MI	$ 6.78 /H	$ 7.71 /H	$ 0.92 /H
11	30020606	TRUCK, MISCELLANEOUS	$ 11,311.65	$ 298.27	$ 367.44	$ 40.14	$ 443.58	$ 3,211.97	$ 44.56	$ 265.08	$ 4,671.93	$ 6,639.72	1,404.500 H		14,567.000 MI	$ 3.33 /H	$ 8.05 /H	$ 4.73 /H
12	30020611	TRUCK, MISCELLANEOUS	$ 16,001.55	$ 298.27	$ 298.27	$ 23.42	$ 155.36	$ 2,311.49	$ 26.98	$ 8.82	$ 3,122.61	$ 12,878.94	1,975.500 H		10,401.000 MI	$ 1.58 /H	$ 8.10 /H	$ 6.52 /H
13	30020612	TRUCK, MISCELLANEOUS	$ 10,947.00	$ 210.54	$ 280.73	$ 4.34	$ 11.91	$ 1,741.08			$ 2,248.60	$ 8,698.40	890.000 H		6,952.000 MI	$ 2.53 /H	$ 12.30 /H	$ 9.77 /H
14	30020614	TRUCK, MISCELLANEOUS		$ 105.27	$ 1,860.09	$ 1.99	$ 136.70	$ 861.85	$ 12.15		$ 2,978.05	-$ 2,978.05			7,182.000 MI		X	X
15	30020637	TRUCK, MISCELLANEOUS													0.000 MI			
16	30020703	TRUCK, MISCELLANEOUS	$ 21,900.15	$ 91.23	$ 83.78	$ 18.41	$ 105.97	$ 2,953.38	$ 50.12		$ 3,302.89	$ 18,597.26	1,779.500 H		11,624.000 MI	$ 1.86 /H	$ 12.31 /H	$ 10.45 /H
17	30020723	TRUCK, MISCELLANEOUS	$ 11,727.93	$ 175.45	$ 13.60	$ 14.39		$ 76.78	$ 12.57		$ 292.79	$ 11,435.14	985.250 H		25.000 MI	$ 0.30 /H	$ 11.90 /H	$ 11.61 /H
18	30021105	TRUCK, MISCELLANEOUS	$ 2,041.80	$ 245.63	$ 105.28	$ 20.08	$ 31.84	$ 525.78			$ 928.61	$ 1,113.19	166.000 H		1,946.000 MI	$ 5.59 /H	$ 12.30 /H	$ 6.71 /H
19	30021152	TRUCK, MISCELLANEOUS	$ 13,312.00	$ 175.45	$ 2,035.26	$ 26.99	$ 996.37	$ 323.11		$ 226.32	$ 3,783.50	$ 9,528.50	2,080.000 H		1,138.000 MI	$ 1.82 /H	$ 6.40 /H	$ 4.58 /H
20	30021223	TRUCK, MISCELLANEOUS	$ 7,540.00	$ 350.90	$ 350.95	$ 29.78	$ 386.03	$ 2,890.77	$ 38.98		$ 4,027.41	$ 3,512.59	1,160.000 H		11,837.000 MI	$ 3.47 /H	$ 6.50 /H	$ 3.03 /H
21	30021537	TRUCK, MISCELLANEOUS	$ 4,837.25	$ 245.64	$ 561.48	$ 3.33	$ 61.94	$ 539.21	$ 11.17	$ 100.83	$ 1,523.60	$ 3,313.65	596.500 H		2,271.000 MI	$ 2.55 /H	$ 7.77 /H	$ 5.22 /H
22	30021605	TRUCK, MISCELLANEOUS	$ 12,668.40	$ 175.45	$ 52.64	$ 13.46	$ 4.07	$ 460.42			$ 706.04	$ 11,962.36	1,580.000 H		175.000 MI	$ 0.45 /H	$ 8.02 /H	$ 7.57 /H
23	30021611	TRUCK, MISCELLANEOUS	$ 13,312.00	$ 63.16	$ 217.18	$ 7.28	$ 113.48	$ 1,060.12	$ 16.78		$ 1,478.00	$ 11,834.00	2,080.000 H		4,911.000 MI	$ 0.71 /H	$ 6.40 /H	$ 5.69 /H
24	30021612	TRUCK, MISCELLANEOUS	$ 162.00	$ 87.73	$ 927.07	$ 7.28	$ 962.03	$ 563.70	$ 26.62		$ 2,574.43	-$ 2,412.43	20.000 H		1,238.000 MI	$ 128.72 /H	$ 8.10 /H	-$ 120.62 /H
25	30021613	TRUCK, MISCELLANEOUS	$ 13,260.00	$ 87.73	$ 245.67	$ 14.60	$ 48.30	$ 358.07			$ 754.37	$ 12,505.63	2,040.000 H		1,628.000 MI	$ 0.37 /H	$ 6.50 /H	$ 6.13 /H

Figure 8: Equipment Rental Income Worksheet in Raw Data File

	A	B	C	D	E	F	G	H	I	J
1	Equipment		Fuel Used	Rent Hours	Available Hours	Utilization				
2	30011935	TRUCK, MISCELLANEOUS	212.600 GAL	40.000 H	1,931.932 H	2.1				
3	30011938	TRUCK, MISCELLANEOUS	853.400 GAL	1,050.000 H	1,988.255 H	52.8				
4	30014938	TRUCK, MISCELLANEOUS	485.700 GAL	204.000 H	1,977.500 H	10.3				
5	30015316	TRUCK, MISCELLANEOUS	406.200 GAL	2,080.000 H	1,864.562 H	111.6				
6	30017146	TRUCK, MISCELLANEOUS	40.800 GAL	0	1,981.685 H	0.0				
7	30020098	TRUCK, MISCELLANEOUS	466.600 GAL	2,080.000 H	1,819.712 H	114.3				
8	30020536	TRUCK, MISCELLANEOUS	968.700 GAL	652.000 H	1,988.693 H	32.8				
9	30020538	TRUCK, MISCELLANEOUS	867.200 GAL	401.500 H	1,711.780 H	23.5				
10	30020599	TRUCK, MISCELLANEOUS	1,159.500 GAL	842.250 H	1,948.972 H	43.2				
11	30020606	TRUCK, MISCELLANEOUS	1,112.900 GAL	1,404.500 H	2,000.467 H	70.2				
12	30020611	TRUCK, MISCELLANEOUS	802.600 GAL	1,975.500 H	1,980.056 H	99.8				
13	30020612	TRUCK, MISCELLANEOUS	601.600 GAL	890.000 H	1,969.574 H	45.2				
14	30020614	TRUCK, MISCELLANEOUS	258.500 GAL	0	1,917.229 H	0.0				
15	30020637	TRUCK, MISCELLANEOUS		0	2,008.000 H	0.0				
16	30020703	TRUCK, MISCELLANEOUS	1,032.300 GAL	1,779.500 H	2,006.200 H	88.7				

Figure 9: Equipment Utilization Worksheet in Raw Data File

C.6 Performing the Analysis

To initiate the analysis, select the *Analyze and Model* button on left side of the Main worksheet. The user will be prompted to select the file containing the raw data to be analyzed. Navigate to the raw data file, select it, and select the Open button.

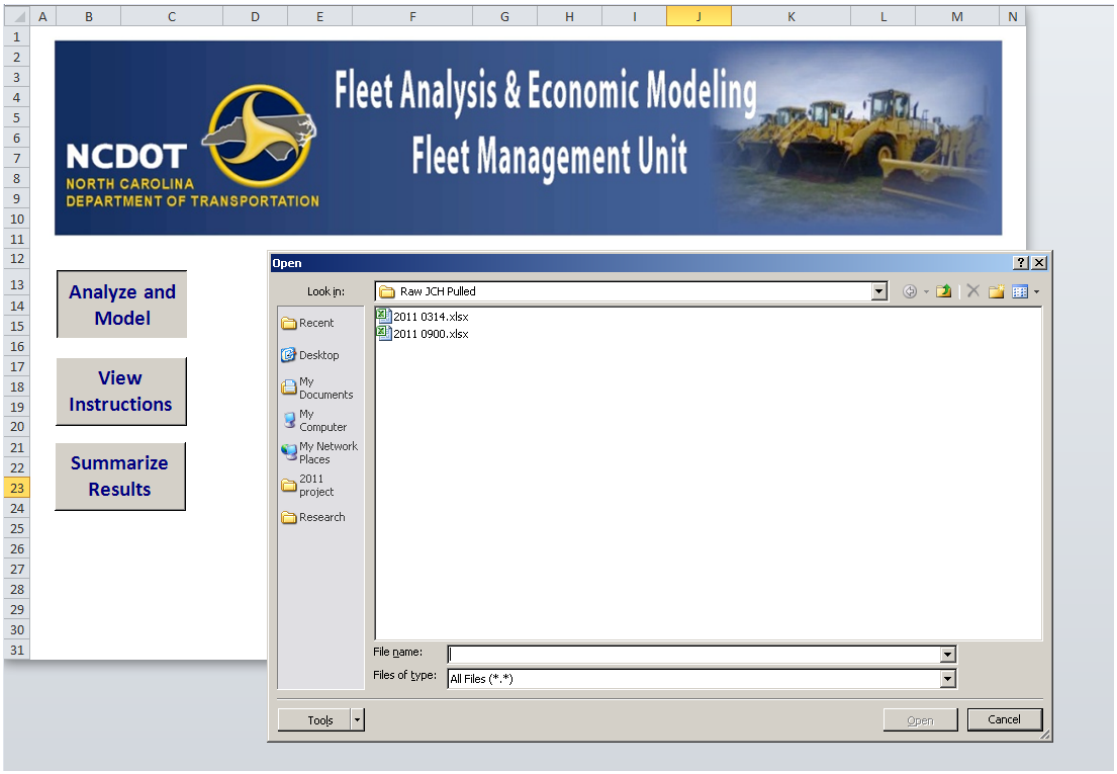


Figure 10: Specifying the Raw Data File for Analysis

The analysis process consists of processing the raw data and analyzing the data. A dialog box will appear to show the progress through the two processes.

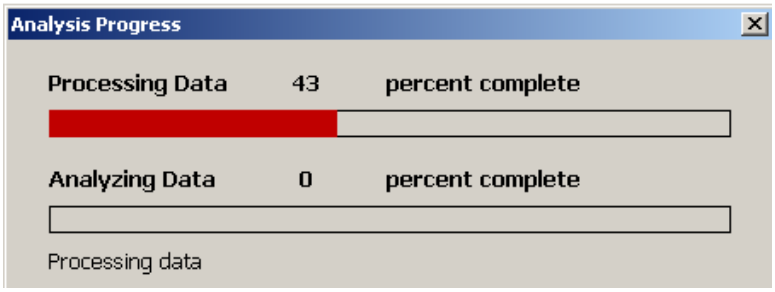


Figure 11: Analysis Progress Indicators

When the analysis is complete, the user is prompted to save the workbook containing the analysis and results. The default filename is the filename of the raw data file appended with "Analyzed".

C.7 Analysis Results

C.7.1 Overview of Results

The results of the analyses are contained in the "analyzed" workbook saved by the user. Results are in multiple forms, including tables, charts, histograms, mathematical models, and economic models. The makeup of results for equipment classes with use measured in miles or hours are slightly different than for classes measured in years. An analyzed workbook contains the following worksheets (ordered from right to left, and listed generally in the order created during analysis):

14. *Master* – combined raw data for all machines in the class
15. *Excluded Data* – data for machines excluded from the analysis
16. *Analyzed Data* – data for machines included in the analysis
17. *Data Summary* – data regarding machine acquisitions and data used to develop the histograms
18. *Process Summary* – summary of the equipment class; including a count of equipment by class code and functional code, and a count of equipment excluded by exclusion criteria
19. *Usage Model* – chart of annual use versus equipment age, including the mathematical model for annual use (not included for equipment use measured in years)
20. *Operating Rate Model* – chart of average annual operating rate versus equipment age, including the mathematical model for estimating annual operating rate
21. *Usage Histogram* – histogram of annual equipment use for analyzed equipment (not included for equipment use measured in years)
22. *Utilization Histogram* – histogram of equipment utilization for analyzed equipment
23. *Age Histogram* – histogram of equipment age for analyzed equipment
24. *Forward Analysis* – economic model and results of analyses considering reduced fleet sizes
25. *Current Analysis* – economic model and analysis results for the analyzed equipment fleet
26. *Analyses Summary* – summary of analyzed equipment class, economic analysis of current fleet, and forward analyses considering reduced fleet sizes

C.7.2 Data Worksheets

The data worksheets are the *Master*, *Excluded Data*, and *Analyzed Data* worksheets.

C.7.2.1 Master Worksheet

The *Master* worksheet contains the data for each machine in the equipment class, and is the raw data combined into a single worksheet. The purpose of this worksheet is to provide historical documentation of original data on which the analyses are performed.

C.7.2.2 Excluded Data Worksheet

The *Excluded Data* worksheet contains the data for each machine in the equipment class that was excluded from the analysis. Each machine record is tagged with the reason for exclusion from the analysis. Machines are excluded based on the following criteria:

6. Annual use (hours or miles) is NULL or 0
7. Machine age is greater than the maximum age or less than 1
8. Total cost (annual operating cost) is NULL, 0, or not included in the data

9. Date of machine acquisition is not included in the data
10. Annual operating rate is significantly different relative to other machines in the class. Rates are considered significantly different if the standardized residual is less than -3 or greater than 3.

C.7.2.3 Analyzed Data Worksheet

The Analyzed Data worksheet contains the data for each machine in the equipment class that was included in the analysis.

C.7.3 Equipment Fleet Summaries

The equipment fleet summaries are the *Data Summary* and *Process Summary* worksheets.

C.7.3.1 Data Summary Worksheet

The *Data Summary* worksheet contains data regarding the acquisition of machines included in the analysis and the acquisition value adjusted to the current year (year for which data is analyzed). This worksheet also contains the data required to develop the annual usage, utilization, and age histograms.

C.7.3.2 Process Summary Worksheet

The *Process Summary* worksheet is a snapshot summary of the analyzed machines of the equipment class in the year analyzed. The fleet is summarized in terms of number of machines, average and total use, average age, average utilization, average operating cost, and average adjusted acquisition value. Also included is a list and count of machines by class code and functional class. The number of machines excluded by criteria is also provided.

	A	B	C	D	E	F	G	H	I	J	K
1	Year	**2011**		Class Code	Count		Functional Class	Count		Exclusion Criteria	Count
2	Number of Units	329		0210	57		GIMAPT	57		Zero Use	16
3	Average Miles/Year	18,408		0220	171		TRUCK1	269		Null or Blank Use	0
4	Total Miles	6,056,288		0202	101		GMCHST	2		Age Over 20	19
5	Average Age of Fleet at Year End	6.1					PAINTM	1		Age Less Than 1	12
6	Average Utilization	82								Zero Cost	0
7	Average Cost per Mile	$ 0.41								Null Cost	0
8	CPI Corrected Acquisition Value	$ 27,367								Blank Cost	0
9										Outlying Operating Rate	29
10										No Acquisition Date	0

Figure 12: Process Summary Worksheet

C.7.4 Fleet Models

The fleet models are the *Usage Model* and the *Operating Rate Model* worksheets.

C.7.4.1 Usage Model Worksheet

The *Usage Model Worksheet* is a chart of the annual use versus equipment age. The annual use (hours or miles) of each machine included in the analysis is plotted against the machine age to depict the relationship between age and annual use. A linear mathematical model ($y = mx+b$) is fit to the data and used to estimate annual machine use throughout machine life.

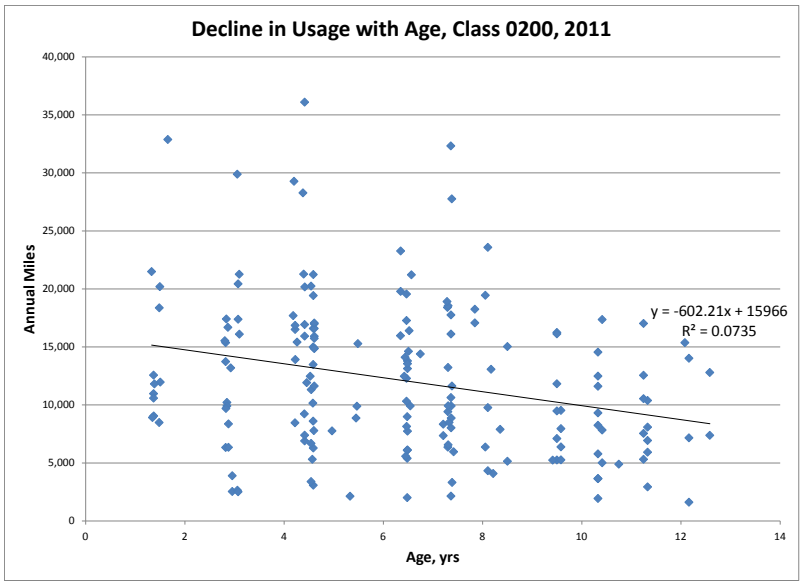


Figure 13: Usage Model Worksheet

C.7.4.2 Operating Rate Model Worksheet

The *Operating Rate Model* worksheet is a chart of the average annual operating rate (total operating cost divided by annual use) versus equipment age. The average annual operating rate of each machine included in the analysis is plotted against machine age to depict the relationship between age and average annual operating rate. An exponential mathematical model ($y = ke^{xt}$) is fit to the data and used to estimate the average annual operating rate throughout machine life.

Figure 14: Operating Rate Model Worksheet

C.7.5 Fleet Histograms

The fleet histograms are the *Usage Histogram*, *Utilization Histogram*, and *Age Histogram* worksheets.

C.7.5.1 Usage Histogram Worksheet

The *Usage Histogram* worksheet is a histogram chart depicting the distribution of annual use for the machines analyzed.

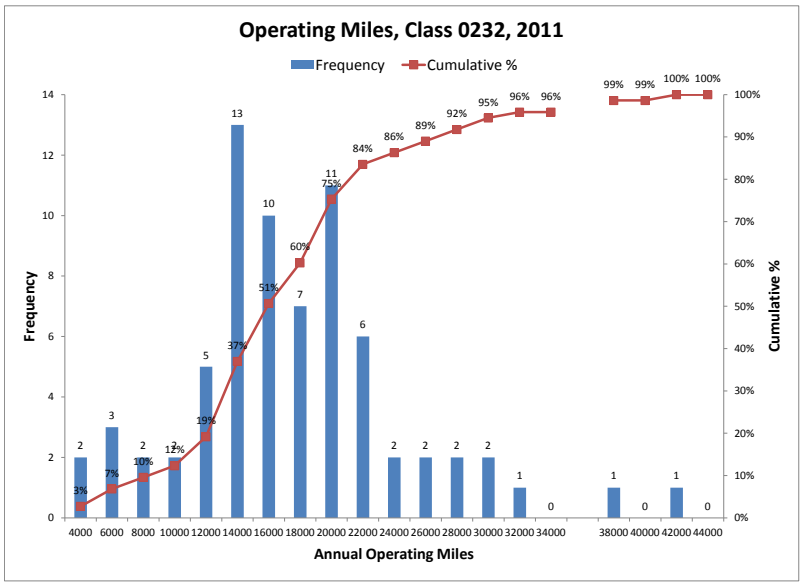


Figure 15: Usage Histogram Worksheet

C.7.5.2 Utilization Histogram Worksheet

The *Utilization Histogram* worksheet is a histogram chart depicting the distribution of equipment utilization for the machines analyzed.

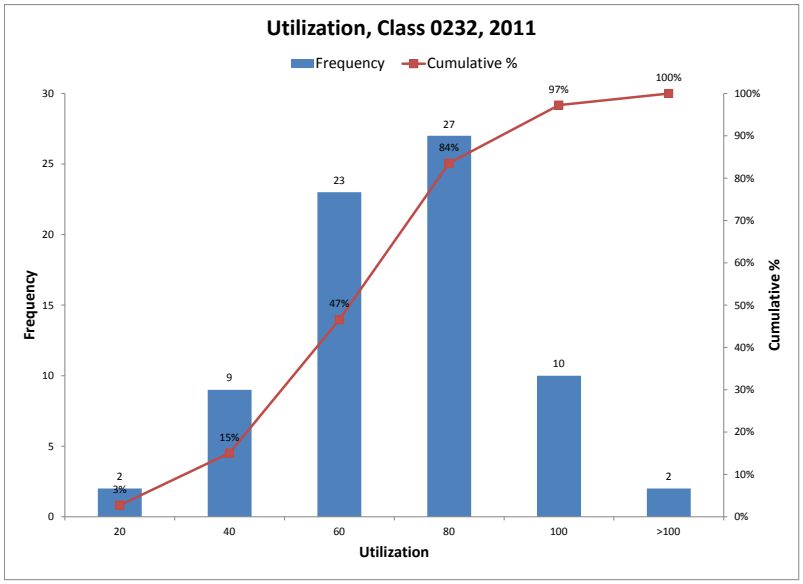


Figure 16: Utilization Histogram Worksheet

C.7.5.3 Age Histogram Worksheet

The *Age Histogram* worksheet is a histogram chart depicting the distribution of equipment ages for the machines analyzed.

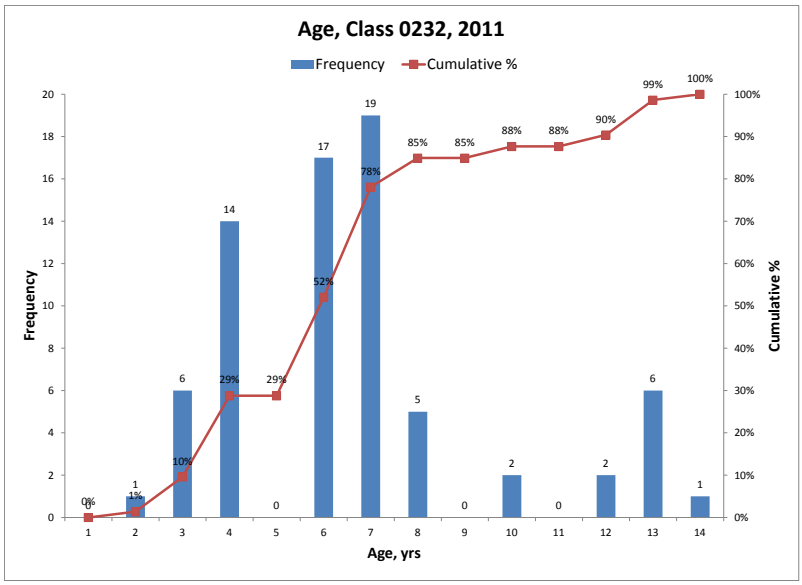


Figure 17: Age Histogram Worksheet

C.7.6 Analysis Worksheets

The analysis worksheets are the *Current Analysis*, *Forward Analysis*, and *Analyses Summary* worksheets.

C.7.6.1 Current Analysis Worksheet

The *Current Analysis* worksheet contains the economic model for a machine in the analyzed equipment class. The model consists of the estimated owning and operating costs for the machine throughout its life based on the usage and operating rate models. For each year, the annual owning and operating costs are estimated and an equivalent uniform annual cost (EUAC) is calculated to represent the costs, as a uniform series of annual costs, of owning and operating the machine from the time of acquisition to the end of each year. A typical economic model is provided as Figure 18. As an example, the life-to-date equivalent uniform annual cost (LTD EUAC) for owning and operating a machine for 10 years is estimated to be $32,642. This means that the cost of purchasing a machine, operating it for a period of 10 years, and disposing of the machine at the end of 10 years is estimated to be equivalent to paying $32,642 in each of the 10 years.

Total owning and operating costs are also modeled as an average life-to-date rate (cost per unit of use), and these estimated costs are provided in the column titled LTD Rate in Figure 18. Furthering the previous example, owning and operating a machine for 10 years is estimated to result in 171,018 miles of use and the average cost of each mile is $1.63. This cost is a present value cost, which means it is $1.63 per mile at the current value of money.

The economic model is used to estimate the economic life of machine in the equipment class, which is the period that ends when the average cost reaches a minimum. From Figure 18, the economic life based on EUAC is 18 years and the minimum EUAC is $31,623, and the economic life based on average life-to-date rate is 28 years and the minimum rate is $1.46 per mile.

Interest Rate	3%											
Initial MV	$ 91,606											
Depreciation Term	7											
Sum of Years	28											
Residual Value	20%											
Initial Miles	18,172											
Mile Decline	-214											
Cost/Mile	$ 1.11						Min	$ 31,623	per year		$ 1.46	per Mile
Annual Cost Factor	0.0151						Economic Life	16	years		28	years
Inflation Rate	0.024											

Year	Market Value	Owning EUAC	Miles	Operating Cost	Operating Cost PV	Operating EUAC	LTD EUAC	LTD Miles	LTD PV	LTD Rate ($/Mile)
0	$ 91,606									
1	$ 73,285	$ 21,069	18,065	$ 20,938	$ 20,329	$ 20,938	$ 42,008	18,065	$ 40,784	$ 2.26
2	$ 57,581	$ 19,509	17,851	$ 21,508	$ 20,274	$ 21,219	$ 40,729	35,917	$ 77,933	$ 2.17
3	$ 44,495	$ 17,990	17,637	$ 22,090	$ 20,216	$ 21,501	$ 39,491	53,554	$ 111,706	$ 2.09
4	$ 34,025	$ 16,512	17,423	$ 22,685	$ 20,155	$ 21,784	$ 38,296	70,977	$ 142,349	$ 2.01
5	$ 26,173	$ 15,073	17,209	$ 23,292	$ 20,092	$ 22,068	$ 37,141	88,186	$ 170,095	$ 1.93
6	$ 20,939	$ 13,673	16,995	$ 23,912	$ 20,026	$ 22,353	$ 36,026	105,180	$ 195,162	$ 1.86
7	$ 18,321	$ 12,312	16,781	$ 24,544	$ 19,956	$ 22,639	$ 34,951	121,961	$ 217,757	$ 1.79
8	$ 18,321	$ 10,990	16,566	$ 25,189	$ 19,884	$ 22,926	$ 33,915	138,527	$ 238,075	$ 1.72
9	$ 18,321	$ 9,962	16,352	$ 25,846	$ 19,809	$ 23,213	$ 33,175	154,879	$ 258,305	$ 1.67
10	$ 18,321	$ 9,141	16,138	$ 26,516	$ 19,730	$ 23,501	$ 32,642	171,018	$ 278,445	$ 1.63
11	$ 18,321	$ 8,470	15,924	$ 27,199	$ 19,649	$ 23,790	$ 32,260	186,941	$ 298,491	$ 1.60
12	$ 18,321	$ 7,912	15,710	$ 27,894	$ 19,564	$ 24,079	$ 31,991	202,651	$ 318,440	$ 1.57
13	$ 18,321	$ 7,441	15,496	$ 28,601	$ 19,476	$ 24,369	$ 31,809	218,147	$ 338,291	$ 1.55
14	$ 18,321	$ 7,037	15,282	$ 29,321	$ 19,385	$ 24,659	$ 31,696	233,429	$ 358,039	$ 1.53
15	$ 18,321	$ 6,688	15,067	$ 30,054	$ 19,290	$ 24,949	$ 31,637	248,496	$ 377,682	$ 1.52
16	$ 18,321	$ 6,384	14,853	$ 30,798	$ 19,192	$ 25,239	$ 31,623	263,349	$ 397,217	$ 1.51
17	$ 18,321	$ 6,116	14,639	$ 31,554	$ 19,091	$ 25,529	$ 31,645	277,988	$ 416,640	$ 1.50
18	$ 18,321	$ 5,878	14,425	$ 32,322	$ 18,986	$ 25,819	$ 31,697	292,413	$ 435,949	$ 1.49
19	$ 18,321	$ 5,666	14,211	$ 33,101	$ 18,877	$ 26,109	$ 31,775	306,624	$ 455,139	$ 1.48
20	$ 18,321	$ 5,476	13,997	$ 33,891	$ 18,765	$ 26,399	$ 31,874	320,621	$ 474,208	$ 1.48
21	$ 18,321	$ 5,304	13,783	$ 34,692	$ 18,649	$ 26,688	$ 31,992	334,403	$ 493,152	$ 1.47
22	$ 18,321	$ 5,148	13,568	$ 35,503	$ 18,529	$ 26,977	$ 32,125	347,972	$ 511,968	$ 1.47
23	$ 18,321	$ 5,006	13,354	$ 36,324	$ 18,405	$ 27,265	$ 32,271	361,326	$ 530,651	$ 1.47
24	$ 18,321	$ 4,877	13,140	$ 37,155	$ 18,278	$ 27,552	$ 32,429	374,466	$ 549,200	$ 1.47
25	$ 18,321	$ 4,758	12,926	$ 37,995	$ 18,146	$ 27,838	$ 32,597	387,392	$ 567,609	$ 1.47
26	$ 18,321	$ 4,649	12,712	$ 38,842	$ 18,011	$ 28,124	$ 32,773	400,104	$ 585,874	$ 1.46
27	$ 18,321	$ 4,548	12,498	$ 39,698	$ 17,872	$ 28,408	$ 32,956	412,602	$ 603,993	$ 1.46
28	$ 18,321	$ 4,455	12,284	$ 40,560	$ 17,728	$ 28,691	$ 33,146	424,885	$ 621,962	$ 1.46
29	$ 18,321	$ 4,369	12,069	$ 41,429	$ 17,580	$ 28,973	$ 33,342	436,954	$ 639,775	$ 1.46

Figure 18: Economic Model on the Current Analysis Worksheet

The economic model is also presented graphically as EUAC versus machine age and life-to-date rate versus machine age. These charts are provided as Figure 19.

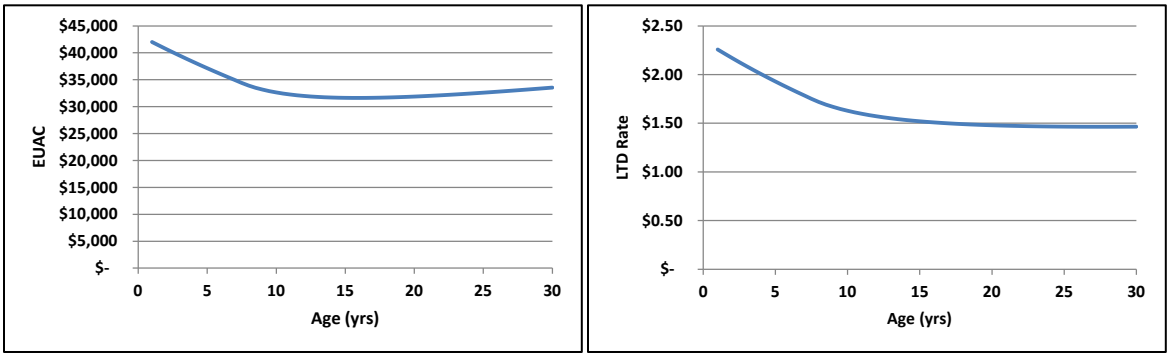


Figure 19: Economic Model Graphs

C.7.6.2 Forward Analysis Worksheet

The *Forward Analysis* worksheet is an economic model of a machine in an equipment class fleet where the number of machines in the fleet and/or machine usage model has been adjusted. The principal goal of the Forward Analysis is to evaluate the impact of reducing the fleet size on the timing (years) and magnitude (cost) of economic life. Additionally, if the user has specified in the Analysis and Modeling Parameters that the year-over-year decline in annual usage is to be limited to the user specified percentage of initial machine use, then the annual usage model is adjusted to reflect this and the modified usage model is incorporated into the Forward Analysis.

A reduction in fleet size requires modification to the usage model developed from the analyzed data. The principal constraint placed on the analysis is that the total fleet usage (total hours or miles worked in the year by all machines in the fleet) must be held constant. The parameters of the usage model are adjusted to consider a reduced number of machines and/or a limited year-over-year decline in annual usage.

The adjusted usage is mapped to the current usage and modeled to calculate an Effective Age Modeled, shown in Figure 20. The operating rate model is

Life	20		Decline	-834		a	0.0429101					
Fleet Size	37		Initial	41,700		b	1.9075394					
Year	Market Value	Owning EUAC	Miles	Age (Mile)	Eff Age (yrs)	Eff Age Model (yrs)	Operating Cost	Operating Cost PV	Operating EUAC	Total EUAC	Total PV	Total Rate
0	$ 91,606											
1	$ 73,285	$ 21,069	41,283	41,283	2.30	1.95	$ 48,538	$ 47,125	$ 48,538	$ 69,608	$ 67,580	$ 1.64
2	$ 57,581	$ 19,509	40,449	81,732	4.62	3.99	$ 50,216	$ 47,333	$ 49,364	$ 68,874	$ 131,788	$ 1.61
3	$ 44,495	$ 17,990	39,615	121,347	6.96	6.11	$ 51,996	$ 47,584	$ 50,216	$ 68,206	$ 192,929	$ 1.59
4	$ 34,025	$ 16,512	38,781	160,128	9.32	8.32	$ 53,885	$ 47,876	$ 51,093	$ 67,605	$ 251,293	$ 1.57
5	$ 26,173	$ 15,073	37,947	198,075	11.71	10.61	$ 55,889	$ 48,210	$ 51,996	$ 67,069	$ 307,157	$ 1.55
6	$ 20,939	$ 13,673	37,113	235,188	14.12	12.99	$ 58,015	$ 48,586	$ 52,927	$ 66,600	$ 360,785	$ 1.53
7	$ 18,321	$ 12,312	36,279	271,467	16.55	15.46	$ 60,269	$ 49,004	$ 53,885	$ 66,197	$ 412,428	$ 1.52
8	$ 18,321	$ 10,990	35,445	306,912	19.02	18.01	$ 62,658	$ 49,463	$ 54,871	$ 65,861	$ 462,324	$ 1.51
9	$ 18,321	$ 9,962	34,611	341,523	21.52	20.64	$ 65,190	$ 49,963	$ 55,887	$ 65,849	$ 512,709	$ 1.50
10	$ 18,321	$ 9,141	33,777	375,300	24.06	23.37	$ 67,873	$ 50,504	$ 56,933	$ 66,074	$ 563,621	$ 1.50
11	$ 18,321	$ 8,470	32,943	408,243	26.65	26.18	$ 70,714	$ 51,086	$ 58,009	$ 66,479	$ 615,104	$ 1.51
12	$ 18,321	$ 7,912	32,109	440,352	29.28	29.07	$ 73,723	$ 51,708	$ 59,116	$ 67,028	$ 667,197	$ 1.52
13	$ 18,321	$ 7,441	31,275	471,627	31.98	32.05	$ 76,907	$ 52,370	$ 60,255	$ 67,696	$ 719,941	$ 1.53
14	$ 18,321	$ 7,037	30,441	502,068	34.74	35.12	$ 80,275	$ 53,071	$ 61,427	$ 68,464	$ 773,375	$ 1.54
15	$ 18,321	$ 6,688	29,607	531,675	37.58	38.27	$ 83,835	$ 53,811	$ 62,632	$ 69,320	$ 827,539	$ 1.56
16	$ 18,321	$ 6,384	28,773	560,448	40.51	41.51	$ 87,598	$ 54,588	$ 63,870	$ 70,254	$ 882,470	$ 1.57
17	$ 18,321	$ 6,116	27,939	588,387	43.56	44.83	$ 91,571	$ 55,402	$ 65,143	$ 71,259	$ 938,204	$ 1.59
18	$ 18,321	$ 5,878	27,105	615,492	46.74	48.24	$ 95,762	$ 56,250	$ 66,451	$ 72,329	$ 994,777	$ 1.62
19	$ 18,321	$ 5,666	26,271	641,763	50.11	51.73	$ 100,179	$ 57,131	$ 67,794	$ 73,460	$ 1,052,221	$ 1.64
20	$ 18,321	$ 5,476	25,437	667,200	53.71	55.31	$ 104,831	$ 58,042	$ 69,172	$ 74,648	$ 1,110,567	$ 1.66
21	$ 18,321	$ 5,304	24,603	691,803	57.65	58.98	$ 109,722	$ 58,981	$ 70,586	$ 75,890	$ 1,169,844	$ 1.69
22	$ 18,321	$ 5,148	23,769	715,572	62.09	62.73	$ 114,857	$ 59,943	$ 72,036	$ 77,184	$ 1,230,074	$ 1.72
23	$ 18,321	$ 5,006	22,935	738,507	67.42	66.57	$ 120,240	$ 60,925	$ 73,521	$ 78,528	$ 1,291,277	$ 1.75
24	$ 18,321	$ 4,877	22,101	760,608	74.98	70.50	$ 125,872	$ 61,921	$ 75,042	$ 79,919	$ 1,353,468	$ 1.78
25	$ 18,321	$ 4,758	21,267	781,875	#NUM!	74.51	$ 131,750	$ 62,924	$ 76,597	$ 81,355	$ 1,416,655	$ 1.81
26	$ 18,321	$ 4,649	20,433	802,308	#NUM!	78.60	$ 137,868	$ 63,929	$ 78,186	$ 82,836	$ 1,480,838	$ 1.85
27	$ 18,321	$ 4,548	19,599	821,907	#NUM!	82.79	$ 144,216	$ 64,925	$ 79,808	$ 84,357	$ 1,546,010	$ 1.88
28	$ 18,321	$ 4,455	18,765	840,672	#NUM!	87.05	$ 150,779	$ 65,902	$ 81,462	$ 85,917	$ 1,612,153	$ 1.92
29	$ 18,321	$ 4,369	17,931	858,603	#NUM!	91.41	$ 157,532	$ 66,848	$ 83,144	$ 87,513	$ 1,679,234	$ 1.96
30	$ 18,321	$ 4,289	17,097	875,700	#NUM!	95.85	$ 164,443	$ 67,749	$ 84,853	$ 89,141	$ 1,747,209	$ 2.00

Figure 20: Forward Analysis Economic Model

A number of scenarios are modeled and the results are summarized on the Forward Analysis worksheet, as shown in Figure 21. A parameter used to adjust the usage model is the planned life for machines in the equipment class, which is the period for which the machine is planned to

remain a productive member of the class. Viable solutions to the Forward Analysis are considered to be those solutions where the planned life and economic life reasonable agree. For example, it would not be reasonable to plan to keep machines in the fleet for a life of 6 years when the modeled economic life is 12 years. It would be reasonable to plan for a machine life of 14 years when the modeled economic life is 13 years. The viable solutions are highlighted in green and the presented results are economic life (years), machine age at economic life (miles or hours), and total owning and operating rate at economic life (cost per mile or hour).

	O	P	Q	R	S	T	U	V	W	X
	Year at Minimum Total Rate									
	Portion	**Count/Life**	**6**	**8**	**10**	**12**	**14**	**16**	**18**	**20**
	100%	**73**	30	30	30	30	30	30	29	27
	90%	**66**	30	30	29	27	26	24	23	22
	80%	**58**	24	23	22	21	20	19	**18**	18
	70%	**51**	19	18	17	17	16	**16**	15	14
	60%	**44**	15	14	14	**13**	**13**	13	12	12
	50%	**37**	12	11	**11**	**11**	10	10	10	9
	Age at Minimum Total Rate									
	Portion	**Count/Life**	**6**	**8**	**10**	**12**	**14**	**16**	**18**	**20**
	100%	**73**	377,640	385,770	394,410	403,620	412,980	422,520	424,734	416,489
	90%	**66**	417,780	426,690	427,692	418,892	418,366	406,176	403,949	401,038
	80%	**58**	412,896	409,573	405,746	401,142	395,920	389,852	**383,076**	392,652
	70%	**51**	396,236	388,314	379,423	388,076	378,208	**387,264**	376,350	364,252
	60%	**44**	380,483	367,108	375,326	**360,503**	**368,966**	377,702	361,284	370,320
	50%	**37**	374,760	355,009	**362,907**	**371,140**	349,110	357,440	366,130	341,523
	Minimum Total Rate									
	Portion	**Count/Life**	**6**	**8**	**10**	**12**	**14**	**16**	**18**	**20**
	100%	**73**	$ 1.46	$ 1.46	$ 1.46	$ 1.46	$ 1.46	$ 1.47	$ 1.47	$ 1.47
	90%	**66**	$ 1.46	$ 1.47	$ 1.47	$ 1.47	$ 1.47	$ 1.48	$ 1.48	$ 1.48
	80%	**58**	$ 1.48	$ 1.48	$ 1.48	$ 1.48	$ 1.49	$ 1.49	**$ 1.49**	$ 1.49
	70%	**51**	$ 1.49	$ 1.49	$ 1.49	$ 1.49	$ 1.50	**$ 1.50**	$ 1.50	$ 1.50
	60%	**44**	$ 1.50	$ 1.50	$ 1.50	**$ 1.50**	**$ 1.50**	$ 1.50	$ 1.50	$ 1.50
	50%	**37**	$ 1.50	$ 1.50	**$ 1.50**	**$ 1.50**	$ 1.50	$ 1.50	$ 1.50	$ 1.50

Figure 21: Forward Analysis Solutions

C.7.6.3 Analyses Summary Worksheet

The *Analyses Summary* worksheet is designed to provide a single page summary of the current fleet, parameters and results of the economic model for the current fleet, and forward analyses solutions. The results are also flagged if any of the following conditions are observed:

7. *Increasing use with age* – the slope parameter of the usage model (annual decline in use) is greater than zero, indicating that annual use increases with machine age
8. *Negative Initial Use* – the intercept parameter of the usage model (annual use in the first year) is less than zero
9. *Decreasing Cost with age* – the annual cost increase parameter of the operating cost model is less than zero, indicating that operating rate decreases with machine age
10. *Very large increasing cost with age* – the annual cost increase parameter of the operating cost model is greater than 0.1, indicating that the operating rate increases greatly with machine age
11. *Very small increasing cost with age* – the annual cost increase parameter of the operating cost model is less than 0.01, indicating that the operating rate only slightly increases with machine age
12. *Small number of machines* – the number of machines on which the analysis was based is less than 20

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**0202**							
Description:	TRUCK, 7500 GVW							
Functional Code:	All (4)							
Fleet Status Summary								
Data from year	2011							
Number of units	329							
Average annual usage	18,408	Miles						
Total annual fleet usage	6,056,288	Miles/yr						
Average unit age at year end	6.1	yrs						
Average unit utilization	82.2 %							
Average operating rate	$ 0.41	per Mile						
Economic Analyses								
Input Values								
Interest Rate	3.0 %							
Inflation Rate	2.4 %							
Purchase Price	$ 27,367							
Depreciation Term	5	yrs						
Residual Value	20 %							
Initial operating rate	$ 0.37	per Mile						
Annual operating rate factor	0.0096							
Analyses Results								
	Current Fleet		**Reduced Fleet Size**					
Fleet reduction	**0 %**		**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	329		329	296	263	230	197	165
Initial usage (Miles)	28,145		33,920	34,109	38,389	40,077	43,046	51,394
Annual usage decline (Miles)	-1,609		-1,939	-1,950	-2,194	-2,291	-2,461	-2,938
Economic life (yrs)	No Min		16	15	14	13	11	9
Age at economic life (Miles)			294,528	292,260	322,434	327,412	324,616	343,557
LTD total rate at economic life ($/Miles)			$ 0.47	$ 0.47	$ 0.47	$ 0.47	$ 0.47	$ 0.47

These analyses revealed the following issues:
- Very small increasing cost with age

Figure 22: Analyses Summary Worksheet

Appendix D Resale Value Model Parameters

Class	Description	NCDOT Depreciation Term (yrs)	USACE			Modeled Depreciation Term (yrs)
			Hours	Life Years	Salvage Value (% of Purchase)	
0200	TRUCK,MISC SPCL USE 5000 GVW	5	8,000	4.0	20%	5
0201	TRUCK,PICKUP 5000 GVW	5	8,000	4.0	20%	5
0202	TRUCK,PICKUP 7500 GVW	5	8,000	4.0	20%	5
0203	TRUCK,UTILITY BODY 15000 GVW	5	10,000	5.0	20%	5
0204	TRUCK,CREW CAB	5	8,000	4.0	20%	5
0205	TRUCK,DUMP 33000 GVW	8	12,000	6.0	20%	7
0206	TRUCK,MISC 32000 GVW	8	12,000	6.0	20%	7
0207	TRUCK, MAP 5,000/7500 GVW, EXT. CAB	4	8,000	4.0	20%	4
0208	TRUCK, ATTENUATOR	8	12,000	6.0	20%	7
0209	TRUCK,CREW CAB 32000 GVW	8	12,000	6.0	20%	7
0210	TRUCK, MAP 4X4 EXT CAB 9,900 GVW	4	8,000	4.0	20%	4
0211	TRUCK, 22,000 GVW	5	10,000	5.0	20%	5
0212	TRUCK,DUMP TANDEM 50000 GVW	10	12,000	6.0	20%	8
0213	TRUCK, DRILL 4WD 20,000 GVW	10	10,000	5.0	20%	8
0214	TRUCK, TRACTOR 35,000 GVW	10	12,000	6.0	20%	8
0217	TRUCK,TRACTOR TANDEM 50000 GVW	10	12,000	6.0	20%	8
0218	TRUCK, 37,000 GVW	10	12,000	6.0	20%	8
0219	TRUCK,C&C TILT CAB 31000 GVW	10	12,000	6.0	20%	8
0220	TRUCK,PICKUP 4WD 7500 GVW	5	8,000	4.0	20%	5
0221	TRUCK,MISC SPCL USE 4WD 5000 GVW	5	8,000	4.0	20%	5
0222	TRUCK,PICKUP 4WD 5000 GVW (IMAP)	5	8,000	4.0	20%	5
0224	TRUCK,CREW CAB 4WD 7500 GVW	5	8,000	4.0	20%	5
0227	TRUCK, TRACTOR TANDEM 75,000 GVW	12	12,000	6.0	20%	9
0230	TRUCK,C&C TANDEM 50000 GVW	10	12,000	6.0	20%	8

Class	Description	NCDOT Depreciation Term (yrs)	USACE			Modeled Depreciation Term (yrs)
			Hours	Life Years	Salvage Value (% of Purchase)	
0232	TRUCK,DUMP,4 AXLE 5000 GVW	10	8,000	4.0	20%	7
0233	TRUCK C & C,15,000-18,000 GVWR	5	10,000	5.0	20%	5
0234	TRUCK, >15,000-18,000 GVW, 4X4	8	10,000	5.0	20%	7
0235	BUS, 25-48 PASS	10	10,000	5.0	20%	8
0236	UTILITY VEHICLE OFF ROAD	5	10,000	5.0	10%	5
0270	TRUCK BEDS FOR MED. DUTY TRUCKS	5	8,000	4.0	10%	5
0271	TRUCK BEDS, STAKE BODY	10	8,000	4.0	10%	7
0272	DUMP TRUCK BODIES	6	8,000	4.0	10%	5
0273	UTILITY BODIES	5	8,000	4.0	20%	5
0274	SPECIALTY BODIES	5	8,000	4.0	20%	5
0299	NON REPLACEMENT	5	8,000	4.0	20%	5
0300	TRACTOR, WHEEL 30-40 HP	10	14,000	7.1	15%	9
0301	TRACTOR, WHEEL, 41-60 HP	10	14,000	7.1	15%	9
0302	TRACTOR,WHEEL 51-80 DBHP	10	14,000	7.1	15%	9
0303	TRACTOR,WHEEL 81-99 DBHP	10	14,000	7.1	15%	9
0311	TRACTOR,WHEEL 100 & UP DBHP	10	14,000	7.1	15%	9
0314	BACKHOE,LOADER TRACTOR MTD	8	10,000	5.0	25%	7
0324	BACKHOE, LOADER TRACTOR MTD 4WD/4WS	8	10,000	5.0	20%	7
0404	TRACTOR, CRAWLER 90-115 FWHP	10	10,000	5.0	30%	8
0405	TRACTOR,CRAWLER 150-190 FWHP	10	10,000	5.0	30%	8
0900	GRADER,155 HP 25000 LB	10	14,500	7.3	25%	9
1000	ASHPALT PLANT 30 TON PER HOUR	10	8,000	4.0	20%	7
1010	ASPHALT PATCHING MACHINE, TRAILER MOUNTED	10	10,000	5.0	20%	8
1011	PAVER, ASHPALT GRINDER	8	6,000	3.0	20%	6
1012	ASPHALT PATCH MACHINE	10	8,000	4.0	20%	7
1013	ASPHALT MILLING MACHINE	10	6,000	3.0	20%	7

Class	Description	NCDOT Depreciation Term (yrs)	USACE			Modeled Depreciation Term (yrs)
			Hours	Life Years	Salvage Value (% of Purchase)	
1014	LOADER, SKID STEER	10	8,000	4.0	20%	7
1100	PUMP, ASPHALT	5	10,000	5.0	10%	5
1150	PAVER, 6-8 TON WHEEL MOUNT	10	8,000	4.0	15%	7
1151	PAVER, 6-8 TON TRACK MOUNT	10	8,000	4.0	15%	7
1152	PAVER, 9-12 TON	10	8,000	4.0	15%	7
1154	PAVER, PULL TYPE	10	10,000	5.0	20%	8
1300	TANK, ASPHALT 600 GAL UTILITY	8	6,000	3.0	20%	6
1302	DISTRIBUTOR,ASPHALT 1250-1500 GAL	10	6,000	3.0	10%	7
1306	SEALER, JOINT/CRACK TRL MTD	10	5,000	2.5	20%	6
1307	KETTLE, ASPHALT, 250 GAL	7	6,000	3.0	20%	5
1400	BROOM, FRONT TRACTOR MOUNTED ATTACHMENT	10	8,000	4.0	10%	7
1404	SWEEPER, INTEGRAL	10	8,000	4.0	10%	7
1410	ASPAHALT MAINTAINER	7	5,000	2.5	20%	5
1441	BITUMEN APPLICATOR TRL MTD	5	5,000	2.5	10%	5
1450	PAINT MACHINE,CTR EDGELINE ATT	5	10,000	5.0	10%	5
1453	PAINT MACHINE, PRELINE	5	10,000	5.0	10%	5
1454	PAINT MACHINE, TRAFFIC STRIPER HAND	5	10,000	5.0	10%	5
1456	PAINT REMOVER, TRAFFIC LINE HAND	10	10,000	5.0	10%	10
1457	THERMOPLASTIC APPLICATION UNIT	6	10,000	5.0	10%	6
1462	VACUUM STREET SWEEPER, SELF PROPELLED	10	10,000	5.0	20%	8
1470	VACUUM, SELF PROPELLED, SMALL	10	10,000	5.0	20%	8
1500	COMPRESSOR,AIR 105-150, CFM	10	12,000	6.0	15%	8
1503	COMPRESSOR, AIR 210-250 CFM	10	12,000	6.0	15%	8
1510	COMPRESSOR,AIR 750 CFM	10	12,000	6.0	15%	8
1511	COMPRESSOR,AIR, 35 CFM	5	12,000	6.0	15%	6
1512	COMPRESSOR,AIR 10 CFM	5	12,000	6.0	15%	6

Class	Description	NCDOT Depreciation Term (yrs)	USACE			Modeled Depreciation Term (yrs)
			Hours	Life Years	Salvage Value (% of Purchase)	
1600	SALT DOME	10	8,000	4.0	20%	7
1601	SYSTEM, SALT BRINE PRODUCTION	20	8,000	4.0	20%	12
1602	TANK, SALT BRINE STORAGE	20	8,000	4.0	20%	12
1603	STATION, SALT BRINE FILL	20	8,000	4.0	20%	12
1604	SYSTEM, SALT BRINE APPLICATOR	20	8,000	4.0	20%	12
1700	AUGER, PORTABLE TWO MAN	10	10,000	5.0	25%	8
1701	DRILL, ROCK DRILL, AIR TRACK 4 TO 4 1/2 INCH	10	14,000	7.1	25%	9
1703	DRILL, GRAIN FERTILIZER ATTACHMENT	4	10,000	5.0	20%	5
1708	DRILL, DIAMOND CORE	10	10,000	5.0	25%	8
1709	DRILL, AUGER	10	10,000	5.0	25%	8
1711	DRILL, AUGER CORE W/CARRIER	10	10,000	5.0	25%	8
1712	DRILL, AUGER CORE SKID MOUNTED	10	10,000	5.0	25%	8
1713	CARRIER, PNEUMATIC TIRED ATV	10	10,000	5.0	25%	8
1715	DRILL, VERTICAL CORE, (ACKER)	10	10,000	5.0	25%	8
1717	DRILL, HYDRAULIC ROCK	10	10,000	5.0	25%	8
1718	CARRIER, SOFT TRACK	10	10,000	5.0	25%	8
1720	BREAKER, ATTACHMENT	5	6,000	3.0	20%	5
1730	DRIVER, POST LARGE	10	6,000	3.0	20%	7
1800	WRECKER, ATTACHMENT	8	8,000	4.0	20%	6
1802	AERIAL DEVICE, TRUCK MTD	8	8,000	4.0	10%	6
1803	AERIAL DEVICE, 37,40,55 FT TRK MTD	10	8,000	4.0	10%	7
1805	DIGGER, DERRICK AUGER	10	10,000	5.0	25%	8
1806	MANLIFT, SELF-POWERED	10	8,000	4.0	10%	7
1807	PLATFORM, TRAILER MOUNTED	6	8,000	4.0	10%	5
1814	CRANE, 15 TON	10	14,000	7.1	15%	9
1815	CRANE, 16-18 TON	10	14,000	7.1	15%	9

Class	Description	NCDOT Depreciation Term (yrs)	USACE			Modeled Depreciation Term (yrs)
			Hours	Life Years	Salvage Value (% of Purchase)	
1822	AERIAL WORK PLATFORM	10	8,000	4.0	10%	7
1852	EXCAVATOR, RUBBER TIRE (15-17 METRIC TON.)	10	8,000	4.0	25%	7
1853	EXCAVATOR, CRAWLER (20 METRIC TON)	10	8,500	4.3	25%	7
1854	EXCAVATOR, CRAWLER (12-13 METRIC TON)	10	8,500	4.3	25%	7
1855	EXCAVATOR, COMPACT	10	8,000	4.0	25%	7
2002	LOADER,2 CY RUB TIRED	10	9,250	4.7	25%	7
2008	LOADER 2 CUBIC YARD CRAWLER	10	10,000	5.0	20%	8
2009	LOADER,FORCE FEED	10	10,000	5.0	20%	8
2013	CRANE, MECHANIC	5	8,000	4.0	20%	5
2014	LOADER, RUBBER TIRE 4 CY	10	9,250	4.7	25%	7
2020	GRAPPLE	10	10,000	5.0	10%	10
2101	GENERATOR,4 KW	5	10,000	5.0	10%	5
2102	GENERATOR, POWER SYSTEMS	5	8,000	4.0	10%	5
2105	POWER UNIT, AUXILIARY	5	8,000	4.0	10%	5
2115	LIGHT PLANT	10	8,000	4.0	20%	7
2205	MIXER, MORTAR 2 BAG	10	5,000	2.5	20%	6
2206	MIXER, CONCRETE 1 CUBIC YARD (TUB TYPE)	5	5,000	2.5	20%	4
2207	MIXER, CONCRETE 2 CUBIC YARD (TUB TYPE)	5	5,000	2.5	20%	4
2209	MIXER, ASPHALT PORTABLE PLANT	10	8,000	4.0	20%	7
2212	MIXER, PULVERIZER SELF PROPELLED	10	6,000	3.0	15%	7
2215	IMPACTOR, HYDRAULIC, ATTACHMENT	10	25,000	12.6	10%	11
2300	GUARDRAILMOWER ATTACHMENT	10	10,000	5.0	20%	7
2301	MOWER ATTACHMENTS	5	10,000	5.0	20%	5
2308	MOWER, A-BOOMATTACHMENTS	10	10,000	5.0	20%	8
2310	MOWER, RIDING TYPE	8	4,000	2.0	15%	5
2311	RIDING SLOPE MOWER	8	8,000	4.0	10%	6

Class	Description	NCDOT Depreciation Term (yrs)	USACE			Modeled Depreciation Term (yrs)
			Hours	Life Years	Salvage Value (% of Purchase)	
2400	RADIO, MOBILE 100 WATT PERM MOUNT	10	10,000	5.0	10%	10
2403	BASE STATION RADIO	5	10,000	5.0	10%	5
2411	RADIO, PORTABLE HAND-HELD	5	10,000	5.0	10%	5
2500	ROLLER, SHEEP FOOT TOW TYPE	10	8,000	4.0	20%	7
2502	ROLLER, 5-8 TON TANDEM	6	8,000	4.0	20%	5
2504	ROLLER, RUBBER TIRE SELF PROPELLED	6	8,000	4.0	25%	5
2507	ROLLER, VIBRATORY SELF PROPELLED	6	8,000	4.0	25%	5
2508	ROLLER, 8-12-TON TANDEM	8	10,000	5.0	15%	7
2510	ROLLER, 4-6 TON TANDEM PATCH	6	10,000	5.0	15%	6
2511	ROLLER, PATCH SMALL	6	10,000	5.0	15%	6
2512	ROLLER, VIBRATORY HIGH PRESSURE	10	8,000	4.0	20%	7
2513	ROLLER, VIBRATORY 3 TON SMOOTH DRUM	6	8,000	4.0	20%	5
2604	SCRAPER,11 CY SELF PROPELLED	10	15,000	7.6	20%	9
2703	CRANE, 25-30 TON, CRAWLER	10	18,000	9.1	20%	10
2704	CRANE, 50 TON, CRAWLER	10	18,001	9.1	20%	10
2850	SPREADER, WIDENER, SELF PROPELLED	10	8,000	4.0	20%	7
2851	SHOULDER MACHINE	10	8,000	4.0	15%	7
2852	DITCHER MACHINE	10	8,000	4.0	15%	7
2853	SPREADER,AGGREGATE SELF PROP	10	8,000	4.0	20%	7
2860	DITCHER, SELF PROP	10	8,000	4.0	15%	7
3151	TANK,LUBE FUEL	12	10,000	5.0	25%	9
3201	TRAILER,15-20 TON	10	10,000	5.0	10%	8
3202	TRAILER, HEAVY EQUIPMENT TRANSPORT	10	10,000	5.0	10%	8
3203	TRAILER, MATERIAL TRANSPORT	10	10,000	5.0	10%	8
3205	TRAILER, SPECIAL PURPOSE	10	10,000	5.0	10%	8
3206	TRAILER,50 TON LOW BED	10	10,000	5.0	10%	8

Class	Description	NCDOT Depreciation Term (yrs)	USACE			Modeled Depreciation Term (yrs)
			Hours	Life Years	Salvage Value (% of Purchase)	
3214	TRAILER, UTILITY	10	10,000	5.0	10%	8
3221	MODULAR OFFICE, SINGLE	10	10,000	5.0	10%	10
3222	MODULAR OFFICE, DOUBLE	10	10,000	5.0	10%	10
3223	MODULAR OFFICE, TRIPLE	10	10,000	5.0	10%	10
3224	MODULAR OFFICE, FOUR PLEX	10	10,000	5.0	10%	10
3230	ATTENUATOR,TRUCK MOUNT TYPE	10	8,000	4.0	20%	7
3301	BOAT, MOTOR	5	10,000	5.0	10%	5
3303	BOAT,TUG	10	40,000	20.2	10%	15
3316	BARGE	10	30,000	15.1	5%	13
3500	PUMP, WATER	5	8,000	4.0	20%	5
3980	PLOW, SNOW VEE HYDRAULIC, ATTACHMENT	10	8,000	4.0	20%	7
3981	PLOW, VEE SNOW	5	8,000	4.0	20%	5
4095	AIR TUG	5	10,000	5.0	10%	5
4101	AIRCRAFT	5	10,000	5.0	10%	5
4102	BRUSHCHIPPER	10	6,000	3.0	20%	7
4103	CURB MACHINE	10	8,000	4.0	15%	7
4104	HYDRO-SEEDER ATTACHMENT	6	10,000	5.0	20%	6
4106	SPRAYER, 3 POINT HITCH ATTACHMENT	6	10,000	5.0	20%	6
4111	PRESSURE GROUTING PLANT	10	8,000	4.0	15%	7
4118	TRENCHER	8	8,000	4.0	20%	6
4119	WELDER/GENERATOR	8	8,000	4.0	25%	6
4120	WELDER	8	8,000	4.0	25%	6
4122	POST DRIVING/HYDRAULIC TOOL KIT ATTACHMENT	8	10,000	5.0	20%	7
4125	DROP BALL	5	10,000	5.0	10%	5
4126	SPREADER, TAILGATE MOUNT ATTACHMENT	8	10,000	5.0	20%	7
4127	SPREADER,IN-BODY 5 CY	8	10,000	5.0	20%	7

Class	Description	NCDOT Depreciation Term (yrs)	USACE			Modeled Depreciation Term (yrs)
			Hours	Life Years	Salvage Value (% of Purchase)	
4128	SNOW PLOW,9-10 FT FRT END	10	8,000	4.0	20%	7
4129	POWER TOOLS	8	6,000	3.0	10%	6
4136	FORKLIFT	10	10,000	5.0	20%	8
4142	SHEAR	5	6,000	3.0	15%	4
4145	TRAFFIC CONTROL DEVICES	10	10,000	5.0	10%	10
4151	MULCHER, TRACK CARRIER	10	10,000	5.0	15%	8
4152	WASTE WOOD RECYCLER	3	10,000	5.0	15%	4
4154	HAMMER, DIESEL PILE, ATTACHMENT	10	10,000	5.0	20%	8
4156	MULCHER, EXCAVATOR MTD	10	6,000	3.0	15%	7
4180	FERTILIZER TENDER ATTACHMENT	6	10,000	5.0	20%	6
4229	SPREADER, IN-BODY, 10 CY, ATTACHMENT	10	10,000	5.0	20%	8
4230	SNOW, BLOWER	10	8,000	4.0	20%	7
4231	PLOW, SNOW 8'	10	8,000	4.0	20%	7
4233	PLOW, SNOW 12 FT FRONT END MOUNT, ATTACHMENT	10	8,000	4.0	20%	7
4234	SPREADER, MATERIAL TOW TYPE ATTACHMENT	10	10,000	5.0	20%	8
4240	SAND BLAST CLEANER	10	6,000	3.0	20%	7
4241	SEWER RODDER	10	20,000	10.1	10%	10
4248	SOIL CONDITIONER	5	10,000	5.0	10%	5
4252	PAVEMENT TEST EQUIPMENT	5	10,000	5.0	10%	5
4254	SPADE,TREE,SKID STEER MOUNT ATTACHMENT	10	4,000	2.0	20%	6
230R	REAR MOUNT MOWER ATT	5	8,000	4.0	20%	5
230S	SIDE/MID MOWER ATT	5	8,000	4.0	20%	5

Appendix E Summary Analysis Sheets by Class Code

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**0201**						
Description:	TRUCK, 5000 GVW						
Functional Code:	All (5)						
Fleet Status Summary							
Data from year	2011						
Number of units	1,903						
Average annual usage	13,237	Miles					
Total annual fleet usage	25,189,332	Miles/yr					
Average unit age at year end	6.3	yrs					
Average unit utilization	77.6 %						
Average operating rate	$ 0.33	per Mile					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 23,526						
Depreciation Term	5	yrs					
Residual Value	20 %						
Initial operating rate	$ 0.25	per Mile					
Annual operating rate factor	0.0373						
Analyses Results							
	Current Fleet	**Reduced Fleet Size and Limited Annual Usage Decline**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	1,903	1,903	1,713	1,522	1,332	1,142	952
Initial usage (Miles)	17,653	15,391	16,710	18,389	21,012	23,975	28,148
Annual usage decline (Miles)	-697	-308	-334	-368	-420	-480	-563
Economic life (yrs)	15	14	13	11	9	8	7
Age at economic life (Miles)	186,379	185,290	189,007	180,015	172,098	176,440	183,243
LTD total rate at economic life ($/Miles)	$ 0.42	$ 0.42	$ 0.42	$ 0.42	$ 0.42	$ 0.43	$ 0.43

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**0200**						
Description:	TRUCK, MISCELLANEOUS						
Functional Code:	All (2)						
Fleet Status Summary							
Data from year	2011						
Number of units	179						
Average annual usage	12,116	Miles					
Total annual fleet usage	2,168,751	Miles/yr					
Average unit age at year end	6.4	yrs					
Average unit utilization	72.1 %						
Average operating rate	$ 0.36	per Mile					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 32,584						
Depreciation Term	5	yrs					
Residual Value	20 %						
Initial operating rate	$ 0.28	per Mile					
Annual operating rate factor	0.0310						
Analyses Results							
	Current Fleet	**Reduced Fleet Size and Limited Annual Usage Decline**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	179	179	161	143	125	107	90
Initial usage (Miles)	15,966	14,424	15,663	17,234	19,278	22,521	26,193
Annual usage decline (Miles)	-602	-288	-313	-345	-386	-450	-524
Economic life (yrs)	20	17	15	13	11	9	8
Age at economic life (Miles)	198,869	203,592	199,733	194,890	188,705	184,464	192,776
LTD total rate at economic life ($/Miles)	$ 0.50	$ 0.50	$ 0.50	$ 0.50	$ 0.50	$ 0.51	$ 0.51

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**0202**						
Description:	TRUCK, 7500 GVW						
Functional Code:	All (4)						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Very small increasing cost with age**			
Number of units	329						
Average annual usage	18,408	Miles					
Total annual fleet usage	6,056,288	Miles/yr					
Average unit age at year end	6.1	yrs					
Average unit utilization	82.2 %						
Average operating rate	$ 0.41	per Mile					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 27,367						
Depreciation Term	5	yrs					
Residual Value	20 %						
Initial operating rate	$ 0.37	per Mile					
Annual operating rate factor	0.0096						
Analyses Results							
	Current Fleet	**Reduced Fleet Size and Limited Annual Usage Decline**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	329	329	296	263	230	197	165
Initial usage (Miles)	28,145	23,010	24,952	27,414	29,922	34,935	40,783
Annual usage decline (Miles)	-1,609	-460	-499	-548	-598	-699	-816
Economic life (yrs)	No Min	20	17	17	13	12	10
Age at economic life (Miles)		368,200	352,079	386,852	338,455	368,892	367,030
LTD total rate at economic life ($/Miles)		$ 0.46	$ 0.46	$ 0.46	$ 0.47	$ 0.47	$ 0.47

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**0202**						
Description:	TRUCK, 7500 GVW						
Functional Code:	GIMAPT						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Decreasing cost with age**			
Number of units	57						
Average annual usage	37,155	Miles					
Total annual fleet usage	2,117,818	Miles/yr					
Average unit age at year end	3.8	yrs					
Average unit utilization	98.2 %						
Average operating rate	$ 0.50	per Mile					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 32,136						
Depreciation Term	5	yrs					
Residual Value	20 %						
Initial operating rate	$ 0.50	per Mile					
Annual operating rate factor	-0.0071						
Analyses Results							
	Current Fleet	**Reduced Fleet Size and Limited Annual Usage Decline**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	57	57	51	46	40	34	29
Initial usage (Miles)	44,353						
Annual usage decline (Miles)	-1,872						
Economic life (yrs)	No Min	No Match	No Match	No Match	No Match	No Match	No Match
Age at economic life (Miles)							
LTD total rate at economic life ($/Miles)							

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**0202**						
Description:	TRUCK, 7500 GVW						
Functional Code:	TRUCK1						
Fleet Status Summary							
Data from year	2011						
Number of units	268						
Average annual usage	14,570	Miles					
Total annual fleet usage	3,904,854	Miles/yr					
Average unit age at year end	6.5	yrs					
Average unit utilization	78.7 %						
Average operating rate	$ 0.39	per Mile					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 26,336						
Depreciation Term	5	yrs					
Residual Value	20 %						
Initial operating rate	$ 0.31	per Mile					
Annual operating rate factor	0.0271						
Analyses Results							
	Current Fleet		**Reduced Fleet Size and Limited Annual Usage Decline**				
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	268	268	241	214	188	161	134
Initial usage (Miles)	18,075	17,346	18,840	20,735	23,078	26,363	31,675
Annual usage decline (Miles)	-538	-347	-377	-415	-462	-527	-634
Economic life (yrs)	18	16	14	12	11	9	7
Age at economic life (Miles)	238,128	233,120	226,814	218,940	225,907	215,924	206,192
LTD total rate at economic life ($/Miles)	$ 0.48	$ 0.48	$ 0.48	$ 0.48	$ 0.48	$ 0.48	$ 0.49

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**0203**						
Description:	TRUCK, 15000 GVW						
Functional Code:	All (5)						
Fleet Status Summary							
Data from year	2011						
Number of units	345						
Average annual usage	12,119	Miles					
Total annual fleet usage	4,181,132	Miles/yr					
Average unit age at year end	6.4	yrs					
Average unit utilization	82.8 %						
Average operating rate	$ 0.74	per Mile					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 34,872						
Depreciation Term	5	yrs					
Residual Value	20 %						
Initial operating rate	$ 0.50	per Mile					
Annual operating rate factor	0.0456						
Analyses Results							
	Current Fleet		**Reduced Fleet Size and Limited Annual Usage Decline**				
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	345	345	311	276	242	207	173
Initial usage (Miles)	17,340	13,772	14,938	16,832	18,780	21,488	25,711
Annual usage decline (Miles)	-819	-275	-299	-337	-376	-430	-514
Economic life (yrs)	12	12	11	9	8	7	6
Age at economic life (Miles)	149,122	145,464	146,229	137,840	138,208	139,881	145,014
LTD total rate at economic life ($/Miles)	$ 0.83	$ 0.83	$ 0.83	$ 0.83	$ 0.84	$ 0.84	$ 0.85

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**0204**						
Description:	TRUCK, 9000 - 10000 GVW						
Functional Code:	All (2)						
Fleet Status Summary							
Data from year	2011						
Number of units	510						
Average annual usage	15,053	Miles					
Total annual fleet usage	7,676,785	Miles/yr					
Average unit age at year end	6.5	yrs					
Average unit utilization	75.1 %						
Average operating rate	$ 0.50	per Mile					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 28,107						
Depreciation Term	5	yrs					
Residual Value	20 %						
Initial operating rate	$ 0.42	per Mile					
Annual operating rate factor	0.0207						
Analyses Results							
	Current Fleet	**Reduced Fleet Size and Limited Annual Usage Decline**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	510	510	459	408	357	306	255
Initial usage (Miles)	17,893	18,357	19,448	21,381	23,893	27,875	32,723
Annual usage decline (Miles)	-434	-367	-389	-428	-478	-558	-654
Economic life (yrs)	20	17	15	13	11	10	8
Age at economic life (Miles)	271,013	259,038	247,958	241,787	233,904	250,850	240,856
LTD total rate at economic life ($/Miles)	$ 0.57	$ 0.57	$ 0.57	$ 0.58	$ 0.58	$ 0.58	$ 0.59

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**0205**						
Description:	TRUCK, DUMP 33000 GVW						
Functional Code:	TRKDMP						
Fleet Status Summary							
Data from year	2011						
Number of units	862						
Average annual usage	7,553	Miles					
Total annual fleet usage	6,510,493	Miles/yr					
Average unit age at year end	9.1	yrs					
Average unit utilization	42.7 %						
Average operating rate	$ 1.89	per Mile					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 56,419						
Depreciation Term	7	yrs					
Residual Value	20 %						
Initial operating rate	$ 0.91	per Mile					
Annual operating rate factor	0.0482						
Analyses Results							
	Current Fleet	**Reduced Fleet Size and Limited Annual Usage Decline**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	862	862	776	690	603	517	431
Initial usage (Miles)	13,185	8,782	9,756	10,722	11,996	13,688	16,070
Annual usage decline (Miles)	-621	-176	-195	-214	-240	-274	-321
Economic life (yrs)	12	15	13	12	10	9	7
Age at economic life (Miles)	113,525	111,930	110,351	113,256	107,960	112,095	104,626
LTD total rate at economic life ($/Miles)	$ 1.60	$ 1.58	$ 1.59	$ 1.59	$ 1.60	$ 1.61	$ 1.62

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**0206**						
Description:	TRUCK, 20000 - 33000 GVW						
Functional Code:	All (19)						
Fleet Status Summary							
Data from year	2011						
Number of units	847						
Average annual usage	6,819	Miles					
Total annual fleet usage	5,775,763	Miles/yr					
Average unit age at year end	9.4	yrs					
Average unit utilization	50.6 %						
Average operating rate	$ 1.34	per Mile					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 56,995						
Depreciation Term	7	yrs					
Residual Value	20 %						
Initial operating rate	$ 0.78	per Mile					
Annual operating rate factor	0.0311						
Analyses Results							
	Current Fleet		**Reduced Fleet Size and Limited Annual Usage Decline**				
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	847	847	762	678	593	508	424
Initial usage (Miles)	9,991	8,316	9,024	9,906	11,068	12,633	14,807
Annual usage decline (Miles)	-338	-166	-180	-198	-221	-253	-296
Economic life (yrs)	20	19	17	15	13	11	9
Age at economic life (Miles)	132,176	128,041	127,398	126,315	125,210	123,657	121,275
LTD total rate at economic life ($/Miles)	$ 1.37	$ 1.37	$ 1.37	$ 1.38	$ 1.38	$ 1.39	$ 1.40

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**0206**						
Description:	TRUCK, 20000 - 33000 GVW						
Functional Code:	GASPC1						
Fleet Status Summary							
Data from year	2011						
Number of units	27						
Average annual usage	8,804	Miles					
Total annual fleet usage	237,699	Miles/yr					
Average unit age at year end	7.8	yrs					
Average unit utilization	39.8 %						
Average operating rate	$ 1.15	per Mile					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 58,301						
Depreciation Term	7	yrs					
Residual Value	20 %						
Initial operating rate	$ 1.05	per Mile					
Annual operating rate factor	0.0019						
Analyses Results							
	Current Fleet		**Reduced Fleet Size and Limited Annual Usage Decline**				
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	27	27	24	22	19	16	14
Initial usage (Miles)	14,407						
Annual usage decline (Miles)	-722						
Economic life (yrs)	No Min	No Match	No Match	No Match	No Match	No Match	No Match
Age at economic life (Miles)							
LTD total rate at economic life ($/Miles)							

These analyses revealed the following issues:

- Very small increasing cost with age

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**0206**						
Description:	TRUCK, 20000 - 33000 GVW						
Functional Code:	GDIST1						
Fleet Status Summary							
Data from year	2011						
Number of units	59						
Average annual usage	4,897	Miles					
Total annual fleet usage	288,946	Miles/yr					
Average unit age at year end	7.8	yrs					
Average unit utilization	39.1 %						
Average operating rate	$ 1.67	per Mile					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 60,038						
Depreciation Term	7	yrs					
Residual Value	20 %						
Initial operating rate	$ 1.06	per Mile					
Annual operating rate factor	0.0426						
Analyses Results							
	Current Fleet		**Reduced Fleet Size and Limited Annual Usage Decline**				
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	59	59	53	47	41	35	30
Initial usage (Miles)	6,339	5,830	6,339	6,986	7,831	8,973	10,469
Annual usage decline (Miles)	-184	-117	-127	-140	-157	-179	-209
Economic life (yrs)	17	16	14	13	11	9	8
Age at economic life (Miles)	81,171	78,304	76,300	78,988	76,643	73,508	77,064
LTD total rate at economic life ($/Miles)	$ 2.09	$ 2.08	$ 2.08	$ 2.09	$ 2.10	$ 2.11	$ 2.13

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**0206**						
Description:	TRUCK, 20000 - 33000 GVW						
Functional Code:	GFUELT						
Fleet Status Summary							
Data from year	2011						
Number of units	95						
Average annual usage	5,806	Miles					
Total annual fleet usage	551,590	Miles/yr					
Average unit age at year end	7.5	yrs					
Average unit utilization	104.4 %						
Average operating rate	$ 1.15	per Mile					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 49,545						
Depreciation Term	7	yrs					
Residual Value	20 %						
Initial operating rate	$ 0.90	per Mile					
Annual operating rate factor	-0.0020						
Analyses Results							
	Current Fleet		**Reduced Fleet Size and Limited Annual Usage Decline**				
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	95	95	86	76	67	57	48
Initial usage (Miles)	7,171						
Annual usage decline (Miles)	-182						
Economic life (yrs)	No Min	No Match	No Match	No Match	No Match	No Match	No Match
Age at economic life (Miles)							
LTD total rate at economic life ($/Miles)							

These analyses revealed the following issues:

- Decreasing cost with age

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**0206**						
Description:	TRUCK, 20000 - 33000 GVW						
Functional Code:	All (15)						
Fleet Status Summary							
Data from year	2011						
Number of units	116						
Average annual usage	7,755	Miles					
Total annual fleet usage	899,547	Miles/yr					
Average unit age at year end	9.2	yrs					
Average unit utilization	39.7%						
Average operating rate	$ 1.45	per Mile					
Economic Analyses							
Input Values							
Interest Rate	3.0%						
Inflation Rate	2.4%						
Purchase Price	$ 63,399						
Depreciation Term	7	yrs					
Residual Value	20%						
Initial operating rate	$ 0.74	per Mile					
Annual operating rate factor	0.0457						
Analyses Results							
	Current Fleet	**Reduced Fleet Size and Limited Annual Usage Decline**					
Fleet reduction	**0%**	**0%**	**10%**	**20%**	**30%**	**40%**	**50%**
Number of units	116	116	104	93	81	70	58
Initial usage (Miles)	11,899	9,232	10,058	10,992	12,339	14,279	16,858
Annual usage decline (Miles)	-451	-185	-201	-220	-247	-286	-337
Economic life (yrs)	15	16	14	13	11	9	8
Age at economic life (Miles)	127,762	124,032	121,114	124,306	120,786	116,928	124,080
LTD total rate at economic life ($/Miles)	$ 1.43	$ 1.42	$ 1.42	$ 1.42	$ 1.43	$ 1.44	$ 1.45

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**0206**						
Description:	TRUCK, 20000 - 33000 GVW						
Functional Code:	TRUCK2						
Fleet Status Summary							
Data from year	2011						
Number of units	549						
Average annual usage	6,916	Miles					
Total annual fleet usage	3,796,923	Miles/yr					
Average unit age at year end	10.0	yrs					
Average unit utilization	45.2%						
Average operating rate	$ 1.32	per Mile					
Economic Analyses							
Input Values							
Interest Rate	3.0%						
Inflation Rate	2.4%						
Purchase Price	$ 56,485						
Depreciation Term	7	yrs					
Residual Value	20%						
Initial operating rate	$ 0.70	per Mile					
Annual operating rate factor	0.0382						
Analyses Results							
	Current Fleet	**Reduced Fleet Size and Limited Annual Usage Decline**					
Fleet reduction	**0%**	**0%**	**10%**	**20%**	**30%**	**40%**	**50%**
Number of units	549	549	494	439	384	329	275
Initial usage (Miles)	10,914	8,434	9,150	10,057	11,236	12,823	15,008
Annual usage decline (Miles)	-400	-169	-183	-201	-225	-256	-300
Economic life (yrs)	17	19	17	14	13	11	9
Age at economic life (Miles)	127,748	129,742	129,107	121,100	127,056	125,565	122,922
LTD total rate at economic life ($/Miles)	$ 1.30	$ 1.29	$ 1.29	$ 1.30	$ 1.30	$ 1.31	$ 1.31

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**0212**						
Description:	TRUCK, DUMP 50000 GVW						
Functional Code:	TRKDMP						
Fleet Status Summary							
Data from year	2011						
Number of units	610						
Average annual usage	12,127	Miles					
Total annual fleet usage	7,397,272	Miles/yr					
Average unit age at year end	7.8	yrs					
Average unit utilization	53.1 %						
Average operating rate	$ 1.43	per Mile					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 84,152						
Depreciation Term	8	yrs					
Residual Value	20 %						
Initial operating rate	$ 0.93	per Mile					
Annual operating rate factor	0.0446						
Analyses Results							
	Current Fleet	**Reduced Fleet Size and Limited Annual Usage Decline**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	610	610	549	488	427	366	305
Initial usage (Miles)	17,412	14,101	15,311	16,843	19,249	21,969	
Annual usage decline (Miles)	-674	-282	-306	-337	-385	-439	
Economic life (yrs)	13	14	12	11	9	7	No Match
Age at economic life (Miles)	169,437	169,778	161,700	164,885	157,649	143,028	
LTD total rate at economic life ($/Miles)	$ 1.62	$ 1.61	$ 1.62	$ 1.63	$ 1.63	$ 1.64	

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**0217**						
Description:	TRUCK, TRACTOR 60000 GVW						
Functional Code:	TRUCK5						
Fleet Status Summary							
Data from year	2011						
Number of units	84						
Average annual usage	8,820	Miles					
Total annual fleet usage	740,901	Miles/yr					
Average unit age at year end	8.2	yrs					
Average unit utilization	46.9 %						
Average operating rate	$ 1.33	per Mile					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 88,205						
Depreciation Term	8	yrs					
Residual Value	20 %						
Initial operating rate	$ 0.95	per Mile					
Annual operating rate factor	0.0326						
Analyses Results							
	Current Fleet	**Reduced Fleet Size and Limited Annual Usage Decline**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	84	84	76	67	59	50	42
Initial usage (Miles)	11,639	10,756	11,606	12,858	14,270	16,464	19,174
Annual usage decline (Miles)	-342	-215	-232	-257	-285	-329	-383
Economic life (yrs)	20	18	16	14	12	11	9
Age at economic life (Miles)	164,330	158,778	156,000	154,826	150,720	161,200	157,055
LTD total rate at economic life ($/Miles)	$ 1.70	$ 1.69	$ 1.70	$ 1.71	$ 1.71	$ 1.72	$ 1.73

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**0227**						
Description:	TRUCK, TRACTOR 70000 GVW						
Functional Code:	TRUCK5						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Decreasing cost with age**			
Number of units	19			**- Small number of machines**			
Average annual usage	12,234	Miles					
Total annual fleet usage	232,439	Miles/yr					
Average unit age at year end	9.0	yrs					
Average unit utilization	104.8 %						
Average operating rate	$ 1.34	per Mile					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 110,748						
Depreciation Term	9	yrs					
Residual Value	20 %						
Initial operating rate	$ 1.35	per Mile					
Annual operating rate factor	-0.0153						
Analyses Results							
	Current Fleet	**Reduced Fleet Size and Limited Annual Usage Decline**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	19	19	17	15	13	11	10
Initial usage (Miles)	15,522						
Annual usage decline (Miles)	-367						
Economic life (yrs)	No Min	No Match	No Match	No Match	No Match	No Match	No Match
Age at economic life (Miles)							
LTD total rate at economic life ($/Miles)							

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**0230**						
Description:	TRUCK, 35000 - 50000 GVW						
Functional Code:	All (5)						
Fleet Status Summary							
Data from year	2011						
Number of units	72						
Average annual usage	3,249	Miles					
Total annual fleet usage	233,895	Miles/yr					
Average unit age at year end	8.0	yrs					
Average unit utilization	28.4 %						
Average operating rate	$ 3.05	per Mile					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 100,743						
Depreciation Term	8	yrs					
Residual Value	20 %						
Initial operating rate	$ 0.86	per Mile					
Annual operating rate factor	0.0963						
Analyses Results							
	Current Fleet	**Reduced Fleet Size and Limited Annual Usage Decline**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	72	72	65	58	50	43	36
Initial usage (Miles)	5,819	3,867	4,184	4,583	5,198	5,912	6,912
Annual usage decline (Miles)	-320	-77	-84	-92	-104	-118	-138
Economic life (yrs)	13	15	14	12	11	9	7
Age at economic life (Miles)	48,617	49,343	50,344	48,372	50,886	48,429	45,003
LTD total rate at economic life ($/Miles)	$ 3.33	$ 3.33	$ 3.32	$ 3.34	$ 3.35	$ 3.35	$ 3.36

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**0230**						
Description:	TRUCK, 35000 - 50000 GVW						
Functional Code:	GCRAN1						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Increasing use with age**			
Number of units	31			**- Decreasing cost with age**			
Average annual usage	2,510	Miles					
Total annual fleet usage	77,806	Miles/yr					
Average unit age at year end	9.0	yrs					
Average unit utilization	25.7 %						
Average operating rate	$ 1.95	per Mile					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 119,888						
Depreciation Term	8	yrs					
Residual Value	20 %						
Initial operating rate	$ 4.23	per Mile					
Annual operating rate factor	-0.1064						
Analyses Results							
	Current Fleet	**Reduced Fleet Size and Limited Annual Usage Decline**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	31	31	28	25	22	19	16
Initial usage (Miles)	2,221						
Annual usage decline (Miles)	32						
Economic life (yrs)	No Min	No Match	No Match	No Match	No Match	No Match	No Match
Age at economic life (Miles)							
LTD total rate at economic life ($/Miles)							

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**0230**						
Description:	TRUCK, 35000 - 50000 GVW						
Functional Code:	GCRAN2						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Very large increasing cost with age**			
Number of units	23						
Average annual usage	1,788	Miles					
Total annual fleet usage	41,127	Miles/yr					
Average unit age at year end	8.0	yrs					
Average unit utilization	20.6 %						
Average operating rate	$ 4.38	per Mile					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 86,434						
Depreciation Term	8	yrs					
Residual Value	20 %						
Initial operating rate	$ 0.87	per Mile					
Annual operating rate factor	0.1263						
Analyses Results							
	Current Fleet	**Reduced Fleet Size and Limited Annual Usage Decline**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	23	23	21	18	16	14	12
Initial usage (Miles)	2,445	2,079	2,225	2,539	2,856	3,193	3,646
Annual usage decline (Miles)	-82	-42	-45	-51	-57	-64	-73
Economic life (yrs)	14	14	13	11	10	8	6
Age at economic life (Miles)	26,168	24,990	25,123	24,844	25,710	23,496	20,562
LTD total rate at economic life ($/Miles)	$ 5.07	$ 5.05	$ 5.05	$ 5.06	$ 5.11	$ 5.09	$ 5.03

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**230R**						
Description:	REAR MOUNT MOWER ATT						
Functional Code:	All (4)						
Fleet Status Summary				These analyses revealed the following issues:			
Data from year	2011			- Decreasing cost with age			
Number of units	115						
Average unit age at year end	5.9	yrs					
Average unit utilization	21.8 %						
Average operating rate	$ 1,293.93	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 5,683						
Depreciation Term	5	yrs					
Residual Value	20 %						
Initial operating rate	$ 853.70	per Year					
Annual operating rate factor	-0.0757						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	115	115	104	92	81	69	58
Economic life (yrs)	No Min	30	30	30	30	30	30
LTD total rate at economic life ($/Year)		$ 479.88	$ 457.01	$ 429.97	$ 403.18	$ 371.73	$ 340.97

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**230S**						
Description:	SIDE/MID MOWER ATT						
Functional Code:	All (2)						
Fleet Status Summary				These analyses revealed the following issues:			
Data from year	2011			- Decreasing cost with age			
Number of units	83						
Average unit age at year end	6.1	yrs					
Average unit utilization	20.5 %						
Average operating rate	$ 2,041.31	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 13,163						
Depreciation Term	5	yrs					
Residual Value	20 %						
Initial operating rate	$ 1,655.72	per Year					
Annual operating rate factor	-0.0363						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	83	83	75	66	58	50	42
Economic life (yrs)	No Min	30	30	30	30	30	30
LTD total rate at economic life ($/Year)		$ 1,323.18	$ 1,280.43	$ 1,224.76	$ 1,167.00	$ 1,099.64	$ 1,020.59

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**0232**						
Description:	TRUCK, DUMP 60000 GVW						
Functional Code:	TRKDMP						
Fleet Status Summary							
Data from year	2011						
Number of units	73						
Average annual usage	16,909	Miles					
Total annual fleet usage	1,234,326	Miles/yr					
Average unit age at year end	5.9	yrs					
Average unit utilization	63.1 %						
Average operating rate	$ 1.27	per Mile					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 91,606						
Depreciation Term	7	yrs					
Residual Value	20 %						
Initial operating rate	$ 1.11	per Mile					
Annual operating rate factor	0.0151						
Analyses Results							
	Current Fleet		**Reduced Fleet Size and Limited Annual Usage Decline**				
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	73	73	66	58	51	44	37
Initial usage (Miles)	18,172			25,953	28,812	31,878	37,067
Annual usage decline (Miles)	-214			-519	-576	-638	-741
Economic life (yrs)	28	No Match	No Match	18	16	13	11
Age at economic life (Miles)	424,885			383,076	387,264	360,503	362,907
LTD total rate at economic life ($/Miles)	$ 1.46			$ 1.49	$ 1.50	$ 1.50	$ 1.50

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**0233**						
Description:	TRUCK, 17500 - 20000 GVW						
Functional Code:	All (7)						
Fleet Status Summary							
Data from year	2011						
Number of units	183						
Average annual usage	16,943	Miles					
Total annual fleet usage	3,100,606	Miles/yr					
Average unit age at year end	4.8	yrs					
Average unit utilization	86.1 %						
Average operating rate	$ 0.67	per Mile					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 35,925						
Depreciation Term	5	yrs					
Residual Value	20 %						
Initial operating rate	$ 0.52	per Mile					
Annual operating rate factor	0.0427						
Analyses Results							
	Current Fleet		**Reduced Fleet Size and Limited Annual Usage Decline**				
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	183	183	165	146	128	110	92
Initial usage (Miles)	20,068	18,826	20,879	23,084	25,770	29,987	
Annual usage decline (Miles)	-646	-377	-418	-462	-515	-600	
Economic life (yrs)	11	11	9	8	7	6	No Match
Age at economic life (Miles)	181,685	184,278	170,982	169,888	167,773	169,122	
LTD total rate at economic life ($/Miles)	$ 0.81	$ 0.80	$ 0.80	$ 0.80	$ 0.80	$ 0.82	

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**0233**						
Description:	TRUCK, 17500 - 20000 GVW						
Functional Code:	GMCHST						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Decreasing cost with age**			
Number of units	21						
Average annual usage	3,801	Miles					
Total annual fleet usage	79,811	Miles/yr					
Average unit age at year end	4.7	yrs					
Average unit utilization	105.2 %						
Average operating rate	$ 0.68	per Mile					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 32,137						
Depreciation Term	5	yrs					
Residual Value	20 %						
Initial operating rate	$ 0.73	per Mile					
Annual operating rate factor	-0.0322						
Analyses Results							
	Current Fleet	**Reduced Fleet Size and Limited Annual Usage Decline**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	21	21	19	17	15	13	11
Initial usage (Miles)	3,876						
Annual usage decline (Miles)	-16						
Economic life (yrs)	No Min	No Match	No Match	No Match	No Match	No Match	No Match
Age at economic life (Miles)							
LTD total rate at economic life ($/Miles)							

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**0233**						
Description:	TRUCK, 17500 - 20000 GVW						
Functional Code:	GAER1A						
Fleet Status Summary							
Data from year	2011						
Number of units	42						
Average annual usage	18,935	Miles					
Total annual fleet usage	795,288	Miles/yr					
Average unit age at year end	5.6	yrs					
Average unit utilization	89.0 %						
Average operating rate	$ 0.86	per Mile					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 38,090						
Depreciation Term	5	yrs					
Residual Value	20 %						
Initial operating rate	$ 0.65	per Mile					
Annual operating rate factor	0.0377						
Analyses Results							
	Current Fleet	**Reduced Fleet Size and Limited Annual Usage Decline**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	42	42	38	34	29	25	21
Initial usage (Miles)	21,912	21,039	23,254	25,425	29,174	33,842	
Annual usage decline (Miles)	-532	-421	-465	-509	-583	-677	
Economic life (yrs)	11	11	10	9	7	6	No Match
Age at economic life (Miles)	208,858	205,959	209,290	208,211	189,935	190,866	
LTD total rate at economic life ($/Miles)	$ 0.94	$ 0.93	$ 0.92	$ 0.92	$ 0.93	$ 0.94	

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**0233**						
Description:	TRUCK, 17500 - 20000 GVW						
Functional Code:	GTRFSV						
Fleet Status Summary							
Data from year	2011						
Number of units	55						
Average annual usage	21,478	Miles					
Total annual fleet usage	1,181,285	Miles/yr					
Average unit age at year end	5.3	yrs					
Average unit utilization	84.7 %						
Average operating rate	$ 0.65	per Mile					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 32,587						
Depreciation Term	5	yrs					
Residual Value	20 %						
Initial operating rate	$ 0.54	per Mile					
Annual operating rate factor	0.0284						
Analyses Results							
	Current Fleet		**Reduced Fleet Size and Limited Annual Usage Decline**				
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	55	55	50	44	39	33	28
Initial usage (Miles)	33,875	23,864	26,251	29,182	32,923	38,081	44,882
Annual usage decline (Miles)	-2,360	-477	-525	-584	-658	-762	-898
Economic life (yrs)	11	11	10	9	7	7	6
Age at economic life (Miles)	229,838	233,646	236,260	238,986	214,340	247,898	253,128
LTD total rate at economic life ($/Miles)	$ 0.72	$ 0.72	$ 0.72	$ 0.73	$ 0.73	$ 0.73	$ 0.74

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**0233**						
Description:	TRUCK, 17500 - 20000 GVW						
Functional Code:	TRUCK2						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Increasing use with age**			
Number of units	59						
Average annual usage	17,214	Miles					
Total annual fleet usage	1,015,628	Miles/yr					
Average unit age at year end	3.5	yrs					
Average unit utilization	86.4 %						
Average operating rate	$ 0.58	per Mile					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 37,499						
Depreciation Term	5	yrs					
Residual Value	20 %						
Initial operating rate	$ 0.49	per Mile					
Annual operating rate factor	0.0381						
Analyses Results							
	Current Fleet		**Reduced Fleet Size and Limited Annual Usage Decline**				
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	59	59	53	47	41	35	30
Initial usage (Miles)	16,794	20,016	21,776	24,010	26,925	31,541	36,015
Annual usage decline (Miles)	119	-400	-436	-480	-539	-631	-720
Economic life (yrs)	13	13	12	10	9	7	6
Age at economic life (Miles)	228,378	226,408	229,920	216,100	220,496	205,328	203,130
LTD total rate at economic life ($/Miles)	$ 0.76	$ 0.76	$ 0.76	$ 0.76	$ 0.76	$ 0.77	$ 0.77

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**0235**						
Description:	BUS, PASSENGER						
Functional Code:	BUSBUS						
Fleet Status Summary				These analyses revealed the following issues:			
Data from year	2011			- Very large increasing cost with age			
Number of units	11			- Small number of machines			
Average annual usage	11,198	Miles					
Total annual fleet usage	123,181	Miles/yr					
Average unit age at year end	8.1	yrs					
Average unit utilization	90.5 %						
Average operating rate	$ 2.83	per Mile					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 49,944						
Depreciation Term	8	yrs					
Residual Value	20 %						
Initial operating rate	$ 0.24	per Mile					
Annual operating rate factor	0.2068						
Analyses Results							
	Current Fleet	**Reduced Fleet Size and Limited Annual Usage Decline**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	11	11	10	9	8	7	6
Initial usage (Miles)	19,631	12,172	13,389	14,560			
Annual usage decline (Miles)	-1,041	-243	-268	-291			
Economic life (yrs)	1	9	8	6	No Match	No Match	No Match
Age at economic life (Miles)	19,111	99,707	98,536	82,122			
LTD total rate at economic life ($/Miles)	$ 0.82	$ 0.88	$ 0.88	$ 0.88			

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**0236**						
Description:	UTILITY VEHICLE						
Functional Code:	All (2)						
Fleet Status Summary				These analyses revealed the following issues:			
Data from year	2011			- Increasing use with age			
Number of units	18			- Negative initial usage value			
Average annual usage	148	Hours		- Decreasing cost with age			
Total annual fleet usage	2,660	Hours/yr		- Small number of machines			
Average unit age at year end	4.4	yrs					
Average unit utilization	59.3 %						
Average operating rate	$ 23.85	per Hour					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 9,258						
Depreciation Term	5	yrs					
Residual Value	10 %						
Initial operating rate	$ 28.10	per Hour					
Annual operating rate factor	-0.2829						
Analyses Results							
	Current Fleet	**Reduced Fleet Size and Limited Annual Usage Decline**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	18	18	16	14	13	11	9
Initial usage (Hours)	-248						
Annual usage decline (Hours)	90						
Economic life (yrs)	No Min	No Match	No Match	No Match	No Match	No Match	No Match
Age at economic life (Hours)							
LTD total rate at economic life ($/Hours)							

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**0300**						
Description:	TRACTOR, WHEEL						
Functional Code:	All (7)						
Fleet Status Summary							
Data from year	2011						
Number of units	464						
Average annual usage	248	Hours					
Total annual fleet usage	115,122	Hours/yr					
Average unit age at year end	8.4	yrs					
Average unit utilization	27.4 %						
Average operating rate	$ 27.54	per Hour					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 48,882						
Depreciation Term	9	yrs					
Residual Value	15 %						
Initial operating rate	$ 12.69	per Hour					
Annual operating rate factor	0.0578						
Analyses Results							
	Current Fleet		**Reduced Fleet Size and Limited Annual Usage Decline**				
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	464	464	418	371	325	278	232
Initial usage (Hours)	417	295	320	353	394	460	528
Annual usage decline (Hours)	-20	-6	-6	-7	-8	-9	-11
Economic life (yrs)	15	16	14	13	11	9	6
Age at economic life (Hours)	3,992	3,952	3,892	3,998	3,850	3,776	2,970
LTD total rate at economic life ($/Hours)	$ 29.35	$ 29.21	$ 29.31	$ 29.45	$ 29.53	$ 29.73	$ 29.33

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**0314**						
Description:	BACKHOE, TRACTOR LOADER						
Functional Code:	BCKHOE						
Fleet Status Summary							
Data from year	2011						
Number of units	247						
Average annual usage	323	Hours					
Total annual fleet usage	79,691	Hours/yr					
Average unit age at year end	8.1	yrs					
Average unit utilization	48.1 %						
Average operating rate	$ 31.02	per Hour					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 77,614						
Depreciation Term	7	yrs					
Residual Value	25 %						
Initial operating rate	$ 16.40	per Hour					
Annual operating rate factor	0.0544						
Analyses Results							
	Current Fleet		**Reduced Fleet Size and Limited Annual Usage Decline**				
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	247	247	222	198	173	148	124
Initial usage (Hours)	511	384	417	457	512	585	699
Annual usage decline (Hours)	-23	-8	-8	-9	-10	-12	-14
Economic life (yrs)	14	15	14	12	11	9	7
Age at economic life (Hours)	4,862	4,860	5,054	4,836	5,027	4,779	4,550
LTD total rate at economic life ($/Hours)	$ 36.11	$ 36.02	$ 36.09	$ 36.16	$ 36.29	$ 36.36	$ 36.61

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**0404**						
Description:	CRAWLER TRACTOR						
Functional Code:	CRWTRM						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Small number of machines**			
Number of units	18						
Average annual usage	143	Hours					
Total annual fleet usage	2,572	Hours/yr					
Average unit age at year end	11.0	yrs					
Average unit utilization	19.2 %						
Average operating rate	$ 80.52	per Hour					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 214,362						
Depreciation Term	8	yrs					
Residual Value	30 %						
Initial operating rate	$ 37.27	per Hour					
Annual operating rate factor	0.0271						
Analyses Results							
	Current Fleet	**Reduced Fleet Size and Limited Annual Usage Decline**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	18	18	16	14	13	11	9
Initial usage (Hours)	238					285	332
Annual usage decline (Hours)	-9					-6	-7
Economic life (yrs)	25	No Match	No Match	No Match	No Match	18	14
Age at economic life (Hours)	3,246					4,158	3,962
LTD total rate at economic life ($/Hours)	$ 102.65					$ 96.50	$ 96.71

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**0900**						
Description:	MOTOR GRADER						
Functional Code:	GRADRM						
Fleet Status Summary							
Data from year	2011						
Number of units	374						
Average annual usage	320	Hours					
Total annual fleet usage	119,570	Hours/yr					
Average unit age at year end	11.2	yrs					
Average unit utilization	33.1 %						
Average operating rate	$ 51.48	per Hour					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 123,217						
Depreciation Term	9	yrs					
Residual Value	25 %						
Initial operating rate	$ 28.13	per Hour					
Annual operating rate factor	0.0385						
Analyses Results							
	Current Fleet	**Reduced Fleet Size and Limited Annual Usage Decline**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	374	374	337	299	262	224	187
Initial usage (Hours)	600	400	433	476	531	607	710
Annual usage decline (Hours)	-25	-8	-9	-10	-11	-12	-14
Economic life (yrs)	17	21	19	17	14	12	10
Age at economic life (Hours)	6,568	6,636	6,603	6,647	6,356	6,420	6,400
LTD total rate at economic life ($/Hours)	$ 52.20	$ 51.82	$ 51.93	$ 52.04	$ 52.20	$ 52.36	$ 52.61

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**1010**						
Description:	ASPHALT PATCH MACHINE, TRAILER MTD						
Functional Code:	All (2)						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Decreasing cost with age**			
Number of units	32						
Average unit age at year end	8.0	yrs					
Average unit utilization	26.6 %						
Average operating rate	$ 2,710.98	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 39,754						
Depreciation Term	8	yrs					
Residual Value	20 %						
Initial operating rate	$ 1,900.01	per Year					
Annual operating rate factor	-0.0394						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	32	32	29	26	22	19	16
Economic life (yrs)	No Min	30	30	30	30	30	30
LTD total rate at economic life ($/Year)		$ 2,231.87	$ 2,183.07	$ 2,127.61	$ 2,041.03	$ 1,964.53	$ 1,876.04

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**1011**						
Description:	ASPHALT PAVER/GRINDER						
Functional Code:	PAVERM						
Fleet Status Summary							
Data from year	2011						
Number of units	32						
Average annual usage	197	Hours					
Total annual fleet usage	6,297	Hours/yr					
Average unit age at year end	6.2	yrs					
Average unit utilization	21.3 %						
Average operating rate	$ 41.68	per Hour					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 89,732						
Depreciation Term	6	yrs					
Residual Value	20 %						
Initial operating rate	$ 18.34	per Hour					
Annual operating rate factor	0.0941						
Analyses Results							
	Current Fleet	**Reduced Fleet Size and Limited Annual Usage Decline**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	32	32	29	26	22	19	16
Initial usage (Hours)	327	224	247	269	311	360	419
Annual usage decline (Hours)	-21	-4	-5	-5	-6	-7	-8
Economic life (yrs)	12	13	12	10	8	8	6
Age at economic life (Hours)	2,419	2,574	2,604	2,440	2,296	2,656	2,370
LTD total rate at economic life ($/Hours)	$ 62.33	$ 61.96	$ 62.16	$ 62.44	$ 63.42	$ 62.94	$ 63.42

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**1012**						
Description:	ASPHALT PATCHER, TRUCK MTD						
Functional Code:	All (2)						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Decreasing cost with age**			
Number of units	18			**- Small number of machines**			
Average unit age at year end	5.8	yrs					
Average unit utilization	43.0 %						
Average operating rate	$ 3,843.09	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 57,312						
Depreciation Term	7	yrs					
Residual Value	20 %						
Initial operating rate	$ 3,989.46	per Year					
Annual operating rate factor	-0.0810						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	18	18	16	14	13	11	9
Economic life (yrs)	No Min	30	30	30	30	30	30
LTD total rate at economic life ($/Year)		$ 3,111.02	$ 2,988.31	$ 2,855.11	$ 2,784.49	$ 2,635.31	$ 2,476.31

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**1014**						
Description:	LOADER, SKID STEER						
Functional Code:	LOADRM						
Fleet Status Summary							
Data from year	2011						
Number of units	51						
Average annual usage	74	Hours					
Total annual fleet usage	3,785	Hours/yr					
Average unit age at year end	7.6	yrs					
Average unit utilization	24.5 %						
Average operating rate	$ 59.37	per Hour					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 55,205						
Depreciation Term	7	yrs					
Residual Value	20 %						
Initial operating rate	$ 39.65	per Hour					
Annual operating rate factor	0.0108						
Analyses Results							
	Current Fleet	**Reduced Fleet Size and Limited Annual Usage Decline**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	51	51	46	41	36	31	26
Initial usage (Hours)	127						173
Annual usage decline (Hours)	-7						-3
Economic life (yrs)	No Min	No Match	No Match	No Match	No Match	No Match	15
Age at economic life (Hours)							2,258
LTD total rate at economic life ($/Hours)							$ 69.03

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**1150**							
Description:	PAVER, ASPHALT							
Functional Code:	PAVERM							
Fleet Status Summary				These analyses revealed the following issues:				
Data from year	2011			- Very large increasing cost with age				
Number of units	14			- Small number of machines				
Average annual usage	212	Hours						
Total annual fleet usage	2,974	Hours/yr						
Average unit age at year end	7.1	yrs						
Average unit utilization	26.3 %							
Average operating rate	$ 48.65	per Hour						
Economic Analyses								
Input Values								
Interest Rate	3.0 %							
Inflation Rate	2.4 %							
Purchase Price	$ 134,612							
Depreciation Term	7	yrs						
Residual Value	15 %							
Initial operating rate	$ 13.92	per Hour						
Annual operating rate factor	0.1246							
Analyses Results								
	Current Fleet		**Reduced Fleet Size and Limited Annual Usage Decline**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**	
Number of units	14	14	13	11	10	8	7	
Initial usage (Hours)	321	247	260	300	330	404	452	
Annual usage decline (Hours)	-15	-5	-5	-6	-7	-8	-9	
Economic life (yrs)	13	13	12	11	9	7	6	
Age at economic life (Hours)	2,878	2,789	2,760	2,937	2,687	2,632	2,550	
LTD total rate at economic life ($/Hours)	$ 73.32	$ 73.65	$ 73.84	$ 74.13	$ 74.48	$ 75.33	$ 74.65	

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**1300**							
Description:	ASPHALT TANK/KETTLE							
Functional Code:	TNKASP							
Fleet Status Summary				These analyses revealed the following issues:				
Data from year	2011			- Very large increasing cost with age				
Number of units	18			- Small number of machines				
Average annual usage	282	Hours						
Total annual fleet usage	5,074	Hours/yr						
Average unit age at year end	7.2	yrs						
Average unit utilization	47.6 %							
Average operating rate	$ 120.04	per Hour						
Economic Analyses								
Input Values								
Interest Rate	3.0 %							
Inflation Rate	2.4 %							
Purchase Price	$ 92,811							
Depreciation Term	6	yrs						
Residual Value	20 %							
Initial operating rate	$ 6.80	per Hour						
Annual operating rate factor	0.2345							
Analyses Results								
	Current Fleet		**Reduced Fleet Size and Limited Annual Usage Decline**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**	
Number of units	18	18	16	14	13	11	9	
Initial usage (Hours)	619	313	352	394	424	491	600	
Annual usage decline (Hours)	-47	-6	-7	-8	-8	-10	-12	
Economic life (yrs)	7	11	10	9	8	7	5	
Age at economic life (Hours)	3,183	3,080	3,170	3,222	3,136	3,192	2,850	
LTD total rate at economic life ($/Hours)	$ 41.50	$ 41.29	$ 41.34	$ 41.48	$ 41.62	$ 41.94	$ 41.59	

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**1302**						
Description:	DISTRIBUTOR, ASPHALT						
Functional Code:	All (2)						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Increasing use with age**			
Number of units	42			**- Decreasing cost with age**			
Average annual usage	326	Hours					
Total annual fleet usage	13,709	Hours/yr					
Average unit age at year end	9.5	yrs					
Average unit utilization	34.0 %						
Average operating rate	$ 50.17	per Hour					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 65,162						
Depreciation Term	7	yrs					
Residual Value	10 %						
Initial operating rate	$ 38.33	per Hour					
Annual operating rate factor	-0.0315						
Analyses Results							
	Current Fleet	**Reduced Fleet Size and Limited Annual Usage Decline**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	42	42	38	34	29	25	21
Initial usage (Hours)	192						
Annual usage decline (Hours)	14						
Economic life (yrs)	No Min	No Match	No Match	No Match	No Match	No Match	No Match
Age at economic life (Hours)							
LTD total rate at economic life ($/Hours)							

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**1400**						
Description:	BROOM						
Functional Code:	All (7)						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Very large increasing cost with age**			
Number of units	89						
Average unit age at year end	7.3	yrs					
Average unit utilization	24.9 %						
Average operating rate	$ 16,761.25	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 9,144						
Depreciation Term	7	yrs					
Residual Value	10 %						
Initial operating rate	$ 6,261.88	per Year					
Annual operating rate factor	0.1005						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	89	89	80	71	62	53	45
Economic life (yrs)	1	1	1	1	1	1	1
LTD total rate at economic life ($/Year)	$ 9,147.02	$ 9,147.02	$ 9,225.25	$ 9,324.58	$ 9,454.83	$ 9,633.09	$ 9,857.44

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**1404**						
Description:	INTEGRAL SWEEPER						
Functional Code:	SWEEPR						
Fleet Status Summary				These analyses revealed the following issues:			
Data from year	2011			- Decreasing cost with age			
Number of units	7			- Small number of machines			
Average annual usage	147	Hours					
Total annual fleet usage	1,027	Hours/yr					
Average unit age at year end	10.6	yrs					
Average unit utilization	24.5 %						
Average operating rate	$ 29.53	per Hour					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 34,632						
Depreciation Term	7	yrs					
Residual Value	10 %						
Initial operating rate	$ 38.96	per Hour					
Annual operating rate factor	-0.0678						
Analyses Results							
	Current Fleet	**Reduced Fleet Size and Limited Annual Usage Decline**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	7	7	6	6	5	4	4
Initial usage (Hours)	241						
Annual usage decline (Hours)	-9						
Economic life (yrs)	No Min	No Match	No Match	No Match	No Match	No Match	No Match
Age at economic life (Hours)							
LTD total rate at economic life ($/Hours)							

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**1450**						
Description:	PAINT MACHINE, SPECIAL MARKING						
Functional Code:	All (2)						
Fleet Status Summary				These analyses revealed the following issues:			
Data from year	2011			- Very large increasing cost with age			
Number of units	17			- Small number of machines			
Average unit age at year end	5.4	yrs					
Average unit utilization	55.9 %						
Average operating rate	$ 7,957.76	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 169,826						
Depreciation Term	5	yrs					
Residual Value	10 %						
Initial operating rate	$ 2,036.41	per Year					
Annual operating rate factor	0.2109						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	17	17	15	14	12	10	9
Economic life (yrs)	11	11	10	10	9	7	7
LTD total rate at economic life ($/Year)	$ 22,853.61	$ 22,853.61	$ 24,822.43	$ 26,034.71	$ 28,976.36	$ 32,869.94	$ 35,379.44

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**1453**						
Description:	PAINT MACHINE, PRELINE						
Functional Code:	All (3)						
Fleet Status Summary				These analyses revealed the following issues:			
Data from year	2011			- Decreasing cost with age			
Number of units	7			- Small number of machines			
Average unit age at year end	6.0	yrs					
Average unit utilization	14.0 %						
Average operating rate	$ 615.58	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 44,478						
Depreciation Term	5	yrs					
Residual Value	10 %						
Initial operating rate	$ 786.86	per Year					
Annual operating rate factor	-0.1071						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	7	7	6	6	5	4	4
Economic life (yrs)	No Min	30	30	30	30	30	30
LTD total rate at economic life ($/Year)		$ 1,633.45	$ 1,605.50	$ 1,605.50	$ 1,575.64	$ 1,544.15	$ 1,544.15

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**1454**						
Description:	PAINT MACHINE, HAND TRAFFIC STRIPER						
Functional Code:	PAINTM						
Fleet Status Summary				These analyses revealed the following issues:			
Data from year	2011			- Very large increasing cost with age			
Number of units	11			- Small number of machines			
Average unit age at year end	6.2	yrs					
Average unit utilization	33.8 %						
Average operating rate	$ 186.41	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 6,896						
Depreciation Term	5	yrs					
Residual Value	10 %						
Initial operating rate	$ 56.93	per Year					
Annual operating rate factor	0.1107						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	11	11	10	9	8	7	6
Economic life (yrs)	21	21	19	18	16	14	13
LTD total rate at economic life ($/Year)	$ 529.82	$ 529.82	$ 562.62	$ 602.39	$ 649.87	$ 710.33	$ 787.36

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**1457**						
Description:	PAINT MACHINE, THERMOPLASTIC APPL.						
Functional Code:	All (2)						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Very large increasing cost with age**			
Number of units	3			**- Small number of machines**			
Average unit age at year end	4.8	yrs					
Average unit utilization	27.4 %						
Average operating rate	$ 1,636.22	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 27,141						
Depreciation Term	6	yrs					
Residual Value	10 %						
Initial operating rate	$ 231.13	per Year					
Annual operating rate factor	0.2286						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	3	3	3	2	2	2	2
Economic life (yrs)	11	11	11	8	8	8	8
LTD total rate at economic life ($/Year)	$ 3,403.88	$ 3,403.88	$ 3,403.88	$ 4,521.29	$ 4,521.29	$ 4,521.29	$ 4,521.29

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**1500**						
Description:	COMPRESSOR, AIR						
Functional Code:	All (13)						
Fleet Status Summary							
Data from year	2011						
Number of units	291						
Average unit age at year end	9.0	yrs					
Average unit utilization	74.7 %						
Average operating rate	$ 383.43	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 6,951						
Depreciation Term	8	yrs					
Residual Value	15 %						
Initial operating rate	$ 126.63	per Year					
Annual operating rate factor	0.0594						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	291	291	262	233	204	175	146
Economic life (yrs)	26	26	24	22	20	18	15
LTD total rate at economic life ($/Year)	$ 531.31	$ 531.31	$ 560.71	$ 596.04	$ 639.62	$ 695.23	$ 768.61

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**1600**						
Description:	CONVEYOR, SALT						
Functional Code:	CONVYR						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Very large increasing cost with age**			
Number of units	11			**- Small number of machines**			
Average unit age at year end	6.3	yrs					
Average unit utilization	2.8 %						
Average operating rate	$ 3,131.97	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 68,060						
Depreciation Term	7	yrs					
Residual Value	20 %						
Initial operating rate	$ 105.42	per Year					
Annual operating rate factor	0.3915						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	11	11	10	9	8	7	6
Economic life (yrs)	10	10	10	9	8	7	6
LTD total rate at economic life ($/Year)	$ 7,318.06	$ 7,318.06	$ 7,893.17	$ 8,559.90	$ 9,391.21	$ 10,458.04	$ 11,607.51

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**1601**						
Description:	SYSTEM, SALT BRINE PRODUCTION						
Functional Code:	STBRNP						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Decreasing cost with age**			
Number of units	28						
Average unit age at year end	5.8	yrs					
Average unit utilization	1.0 %						
Average operating rate	$ 829.12	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 14,074						
Depreciation Term	12	yrs					
Residual Value	20 %						
Initial operating rate	$ 1,400.24	per Year					
Annual operating rate factor	-0.2916						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	28	28	25	22	20	17	14
Economic life (yrs)	No Min	30	30	30	30	30	30
LTD total rate at economic life ($/Year)		$ 565.23	$ 548.86	$ 532.45	$ 521.49	$ 505.06	$ 488.68

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**1602**						
Description:	TANK, SALT BRINE STORAGE						
Functional Code:	STBRNT						
Fleet Status Summary				These analyses revealed the following issues:			
Data from year	2011			- Decreasing cost with age			
Number of units	21						
Average unit age at year end	4.9	yrs					
Average unit utilization	1.3 %						
Average operating rate	$ 246.90	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 2,856						
Depreciation Term	12	yrs					
Residual Value	20 %						
Initial operating rate	$ 178.36	per Year					
Annual operating rate factor	-0.1608						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	21	21	19	17	15	13	11
Economic life (yrs)	No Min	30	30	30	30	30	30
LTD total rate at economic life ($/Year)		$ 119.91	$ 116.73	$ 113.49	$ 110.21	$ 106.88	$ 103.53

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**1603**						
Description:	STATION, SALT BRINE FILL						
Functional Code:	STBRNS						
Fleet Status Summary				These analyses revealed the following issues:			
Data from year	2011			- Decreasing cost with age			
Number of units	62						
Average unit age at year end	5.1	yrs					
Average unit utilization	0.7 %						
Average operating rate	$ 351.75	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 2,135						
Depreciation Term	12	yrs					
Residual Value	20 %						
Initial operating rate	$ 100.49	per Year					
Annual operating rate factor	-0.0201						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	62	62	56	50	43	37	31
Economic life (yrs)	No Min	30	30	30	30	30	30
LTD total rate at economic life ($/Year)		$ 134.26	$ 132.28	$ 129.95	$ 126.61	$ 123.04	$ 118.57

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**1604**						
Description:	SYSTEM, SALT BRINE APPLICATOR						
Functional Code:	STBRNA						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Decreasing cost with age**			
Number of units	176						
Average unit age at year end	5.2	yrs					
Average unit utilization	1.6 %						
Average operating rate	$ 1,038.79	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 11,166						
Depreciation Term	12	yrs					
Residual Value	20 %						
Initial operating rate	$ 547.45	per Year					
Annual operating rate factor	-0.0303						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	176	176	158	141	123	106	88
Economic life (yrs)	No Min	30	30	30	30	30	30
LTD total rate at economic life ($/Year)		$ 669.83	$ 655.73	$ 640.21	$ 620.83	$ 599.01	$ 571.12

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**1703**						
Description:	TRACTOR IMPLEMENT/ATTACHMENT						
Functional Code:	TRCATT						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Decreasing cost with age**			
Number of units	6			**- Small number of machines**			
Average unit age at year end	7.3	yrs					
Average unit utilization	58.6 %						
Average operating rate	$ 1,082.25	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 12,131						
Depreciation Term	5	yrs					
Residual Value	20 %						
Initial operating rate	$ 344.06	per Year					
Annual operating rate factor	-0.0807						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	6	6	5	5	4	4	3
Economic life (yrs)	No Min	30	30	30	30	30	30
LTD total rate at economic life ($/Year)		$ 488.50	$ 472.27	$ 472.27	$ 453.96	$ 453.96	$ 433.66

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**1709**						
Description:	DRILL, AUGER						
Functional Code:	DRILLM						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			- Very large increasing cost with age			
Number of units	7			- Small number of machines			
Average annual usage	147	Hours					
Total annual fleet usage	1,027	Hours/yr					
Average unit age at year end	8.5	yrs					
Average unit utilization	44.9 %						
Average operating rate	$ 176.32	per Hour					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 249,944						
Depreciation Term	8	yrs					
Residual Value	25 %						
Initial operating rate	$ 20.75	per Hour					
Annual operating rate factor	0.1661						
Analyses Results							
	Current Fleet	**Reduced Fleet Size and Limited Annual Usage Decline**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	7	7	6	6	5	4	4
Initial usage (Hours)	287	171	195	195	228	279	279
Annual usage decline (Hours)	-16	-3	-4	-4	-5	-6	-6
Economic life (yrs)	11	15	13	13	11	8	8
Age at economic life (Hours)	2,163	2,228	2,197	2,197	2,206	2,040	2,040
LTD total rate at economic life ($/Hours)	$ 148.35	$ 149.93	$ 149.76	$ 149.76	$ 149.32	$ 150.78	$ 150.78

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**1720**						
Description:	BREAKER ATTACHMENT						
Functional Code:	All (2)						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			- Small number of machines			
Number of units	14						
Average unit age at year end	6.3	yrs					
Average unit utilization	38.3 %						
Average operating rate	$ 68.62	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 2,657						
Depreciation Term	5	yrs					
Residual Value	20 %						
Initial operating rate	$ 35.28	per Year					
Annual operating rate factor	0.0616						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	14	14	13	11	10	8	7
Economic life (yrs)	27	27	26	23	21	18	16
LTD total rate at economic life ($/Year)	$ 174.00	$ 174.00	$ 181.01	$ 198.16	$ 208.81	$ 236.73	$ 255.62

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**1802**						
Description:	AERIAL DEVICE, TRUCK MTD						
Functional Code:	All (2)						
Fleet Status Summary							
Data from year	2011						
Number of units	79						
Average unit age at year end	7.5	yrs					
Average unit utilization	59.1 %						
Average operating rate	$ 1,461.17	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 47,023						
Depreciation Term	6	yrs					
Residual Value	10 %						
Initial operating rate	$ 788.57	per Year					
Annual operating rate factor	0.0487						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	79	79	71	63	55	47	40
Economic life (yrs)	No Min	30	29	26	24	21	19
LTD total rate at economic life ($/Year)		$ 3,142.35	$ 3,317.18	$ 3,532.47	$ 3,797.93	$ 4,136.79	$ 4,526.32

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**1803**						
Description:	AERIAL DEVICE, BRIDGE INSPECTION						
Functional Code:	GAER3A						
Fleet Status Summary							
Data from year	2011						
Number of units	3						
Average unit age at year end	3.4	yrs					
Average unit utilization	54.8 %						
Average operating rate	$ 1,309.01	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 187,798						
Depreciation Term	7	yrs					
Residual Value	10 %						
Initial operating rate	$ 6,094.87	per Year					
Annual operating rate factor	-0.5224						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	3	3	3	2	2	2	2
Economic life (yrs)	No Min	30	30	30	30	30	30
LTD total rate at economic life ($/Year)		$ 6,293.98	$ 6,293.98	$ 6,171.05	$ 6,171.05	$ 6,171.05	$ 6,171.05

These analyses revealed the following issues:

- **Decreasing cost with age**
- **Small number of machines**

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**1805**						
Description:	AERIAL WORK PLATFORM						
Functional Code:	All (2)						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Decreasing cost with age**			
Number of units	9			**- Small number of machines**			
Average unit age at year end	8.5	yrs					
Average unit utilization	25.5 %						
Average operating rate	$ 2,741.28	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 110,747						
Depreciation Term	8	yrs					
Residual Value	25 %						
Initial operating rate	$ 2,627.10	per Year					
Annual operating rate factor	-0.0236						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	9	9	8	7	6	5	5
Economic life (yrs)	No Min	30	30	30	30	30	30
LTD total rate at economic life ($/Year)		$ 5,031.54	$ 4,965.88	$ 4,886.56	$ 4,789.00	$ 4,666.51	$ 4,666.51

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**1806**						
Description:	AERIAL DEVICE, SELF PROPELLED						
Functional Code:	AERDV2						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Small number of machines**			
Number of units	14						
Average unit age at year end	7.0	yrs					
Average unit utilization	94.7 %						
Average operating rate	$ 1,757.64	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 44,608						
Depreciation Term	7	yrs					
Residual Value	10 %						
Initial operating rate	$ 867.73	per Year					
Annual operating rate factor	0.0592						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	14	14	13	11	10	8	7
Economic life (yrs)	26	26	24	21	20	17	15
LTD total rate at economic life ($/Year)	$ 3,566.64	$ 3,566.64	$ 3,705.15	$ 4,044.45	$ 4,254.52	$ 4,806.50	$ 5,181.25

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**1815**						
Description:	CRANE, 16-18 TON						
Functional Code:	All (2)						
Fleet Status Summary				These analyses revealed the following issues:			
Data from year	2011			- Decreasing cost with age			
Number of units	54						
Average unit age at year end	8.6	yrs					
Average unit utilization	24.3 %						
Average operating rate	$ 2,786.75	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 90,384						
Depreciation Term	9	yrs					
Residual Value	15 %						
Initial operating rate	$ 2,331.93	per Year					
Annual operating rate factor	-0.0142						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	54	54	49	43	38	32	27
Economic life (yrs)	No Min	30	30	30	30	30	30
LTD total rate at economic life ($/Year)		$ 4,561.09	$ 4,526.32	$ 4,475.71	$ 4,423.63	$ 4,344.38	$ 4,258.30

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**1822**						
Description:	CRANE, MECHANIC						
Functional Code:	All (4)						
Fleet Status Summary				These analyses revealed the following issues:			
Data from year	2011			- Decreasing cost with age			
Number of units	266						
Average unit age at year end	7.5	yrs					
Average unit utilization	89.9 %						
Average operating rate	$ 712.13	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 7,235						
Depreciation Term	7	yrs					
Residual Value	10 %						
Initial operating rate	$ 608.45	per Year					
Annual operating rate factor	-0.0252						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	266	266	239	213	186	160	133
Economic life (yrs)	No Min	30	30	30	30	30	30
LTD total rate at economic life ($/Year)		$ 620.84	$ 606.56	$ 590.35	$ 570.24	$ 546.76	$ 516.71

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**1852**						
Description:	EXCAVATOR, WHEEL						
Functional Code:	EXCAVC						
Fleet Status Summary							
Data from year	2011						
Number of units	20						
Average annual usage	279	Hours					
Total annual fleet usage	5,579	Hours/yr					
Average unit age at year end	8.7	yrs					
Average unit utilization	30.3 %						
Average operating rate	$ 47.44	per Hour					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 206,294						
Depreciation Term	7	yrs					
Residual Value	25 %						
Initial operating rate	$ 14.51	per Hour					
Annual operating rate factor	0.1099						
Analyses Results							
	Current Fleet		**Reduced Fleet Size and Limited Annual Usage Decline**				
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	20	20	18	16	14	12	10
Initial usage (Hours)	384	324	360	396	443	505	594
Annual usage decline (Hours)	-12	-6	-7	-8	-9	-10	-12
Economic life (yrs)	14	15	13	12	10	9	7
Age at economic life (Hours)	4,194	4,185	4,089	4,176	3,980	4,140	3,864
LTD total rate at economic life ($/Hours)	$ 73.31	$ 72.70	$ 72.82	$ 72.58	$ 73.18	$ 72.80	$ 73.96

These analyses revealed the following issues:

- Very large increasing cost with age

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**1853**						
Description:	EXCAVATOR, TRACK 20 - 36 METRIC TON						
Functional Code:	All (2)						
Fleet Status Summary							
Data from year	2011						
Number of units	40						
Average annual usage	428	Hours					
Total annual fleet usage	17,126	Hours/yr					
Average unit age at year end	6.7	yrs					
Average unit utilization	43.3 %						
Average operating rate	$ 27.47	per Hour					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 133,982						
Depreciation Term	7	yrs					
Residual Value	25 %						
Initial operating rate	$ 17.86	per Hour					
Annual operating rate factor	0.0439						
Analyses Results							
	Current Fleet		**Reduced Fleet Size and Limited Annual Usage Decline**				
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	40	40	36	32	28	24	20
Initial usage (Hours)	560	510	553	608	695	793	931
Annual usage decline (Hours)	-20	-10	-11	-12	-14	-16	-19
Economic life (yrs)	19	17	15	13	11	10	8
Age at economic life (Hours)	7,089	7,225	7,058	6,890	6,798	7,130	6,840
LTD total rate at economic life ($/Hours)	$ 41.32	$ 41.32	$ 41.36	$ 41.44	$ 41.57	$ 41.72	$ 41.87

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**1854**						
Description:	EXCAVATOR, TRACK 12 - 18 METRIC TON						
Functional Code:	EXCAVC						
Fleet Status Summary							
Data from year	2011						
Number of units	20						
Average annual usage	509	Hours					
Total annual fleet usage	10,183	Hours/yr					
Average unit age at year end	6.9	yrs					
Average unit utilization	48.3 %						
Average operating rate	$ 20.76	per Hour					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 111,494						
Depreciation Term	7	yrs					
Residual Value	25 %						
Initial operating rate	$ 13.42	per Hour					
Annual operating rate factor	0.0484						
Analyses Results							
	Current Fleet	**Reduced Fleet Size and Limited Annual Usage Decline**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	20	20	18	16	14	12	10
Initial usage (Hours)	638	606	658	723	808	943	1,107
Annual usage decline (Hours)	-19	-12	-13	-14	-16	-19	-22
Economic life (yrs)	18	16	14	13	11	9	8
Age at economic life (Hours)	8,477	8,160	7,938	8,216	7,920	7,718	8,152
LTD total rate at economic life ($/Hours)	$ 30.89	$ 30.78	$ 30.72	$ 30.90	$ 30.91	$ 31.12	$ 31.25

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**2002**						
Description:	LOADER, WHEEL 2 CY						
Functional Code:	LOADRM						
Fleet Status Summary							
Data from year	2011						
Number of units	184						
Average annual usage	342	Hours					
Total annual fleet usage	63,007	Hours/yr					
Average unit age at year end	8.2	yrs					
Average unit utilization	67.5 %						
Average operating rate	$ 33.75	per Hour					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 102,495						
Depreciation Term	7	yrs					
Residual Value	25 %						
Initial operating rate	$ 13.50	per Hour					
Annual operating rate factor	0.0799						
Analyses Results							
	Current Fleet	**Reduced Fleet Size and Limited Annual Usage Decline**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	184	184	166	147	129	110	92
Initial usage (Hours)	528	398	431	487	543	623	729
Annual usage decline (Hours)	-23	-8	-9	-10	-11	-12	-15
Economic life (yrs)	13	14	13	11	10	8	6
Age at economic life (Hours)	4,950	4,788	4,843	4,752	4,880	4,600	4,104
LTD total rate at economic life ($/Hours)	$ 39.31	$ 39.17	$ 39.26	$ 39.40	$ 39.42	$ 39.55	$ 39.76

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**2008**							
Description:	LOADER, CRAWLER							
Functional Code:	LOADRM							
Fleet Status Summary				These analyses revealed the following issues:				
Data from year	2011			- Small number of machines				
Number of units	9							
Average annual usage	166	Hours						
Total annual fleet usage	1,495	Hours/yr						
Average unit age at year end	8.6	yrs						
Average unit utilization	16.7 %							
Average operating rate	$ 40.14	per Hour						
Economic Analyses								
Input Values								
Interest Rate	3.0 %							
Inflation Rate	2.4 %							
Purchase Price	$ 180,055							
Depreciation Term	8	yrs						
Residual Value	20 %							
Initial operating rate	$ 11.84	per Hour						
Annual operating rate factor	0.0991							
Analyses Results								
	Current Fleet		**Reduced Fleet Size and Limited Annual Usage Decline**					
Fleet reduction	**0 %**		**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	9		9	8	7	6	5	5
Initial usage (Hours)	246		203	222	248	283	332	332
Annual usage decline (Hours)	-9		-4	-4	-5	-6	-7	-7
Economic life (yrs)	19		18	16	14	12	10	10
Age at economic life (Hours)	3,006		3,006	3,040	2,982	2,964	2,970	2,970
LTD total rate at economic life ($/Hours)	$ 81.93		$ 82.41	$ 82.26	$ 82.19	$ 82.38	$ 83.02	$ 83.02

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**2013**							
Description:	LOADER ATTACHMENT							
Functional Code:	All (2)							
Fleet Status Summary				These analyses revealed the following issues:				
Data from year	2011			- Decreasing cost with age				
Number of units	6			- Small number of machines				
Average unit age at year end	6.4	yrs						
Average unit utilization	13.6 %							
Average operating rate	$ 107.63	per Year						
Economic Analyses								
Input Values								
Interest Rate	3.0 %							
Inflation Rate	2.4 %							
Purchase Price	$ 8,474							
Depreciation Term	5	yrs						
Residual Value	20 %							
Initial operating rate	$ 344.12	per Year						
Annual operating rate factor	-0.2239							
Analyses Results								
	Current Fleet		**Reduced Fleet Size**					
Fleet reduction	**0 %**		**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	6		6	5	5	4	4	3
Economic life (yrs)	No Min		30	30	30	30	30	30
LTD total rate at economic life ($/Year)			$ 303.58	$ 295.51	$ 295.51	$ 287.37	$ 287.37	$ 279.19

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**2101**						
Description:	GENERATOR/STANDBY POWER SYSTEM						
Functional Code:	GENRTR						
Fleet Status Summary				These analyses revealed the following issues:			
Data from year	2011			- Decreasing cost with age			
Number of units	89						
Average annual usage	47	Hours					
Total annual fleet usage	4,166	Hours/yr					
Average unit age at year end	7.4	yrs					
Average unit utilization	130.8 %						
Average operating rate	$ 105.05	per Hour					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 20,171						
Depreciation Term	5	yrs					
Residual Value	10 %						
Initial operating rate	$ 58.07	per Hour					
Annual operating rate factor	-0.0172						
Analyses Results							
	Current Fleet	**Reduced Fleet Size and Limited Annual Usage Decline**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	89	89	80	71	62	53	45
Initial usage (Hours)	51						
Annual usage decline (Hours)	-1						
Economic life (yrs)	No Min	No Match	No Match	No Match	No Match	No Match	No Match
Age at economic life (Hours)							
LTD total rate at economic life ($/Hours)							

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**2115**						
Description:	LIGHT PLANT						
Functional Code:	LTPLNT						
Fleet Status Summary				These analyses revealed the following issues:			
Data from year	2011			- Very large increasing cost with age			
Number of units	20						
Average annual usage	64	Hours					
Total annual fleet usage	1,283	Hours/yr					
Average unit age at year end	6.9	yrs					
Average unit utilization	58.7 %						
Average operating rate	$ 30.25	per Hour					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 8,581						
Depreciation Term	7	yrs					
Residual Value	20 %						
Initial operating rate	$ 1.01	per Hour					
Annual operating rate factor	0.3141						
Analyses Results							
	Current Fleet	**Reduced Fleet Size and Limited Annual Usage Decline**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	20	20	18	16	14	12	10
Initial usage (Hours)	104	71	79	87	97	114	
Annual usage decline (Hours)	-6	-1	-2	-2	-2	-2	
Economic life (yrs)	8	10	9	8	7	5	No Match
Age at economic life (Hours)	647	660	630	632	630	545	
LTD total rate at economic life ($/Hours)	$ 15.77	$ 15.83	$ 15.77	$ 15.84	$ 15.96	$ 15.47	

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**2205**						
Description:	MIXER, MASONRY/ASPHALT						
Functional Code:	MIXERM						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Decreasing cost with age**			
Number of units	4			**- Small number of machines**			
Average unit age at year end	10.3	yrs					
Average unit utilization	32.8 %						
Average operating rate	$ 901.82	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 76,499						
Depreciation Term	6	yrs					
Residual Value	20 %						
Initial operating rate	$ 3,131.70	per Year					
Annual operating rate factor	-0.1668						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	4	4	4	3	3	2	2
Economic life (yrs)	No Min	30	30	30	30	30	30
LTD total rate at economic life ($/Year)		$ 2,890.68	$ 2,890.68	$ 2,746.56	$ 2,746.56	$ 2,598.12	$ 2,598.12

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**2215**						
Description:	HYDRAULIC IMPACTOR						
Functional Code:	All (2)						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Decreasing cost with age**			
Number of units	4			**- Small number of machines**			
Average unit age at year end	11.1	yrs					
Average unit utilization	60.3 %						
Average operating rate	$ 1,152.72	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 30,121						
Depreciation Term	11	yrs					
Residual Value	10 %						
Initial operating rate	$ 600.59	per Year					
Annual operating rate factor	-0.0419						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	4	4	4	3	3	2	2
Economic life (yrs)	No Min	30	30	30	30	30	30
LTD total rate at economic life ($/Year)		$ 1,274.30	$ 1,274.30	$ 1,227.78	$ 1,227.78	$ 1,161.62	$ 1,161.62

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**2301**						
Description:	A-BOOM MOWER ATTACHMENT						
Functional Code:	All (2)						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Very large increasing cost with age**			
Number of units	3			**- Small number of machines**			
Average unit age at year end	6.9	yrs					
Average unit utilization	33.7 %						
Average operating rate	$ 876.69	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 9,242						
Depreciation Term	5	yrs					
Residual Value	20 %						
Initial operating rate	$ 8.31	per Year					
Annual operating rate factor	0.5811						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	3	3	3	2	2	2	2
Economic life (yrs)	8	8	8	6	6	6	6
LTD total rate at economic life ($/Year)	$ 1,207.12	$ 1,207.12	$ 1,207.12	$ 1,710.93	$ 1,710.93	$ 1,710.93	$ 1,710.93

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**2308**						
Description:	A-BOOM MOWER ATTACHMENT						
Functional Code:	All (3)						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Decreasing cost with age**			
Number of units	174						
Average unit age at year end	8.0	yrs					
Average unit utilization	36.0 %						
Average operating rate	$ 5,304.44	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 25,585						
Depreciation Term	8	yrs					
Residual Value	20 %						
Initial operating rate	$ 5,332.17	per Year					
Annual operating rate factor	-0.0405						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	174	174	157	139	122	104	87
Economic life (yrs)	No Min	30	30	30	30	30	30
LTD total rate at economic life ($/Year)		$ 3,598.13	$ 3,454.06	$ 3,279.34	$ 3,089.10	$ 2,855.42	$ 2,598.43

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**2310**						
Description:	RIDING MOWER						
Functional Code:	MOWERM						
Fleet Status Summary							
Data from year	2011						
Number of units	78						
Average annual usage	85	Hours					
Total annual fleet usage	6,633	Hours/yr					
Average unit age at year end	7.3	yrs					
Average unit utilization	58.7 %						
Average operating rate	$ 34.32	per Hour					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 14,873						
Depreciation Term	5	yrs					
Residual Value	15 %						
Initial operating rate	$ 13.48	per Hour					
Annual operating rate factor	0.0559						
Analyses Results							
	Current Fleet		**Reduced Fleet Size and Limited Annual Usage Decline**				
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	78	78	70	62	55	47	39
Initial usage (Hours)	144	99	108	122	134	153	185
Annual usage decline (Hours)	-8	-2	-2	-2	-3	-3	-4
Economic life (yrs)	14	15	13	11	11	9	7
Age at economic life (Hours)	1,220	1,260	1,235	1,221	1,293	1,256	1,197
LTD total rate at economic life ($/Hours)	$ 29.50	$ 29.38	$ 29.44	$ 29.57	$ 29.58	$ 29.92	$ 30.02

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**2502**						
Description:	ROLLER, TANDEM, STATIC						
Functional Code:	ROLLRM						
Fleet Status Summary							
Data from year	2011						
Number of units	15						
Average annual usage	87	Hours					
Total annual fleet usage	1,298	Hours/yr					
Average unit age at year end	9.8	yrs					
Average unit utilization	18.3 %						
Average operating rate	$ 29.00	per Hour					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 44,182						
Depreciation Term	5	yrs					
Residual Value	20 %						
Initial operating rate	$ 52.10	per Hour					
Annual operating rate factor	-0.0979						
Analyses Results							
	Current Fleet		**Reduced Fleet Size and Limited Annual Usage Decline**				
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	15	15	14	12	11	9	8
Initial usage (Hours)	33						
Annual usage decline (Hours)	5						
Economic life (yrs)	No Min	No Match	No Match	No Match	No Match	No Match	No Match
Age at economic life (Hours)							
LTD total rate at economic life ($/Hours)							

These analyses revealed the following issues:

- **Increasing use with age**
- **Decreasing cost with age**
- **Small number of machines**

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**2504**						
Description:	ROLLER, RUBBER TIRE						
Functional Code:	ROLLRM						
Fleet Status Summary							
Data from year	2011						
Number of units	9						
Average annual usage	120	Hours					
Total annual fleet usage	1,081	Hours/yr					
Average unit age at year end	7.8	yrs					
Average unit utilization	24.5 %						
Average operating rate	$ 31.60	per Hour					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 56,145						
Depreciation Term	5	yrs					
Residual Value	25 %						
Initial operating rate	$ 12.56	per Hour					
Annual operating rate factor	0.0630						
Analyses Results							
	Current Fleet		**Reduced Fleet Size and Limited Annual Usage Decline**				
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	9	9	8	7	6	5	5
Initial usage (Hours)	298	150	165	184	209	246	246
Annual usage decline (Hours)	-23	-3	-3	-4	-4	-5	-5
Economic life (yrs)	12	21	19	17	14	12	12
Age at economic life (Hours)	1,939	2,489	2,594	2,550	2,534	2,592	2,592
LTD total rate at economic life ($/Hours)	$ 40.69	$ 38.53	$ 38.29	$ 38.57	$ 38.30	$ 37.95	$ 37.95

These analyses revealed the following issues:

- Small number of machines

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**2507**						
Description:	ROLLER, VIBRATORY						
Functional Code:	ROLLRM						
Fleet Status Summary							
Data from year	2011						
Number of units	94						
Average annual usage	120	Hours					
Total annual fleet usage	11,301	Hours/yr					
Average unit age at year end	5.9	yrs					
Average unit utilization	27.0 %						
Average operating rate	$ 20.26	per Hour					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 44,696						
Depreciation Term	5	yrs					
Residual Value	25 %						
Initial operating rate	$ 14.33	per Hour					
Annual operating rate factor	0.0211						
Analyses Results							
	Current Fleet		**Reduced Fleet Size and Limited Annual Usage Decline**				
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	94	94	85	75	66	56	47
Initial usage (Hours)	178		166	188	204	235	273
Annual usage decline (Hours)	-10		-3	-4	-4	-5	-5
Economic life (yrs)	17	No Match	21	19	17	14	11
Age at economic life (Hours)	1,615		2,825	2,850	2,890	2,800	2,701
LTD total rate at economic life ($/Hours)	$ 39.34		$ 32.77	$ 32.99	$ 32.76	$ 32.92	$ 33.12

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**2604**						
Description:	SCRAPER, SELF PROPELLED, 11 CY						
Functional Code:	SCRPER						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Small number of machines**			
Number of units	17						
Average annual usage	118	Hours					
Total annual fleet usage	2,007	Hours/yr					
Average unit age at year end	13.3	yrs					
Average unit utilization	23.0 %						
Average operating rate	$ 118.96	per Hour					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 234,072						
Depreciation Term	9	yrs					
Residual Value	20 %						
Initial operating rate	$ 29.34	per Hour					
Annual operating rate factor	0.0575						
Analyses Results							
	Current Fleet		**Reduced Fleet Size and Limited Annual Usage Decline**				
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	17	17	15	14	12	10	9
Initial usage (Hours)	206				204	239	259
Annual usage decline (Hours)	-7				-4	-5	-5
Economic life (yrs)	24	No Match	No Match	No Match	19	15	14
Age at economic life (Hours)	3,035				3,154	3,023	3,136
LTD total rate at economic life ($/Hours)	$ 121.57				$ 121.48	$ 121.95	$ 121.88

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**2703**						
Description:	CRANE, TRACK MOUNTED						
Functional Code:	CRANEM						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Decreasing cost with age**			
Number of units	6			**- Small number of machines**			
Average annual usage	98	Hours					
Total annual fleet usage	585	Hours/yr					
Average unit age at year end	15.9	yrs					
Average unit utilization	18.7 %						
Average operating rate	$ 132.50	per Hour					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 638,342						
Depreciation Term	10	yrs					
Residual Value	20 %						
Initial operating rate	$ 138.09	per Hour					
Annual operating rate factor	-0.0370						
Analyses Results							
	Current Fleet		**Reduced Fleet Size and Limited Annual Usage Decline**				
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	6	6	5	5	4	4	3
Initial usage (Hours)	327						
Annual usage decline (Hours)	-14						
Economic life (yrs)	No Min	No Match	No Match	No Match	No Match	No Match	No Match
Age at economic life (Hours)							
LTD total rate at economic life ($/Hours)							

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**2850**						
Description:	SPREADER, WIDENER						
Functional Code:	SPRDRM						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Increasing use with age**			
Number of units	4			**- Small number of machines**			
Average annual usage	139	Hours					
Total annual fleet usage	554	Hours/yr					
Average unit age at year end	9.4	yrs					
Average unit utilization	19.4 %						
Average operating rate	$ 46.59	per Hour					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 177,541						
Depreciation Term	7	yrs					
Residual Value	20 %						
Initial operating rate	$ 35.03	per Hour					
Annual operating rate factor	0.0282						
Analyses Results							
	Current Fleet	**Reduced Fleet Size and Limited Annual Usage Decline**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	4	4	4	3	3	2	2
Initial usage (Hours)	15						
Annual usage decline (Hours)	13						
Economic life (yrs)	No Min	No Match	No Match	No Match	No Match	No Match	No Match
Age at economic life (Hours)							
LTD total rate at economic life ($/Hours)							

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**2851**						
Description:	SHOULDER MACHINE						
Functional Code:	All (2)						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Decreasing cost with age**			
Number of units	24						
Average unit age at year end	7.8	yrs					
Average unit utilization	4.5 %						
Average operating rate	$ 750.70	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 32,856						
Depreciation Term	7	yrs					
Residual Value	15 %						
Initial operating rate	$ 541.59	per Year					
Annual operating rate factor	-0.0640						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	24	24	22	19	17	14	12
Economic life (yrs)	No Min	30	30	30	30	30	30
LTD total rate at economic life ($/Year)		$ 1,246.34	$ 1,233.44	$ 1,212.05	$ 1,196.30	$ 1,170.26	$ 1,151.27

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**2853**						
Description:	SPREADER, AGGREGATE						
Functional Code:	SPRDRM						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Very small increasing cost with age**			
Number of units	28						
Average annual usage	245	Hours					
Total annual fleet usage	6,860	Hours/yr					
Average unit age at year end	7.7	yrs					
Average unit utilization	44.2 %						
Average operating rate	$ 99.53	per Hour					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 141,923						
Depreciation Term	7	yrs					
Residual Value	20 %						
Initial operating rate	$ 75.96	per Hour					
Annual operating rate factor	0.0020						
Analyses Results							
	Current Fleet	**Reduced Fleet Size and Limited Annual Usage Decline**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	28	28	25	22	20	17	14
Initial usage (Hours)	370						
Annual usage decline (Hours)	-16						
Economic life (yrs)	No Min	No Match	No Match	No Match	No Match	No Match	No Match
Age at economic life (Hours)							
LTD total rate at economic life ($/Hours)							

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**3151**						
Description:	FUEL AND LUBE TANK, TRUCK MTD						
Functional Code:	GFUELT						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Decreasing cost with age**			
Number of units	98						
Average unit age at year end	8.3	yrs					
Average unit utilization	104.4 %						
Average operating rate	$ 507.40	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 55,661						
Depreciation Term	9	yrs					
Residual Value	25 %						
Initial operating rate	$ 370.95	per Year					
Annual operating rate factor	-0.0291						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	98	98	88	78	69	59	49
Economic life (yrs)	No Min	30	30	30	30	30	30
LTD total rate at economic life ($/Year)		$ 1,890.16	$ 1,880.79	$ 1,869.80	$ 1,858.15	$ 1,842.72	$ 1,823.92

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**3201**						
Description:	TRAILER, LIGHT EQUIPMENT TRANSPORT						
Functional Code:	All (4)						
Fleet Status Summary							
Data from year	2011						
Number of units	650						
Average unit age at year end	9.3	yrs					
Average unit utilization	38.1 %						
Average operating rate	$ 1,173.70	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 12,843						
Depreciation Term	8	yrs					
Residual Value	10 %						
Initial operating rate	$ 464.80	per Year					
Annual operating rate factor	0.0384						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	650	650	585	520	455	390	325
Economic life (yrs)	28	28	26	24	22	20	17
LTD total rate at economic life ($/Year)	$ 1,209.56	$ 1,209.56	$ 1,264.29	$ 1,329.63	$ 1,409.63	$ 1,511.03	$ 1,643.65

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**3203**						
Description:	TRAILER, MATERIAL TRANSPORT						
Functional Code:	TRALR4						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Decreasing cost with age**			
Number of units	29						
Average unit age at year end	10.5	yrs					
Average unit utilization	45.9 %						
Average operating rate	$ 1,049.56	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 19,349						
Depreciation Term	8	yrs					
Residual Value	10 %						
Initial operating rate	$ 906.40	per Year					
Annual operating rate factor	-0.0888						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	29	29	26	23	20	17	15
Economic life (yrs)	No Min	30	30	30	30	30	30
LTD total rate at economic life ($/Year)		$ 904.95	$ 879.84	$ 852.98	$ 824.38	$ 794.13	$ 773.16

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**3205**						
Description:	TRAILER, SPECIAL PURPOSE						
Functional Code:	TRALR5						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Small number of machines**			
Number of units	9						
Average unit age at year end	11.7	yrs					
Average unit utilization	147.6 %						
Average operating rate	$ 878.95	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 13,524						
Depreciation Term	8	yrs					
Residual Value	10 %						
Initial operating rate	$ 629.89	per Year					
Annual operating rate factor	0.0141						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	9	9	8	7	6	5	5
Economic life (yrs)	No Min	30	30	30	30	30	30
LTD total rate at economic life ($/Year)		$ 1,150.37	$ 1,171.20	$ 1,199.14	$ 1,238.53	$ 1,298.08	$ 1,298.08

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**3214**						
Description:	TRAILER, UTILITY						
Functional Code:	All (6)						
Fleet Status Summary							
Data from year	2011						
Number of units	245						
Average unit age at year end	10.0	yrs					
Average unit utilization	49.3 %						
Average operating rate	$ 400.62	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 4,880						
Depreciation Term	8	yrs					
Residual Value	10 %						
Initial operating rate	$ 144.09	per Year					
Annual operating rate factor	0.0481						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	245	245	221	196	172	147	123
Economic life (yrs)	26	26	24	22	20	18	16
LTD total rate at economic life ($/Year)	$ 446.86	$ 446.86	$ 468.46	$ 495.43	$ 527.22	$ 569.26	$ 622.81

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**3221**						
Description:	MODULAR OFFICE, SINGLE						
Functional Code:	MODULR						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Decreasing cost with age**			
Number of units	5			**- Small number of machines**			
Average unit age at year end	4.6	yrs					
Average unit utilization	221.5 %						
Average operating rate	$ 1,160.42	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 25,491						
Depreciation Term	10	yrs					
Residual Value	10 %						
Initial operating rate	$ 815.41	per Year					
Annual operating rate factor	-0.0317						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	5	5	5	4	4	3	3
Economic life (yrs)	No Min	30	30	30	30	30	30
LTD total rate at economic life ($/Year)		$ 1,294.84	$ 1,294.84	$ 1,249.67	$ 1,249.67	$ 1,187.14	$ 1,187.14

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**3230**						
Description:	TRUCK MOUNT ATTENUATOR						
Functional Code:	All (8)						
Fleet Status Summary							
Data from year	2011						
Number of units	150						
Average unit age at year end	6.6	yrs					
Average unit utilization	28.6 %						
Average operating rate	$ 488.93	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 16,667						
Depreciation Term	7	yrs					
Residual Value	20 %						
Initial operating rate	$ 314.38	per Year					
Annual operating rate factor	0.0302						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	150	150	135	120	105	90	75
Economic life (yrs)	No Min	30	30	30	30	28	25
LTD total rate at economic life ($/Year)		$ 978.32	$ 1,006.50	$ 1,044.73	$ 1,099.32	$ 1,181.23	$ 1,291.73

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**3301**						
Description:	BOAT, MOTOR, TRAILER						
Functional Code:	All (2)						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Very large increasing cost with age**			
Number of units	34						
Average unit age at year end	5.5	yrs					
Average unit utilization	31.4 %						
Average operating rate	$ 376.64	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 14,163						
Depreciation Term	5	yrs					
Residual Value	10 %						
Initial operating rate	$ 47.52	per Year					
Annual operating rate factor	0.2143						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	34	34	31	27	24	20	17
Economic life (yrs)	15	15	14	12	11	10	8
LTD total rate at economic life ($/Year)	$ 1,250.81	$ 1,250.81	$ 1,338.46	$ 1,486.12	$ 1,621.64	$ 1,863.92	$ 2,120.67

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**3500**						
Description:	PUMP, WATER						
Functional Code:	All (2)						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Decreasing cost with age**			
Number of units	35						
Average unit age at year end	6.9	yrs					
Average unit utilization	38.4 %						
Average operating rate	$ 544.39	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 14,161						
Depreciation Term	5	yrs					
Residual Value	20 %						
Initial operating rate	$ 594.07	per Year					
Annual operating rate factor	-0.0829						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	35	35	32	28	25	21	18
Economic life (yrs)	No Min	30	30	30	30	30	30
LTD total rate at economic life ($/Year)		$ 631.65	$ 617.78	$ 597.91	$ 581.95	$ 559.29	$ 541.34

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**3980**						
Description:	PLOW, SNOW 10'						
Functional Code:	SNWEQA						
Fleet Status Summary				These analyses revealed the following issues:			
Data from year	2011			- Decreasing cost with age			
Number of units	1,159						
Average unit age at year end	11.1	yrs					
Average unit utilization	3.2 %						
Average operating rate	$ 405.81	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 2,901						
Depreciation Term	7	yrs					
Residual Value	20 %						
Initial operating rate	$ 342.98	per Year					
Annual operating rate factor	-0.0557						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	1,159	1,159	1,043	927	811	695	580
Economic life (yrs)	No Min	30	30	30	30	30	30
LTD total rate at economic life ($/Year)		$ 240.37	$ 230.43	$ 219.35	$ 206.98	$ 193.17	$ 177.94

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**4102**						
Description:	BRUSH CHIPPER						
Functional Code:	BSHCPR						
Fleet Status Summary				These analyses revealed the following issues:			
Data from year	2011			- Very large increasing cost with age			
Number of units	64						
Average annual usage	69	Hours					
Total annual fleet usage	4,440	Hours/yr					
Average unit age at year end	8.0	yrs					
Average unit utilization	11.2 %						
Average operating rate	$ 54.95	per Hour					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 35,602						
Depreciation Term	7	yrs					
Residual Value	20 %						
Initial operating rate	$ 14.46	per Hour					
Annual operating rate factor	0.1058						
Analyses Results							
	Current Fleet	**Reduced Fleet Size and Limited Annual Usage Decline**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	64	64	58	51	45	38	32
Initial usage (Hours)	101	81	87	97	110	127	148
Annual usage decline (Hours)	-4	-2	-2	-2	-2	-3	-3
Economic life (yrs)	13	15	13	11	9	8	6
Age at economic life (Hours)	979	990	962	946	909	920	834
LTD total rate at economic life ($/Hours)	$ 60.33	$ 60.06	$ 60.26	$ 60.52	$ 60.77	$ 61.07	$ 61.24

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**4103**						
Description:	CURB MACHINE						
Functional Code:	CONFRM						
Fleet Status Summary				These analyses revealed the following issues:			
Data from year	2011			- Very large increasing cost with age			
Number of units	7			- Small number of machines			
Average unit age at year end	11.7	yrs					
Average unit utilization	0.6 %						
Average operating rate	$ 368.32	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 6,966						
Depreciation Term	7	yrs					
Residual Value	15 %						
Initial operating rate	$ 6.31	per Year					
Annual operating rate factor	0.2555						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	7	7	6	6	5	4	4
Economic life (yrs)	17	17	15	15	13	10	10
LTD total rate at economic life ($/Year)	$ 488.01	$ 488.01	$ 551.06	$ 551.06	$ 638.14	$ 763.02	$ 763.02

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**4104**						
Description:	HYDRO-SEEDER ATTACHMENT						
Functional Code:	All (2)						
Fleet Status Summary				These analyses revealed the following issues:			
Data from year	2011			- Very large increasing cost with age			
Number of units	22						
Average annual usage	134	Hours					
Total annual fleet usage	2,953	Hours/yr					
Average unit age at year end	6.1	yrs					
Average unit utilization	33.9 %						
Average operating rate	$ 112.33	per Hour					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 47,255						
Depreciation Term	6	yrs					
Residual Value	20 %						
Initial operating rate	$ 11.81	per Hour					
Annual operating rate factor	0.2638						
Analyses Results							
	Current Fleet	**Reduced Fleet Size and Limited Annual Usage Decline**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	22	22	20	18	15	13	11
Initial usage (Hours)	314	149	160	178	209	242	
Annual usage decline (Hours)	-29	-3	-3	-4	-4	-5	
Economic life (yrs)	1	10	9	8	6	5	No Match
Age at economic life (Hours)	299	1,340	1,319	1,296	1,182	1,148	
LTD total rate at economic life ($/Hours)	$ 54.98	$ 57.17	$ 57.29	$ 57.42	$ 58.10	$ 57.34	

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**4106**						
Description:	SPRAYER ATTACHMENT						
Functional Code:	All (5)						
Fleet Status Summary				These analyses revealed the following issues:			
Data from year	2011			- Very large increasing cost with age			
Number of units	23						
Average unit age at year end	8.8	yrs					
Average unit utilization	26.7 %						
Average operating rate	$ 1,426.23	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 66,757						
Depreciation Term	6	yrs					
Residual Value	20 %						
Initial operating rate	$ 121.68	per Year					
Annual operating rate factor	0.1282						
Analyses Results							
	Current Fleet		**Reduced Fleet Size**				
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	23	23	21	18	16	14	12
Economic life (yrs)	26	26	24	21	19	17	15
LTD total rate at economic life ($/Year)	$ 3,267.69	$ 3,267.69	$ 3,485.62	$ 3,891.90	$ 4,237.17	$ 4,669.81	$ 5,231.23

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**4119**						
Description:	WELDER/GENERATOR						
Functional Code:	All (7)						
Fleet Status Summary				These analyses revealed the following issues:			
Data from year	2011			- Increasing use with age			
Number of units	115			- Very small increasing cost with age			
Average annual usage	58	Hours					
Total annual fleet usage	6,621	Hours/yr					
Average unit age at year end	7.6	yrs					
Average unit utilization	90.6 %						
Average operating rate	$ 23.00	per Hour					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 4,249						
Depreciation Term	6	yrs					
Residual Value	25 %						
Initial operating rate	$ 8.62	per Hour					
Annual operating rate factor	0.0018						
Analyses Results							
	Current Fleet		**Reduced Fleet Size and Limited Annual Usage Decline**				
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	115	115	104	92	81	69	58
Initial usage (Hours)	33						
Annual usage decline (Hours)	3						
Economic life (yrs)	No Min	No Match	No Match	No Match	No Match	No Match	No Match
Age at economic life (Hours)							
LTD total rate at economic life ($/Hours)							

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**4122**						
Description:	POST, PULLER, AUGER/TOOL KIT						
Functional Code:	All (4)						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Decreasing cost with age**			
Number of units	97						
Average unit age at year end	6.2	yrs					
Average unit utilization	70.3 %						
Average operating rate	$ 229.59	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 7,185						
Depreciation Term	7	yrs					
Residual Value	20 %						
Initial operating rate	$ 124.31	per Year					
Annual operating rate factor	-0.0633						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	97	97	87	78	68	58	49
Economic life (yrs)	No Min	30	30	30	30	30	30
LTD total rate at economic life ($/Year)		$ 270.36	$ 266.66	$ 263.00	$ 258.52	$ 253.59	$ 248.74

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**4126**						
Description:	SPREADER, TAILGATE MOUNT						
Functional Code:	SPRTGM						
Fleet Status Summary							
Data from year	2011						
Number of units	75						
Average unit age at year end	5.9	yrs					
Average unit utilization	3.7 %						
Average operating rate	$ 291.38	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 1,771						
Depreciation Term	7	yrs					
Residual Value	20 %						
Initial operating rate	$ 133.22	per Year					
Annual operating rate factor	0.0174						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	75	75	68	60	53	45	38
Economic life (yrs)	No Min	30	30	30	29	25	22
LTD total rate at economic life ($/Year)		$ 214.27	$ 219.04	$ 226.18	$ 234.55	$ 246.52	$ 259.92

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**4127**						
Description:	SPREADER, 5CY IN BODY						
Functional Code:	SPRIBA						
Fleet Status Summary							
Data from year	2011						
Number of units	751						
Average unit age at year end	6.4	yrs					
Average unit utilization	4.6 %						
Average operating rate	$ 570.83	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 5,958						
Depreciation Term	7	yrs					
Residual Value	20 %						
Initial operating rate	$ 249.98	per Year					
Annual operating rate factor	0.0183						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	751	751	676	601	526	451	376
Economic life (yrs)	No Min	30	30	30	30	30	27
LTD total rate at economic life ($/Year)		$ 487.08	$ 497.44	$ 511.04	$ 529.62	$ 556.47	$ 595.75

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**4128**						
Description:	PLOW, SNOW 10'						
Functional Code:	SNPLWA						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Decreasing cost with age**			
Number of units	317						
Average unit age at year end	4.7	yrs					
Average unit utilization	4.3 %						
Average operating rate	$ 388.97	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 4,398						
Depreciation Term	7	yrs					
Residual Value	20 %						
Initial operating rate	$ 246.23	per Year					
Annual operating rate factor	-0.0634						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	317	317	285	254	222	190	159
Economic life (yrs)	No Min	30	30	30	30	30	30
LTD total rate at economic life ($/Year)		$ 234.63	$ 227.46	$ 219.81	$ 211.11	$ 201.55	$ 191.44

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**4136**						
Description:	FORKLIFT						
Functional Code:	FRKLFT						
Fleet Status Summary							
Data from year	2011						
Number of units	86						
Average annual usage	66	Hours					
Total annual fleet usage	5,706	Hours/yr					
Average unit age at year end	9.1	yrs					
Average unit utilization	102.0 %						
Average operating rate	$ 19.78	per Hour					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 38,391						
Depreciation Term	8	yrs					
Residual Value	20 %						
Initial operating rate	$ 7.38	per Hour					
Annual operating rate factor	0.0527						
Analyses Results							
	Current Fleet	**Reduced Fleet Size and Limited Annual Usage Decline**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	86	86	77	69	60	52	43
Initial usage (Hours)	68				119	134	154
Annual usage decline (Hours)	0				-2	-3	-3
Economic life (yrs)	No Min	No Match	No Match	No Match	20	18	15
Age at economic life (Hours)					1,980	1,926	1,973
LTD total rate at economic life ($/Hours)					$ 34.66	$ 34.73	$ 34.86

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**4145**						
Description:	TRAFFIC CONTROL DEVICES						
Functional Code:	All (3)						
Fleet Status Summary							
Data from year	2011						
Number of units	290						
Average unit age at year end	7.8	yrs					
Average unit utilization	74.2 %						
Average operating rate	$ 484.06	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 8,626						
Depreciation Term	10	yrs					
Residual Value	10 %						
Initial operating rate	$ 240.56	per Year					
Annual operating rate factor	0.0118						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	290	290	261	232	203	174	145
Economic life (yrs)	No Min	30	30	30	30	30	30
LTD total rate at economic life ($/Year)		$ 539.87	$ 545.47	$ 552.68	$ 562.33	$ 575.87	$ 596.23

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**4154**						
Description:	PILE DRIVER						
Functional Code:	All (2)						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Small number of machines**			
Number of units	3						
Average unit age at year end	8.7	yrs					
Average unit utilization	4.6 %						
Average operating rate	$ 2,323.67	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 80,035						
Depreciation Term	8	yrs					
Residual Value	20 %						
Initial operating rate	$ 1,134.26	per Year					
Annual operating rate factor	0.0757						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	3	3	3	2	2	2	2
Economic life (yrs)	23	23	23	17	17	17	17
LTD total rate at economic life ($/Year)	$ 6,042.78	$ 6,042.78	$ 6,042.78	$ 7,565.08	$ 7,565.08	$ 7,565.08	$ 7,565.08

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**4229**						
Description:	SPREADER, 10CY IN BODY						
Functional Code:	SPRIBB						
Fleet Status Summary							
Data from year	2011						
Number of units	689						
Average unit age at year end	5.8	yrs					
Average unit utilization	4.0 %						
Average operating rate	$ 632.85	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 7,292						
Depreciation Term	8	yrs					
Residual Value	20 %						
Initial operating rate	$ 207.61	per Year					
Annual operating rate factor	0.0573						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	689	689	620	551	482	413	345
Economic life (yrs)	22	22	21	19	17	15	13
LTD total rate at economic life ($/Year)	$ 692.29	$ 692.29	$ 726.55	$ 767.40	$ 817.82	$ 882.03	$ 965.98

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**4230**						
Description:	SNOW BLOWER						
Functional Code:	GSNWBL						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Very large increasing cost with age**			
Number of units	4			**- Small number of machines**			
Average unit age at year end	9.8	yrs					
Average unit utilization	0.1 %						
Average operating rate	$ 1,234.96	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 302,553						
Depreciation Term	7	yrs					
Residual Value	20 %						
Initial operating rate	$ 110.22	per Year					
Annual operating rate factor	0.2143						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	4	4	4	3	3	2	2
Economic life (yrs)	23	23	23	18	18	12	12
LTD total rate at economic life ($/Year)	$ 14,876.56	$ 14,876.56	$ 14,876.56	$ 18,679.39	$ 18,679.39	$ 25,907.42	$ 25,907.42

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**4231**						
Description:	PLOW, SNOW 8'						
Functional Code:	SNPLWB						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Very large increasing cost with age**			
Number of units	41						
Average unit age at year end	4.2	yrs					
Average unit utilization	2.0 %						
Average operating rate	$ 204.01	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 3,515						
Depreciation Term	7	yrs					
Residual Value	20 %						
Initial operating rate	$ 16.02	per Year					
Annual operating rate factor	0.3640						
Analyses Results							
	Current Fleet	**Reduced Fleet Size**					
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	41	41	37	33	29	25	21
Economic life (yrs)	9	9	8	7	6	5	4
LTD total rate at economic life ($/Year)	$ 473.22	$ 473.22	$ 510.66	$ 558.69	$ 608.68	$ 660.41	$ 713.49

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**4233**						
Description:	PLOW, SNOW 12'						
Functional Code:	SNPLWC						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Very large increasing cost with age**			
Number of units	324						
Average unit age at year end	4.3	yrs					
Average unit utilization	4.4 %						
Average operating rate	$ 395.13	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 4,562						
Depreciation Term	7	yrs					
Residual Value	20 %						
Initial operating rate	$ 113.55	per Year					
Annual operating rate factor	0.1009						
Analyses Results							
	Current Fleet		**Reduced Fleet Size**				
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	324	324	292	259	227	194	162
Economic life (yrs)	15	15	14	13	12	10	9
LTD total rate at economic life ($/Year)	$ 528.91	$ 528.91	$ 557.99	$ 594.30	$ 638.26	$ 697.30	$ 771.71

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**4241**						
Description:	SEWER RODDER						
Functional Code:	SWRROD						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Decreasing cost with age**			
Number of units	15			**- Small number of machines**			
Average annual usage	68	Hours					
Total annual fleet usage	1,017	Hours/yr					
Average unit age at year end	7.3	yrs					
Average unit utilization	15.0 %						
Average operating rate	$ 42.00	per Hour					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 35,635						
Depreciation Term	10	yrs					
Residual Value	10 %						
Initial operating rate	$ 37.69	per Hour					
Annual operating rate factor	-0.0311						
Analyses Results							
	Current Fleet		**Reduced Fleet Size and Limited Annual Usage Decline**				
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	15	15	14	12	11	9	8
Initial usage (Hours)	74						
Annual usage decline (Hours)	-1						
Economic life (yrs)	No Min	No Match	No Match	No Match	No Match	No Match	No Match
Age at economic life (Hours)							
LTD total rate at economic life ($/Hours)							

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**4248**						
Description:	SOIL CONDITIONER						
Functional Code:	TILLER						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Very large increasing cost with age**			
Number of units	8			**- Small number of machines**			
Average unit age at year end	5.1	yrs					
Average unit utilization	10.6 %						
Average operating rate	$ 181.79	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 8,230						
Depreciation Term	5	yrs					
Residual Value	10 %						
Initial operating rate	$ 12.24	per Year					
Annual operating rate factor	0.3212						
Analyses Results							
	Current Fleet		**Reduced Fleet Size**				
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	8	8	7	6	6	5	4
Economic life (yrs)	13	13	11	10	10	8	7
LTD total rate at economic life ($/Year)	$ 796.42	$ 796.42	$ 885.60	$ 1,000.88	$ 1,000.88	$ 1,167.37	$ 1,396.17

Economic Analyses Summary

NCDOT Equipment and Inventory Control

Class:	**4254**						
Description:	SKID STEER ATTACHMENTS						
Functional Code:	All (2)						
Fleet Status Summary				**These analyses revealed the following issues:**			
Data from year	2011			**- Small number of machines**			
Number of units	11						
Average unit age at year end	5.0	yrs					
Average unit utilization	2.5 %						
Average operating rate	$ 57.42	per Year					
Economic Analyses							
Input Values							
Interest Rate	3.0 %						
Inflation Rate	2.4 %						
Purchase Price	$ 4,606						
Depreciation Term	6	yrs					
Residual Value	20 %						
Initial operating rate	$ 44.89	per Year					
Annual operating rate factor	0.0375						
Analyses Results							
	Current Fleet		**Reduced Fleet Size**				
Fleet reduction	**0 %**	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**50 %**
Number of units	11	11	10	9	8	7	6
Economic life (yrs)	No Min	30	30	30	30	30	28
LTD total rate at economic life ($/Year)		$ 216.93	$ 222.22	$ 229.32	$ 239.26	$ 254.08	$ 276.69