DCT 189

Asset Management as a Strategic Decision-Making Tool in DelDOT

By

SUE MCNEIL
DAISUKE MIZUSAWA
RACHEL NATHMAN
DAVID ADAMS

Department of Civil and Environmental Engineering
College of Engineering
University of Delaware

October 2008

Delaware Center for Transportation
University of Delaware
355 DuPont Hall
Newark, Delaware 19716
(302) 831-1446

Asset Management as a Strategic Decision-Making Tool in DelDOT

Final Report

Delaware Center for Transportation

Award Number: 07000112

UD Purpose Code: DCTR422152

Sue McNeil

Professor

smcneil@udel.edu

Daisuke Mizusawa

Post Doctoral Research Associate

Rachel Nathman and David Adams

Graduate Research Assistants

Department of Civil and Environmental Engineering

University of Delaware

October 22, 2008

ACKNOWLEDGEMENT AND DISCLAIMER

This work was sponsored by the Delaware Center for Transportation and was prepared in cooperation with Delaware Department of Transportation. The contents of this report reflect the views of the authors who are responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views of the Delaware Center for Transportation or the Delaware Department of Transportation at the time of publication. This report does not constitute a standard, specification or regulation.

Table of Contents

1 Introduction

Asset management has been receiving greater attention at both the state and national levels. Escalating demands by the public for increased accountability, aging infrastructure, increasingly constrained resources, new funding challenges, and increasing emphasis on the private provision of public services and public-private partnerships all point to the need for asset management at the Delaware Department of Transportation (DelDOT). This report documents the results of the research project "Asset Management as a Strategic Decision Making Tool in DelDOT." This includes documenting the state of the practice of asset management in DelDOT, gaps and issues, and an implementation plan developed to introduce asset management within DelDOT as a strategic decision support tool.

1.1 What is Asset Management?

Asset management is a data-driven process that is rooted in a comprehensive inventory of physical assets and their condition and quantification of the impacts of alternative decisions. Asset management is defined as[1] "a systematic process of maintaining, upgrading, and operating the physical assets cost effectively. It combines engineering principles with sound business practices and economic theory to provide the tools necessary to facilitate a more effective, organized and logical approach toward transportation decision making."

Transportation asset management is characterized by decisions based on accurate data, strong comprehensive planning, and sound engineering and economic analysis. Asset management

[1] US DOT, "Asset Management Primer," 1999.

- Is intended to result in improved decision-making supported by policies, performance-based goals, performance measures, and appropriate service levels.
- Requires a long-term view of assets.
- Provides more robust management and monitoring systems.
- Focuses on strategic goals for the system including performance measures and standards.
- Considers all assets comprehensively.
- Uses trade-off analysis and life-cycle costing to support decisions.
- Considers needs assessment, public preferences, and risk assessment in trade-off analysis.

1.2 Why do Asset Management

National and international drivers for implementing asset management include limited resources, increasing demands for safe, efficient travel, the need for improved credibility with elected officials and the public, and increasing emphasis on strategic oversight[2,3]. The Delaware Department of Transportation (DelDOT) has successfully deployed asset management to support decision making related to maintenance, maintenance management, and preservation. DelDOT's leadership has expressed interest in exploring the role of asset management in supporting strategic decisions including trade-offs between capital improvement and preservation and among modes. The challenge is to implement asset management as a strategic decision making tool at DelDOT. This project

---

[2] Transportation Asset Management In Australia, Canada, England, and New Zealand, Prepared by the International Scanning Study Team, Federal Highway Administration, FHWA-PL-05-019, Washington, DC, November, 2005. http://international.fhwa.dot.gov/assetmanagement/2005tam.pdf

[3] U.S. Domestic Scan Program: Best Practices in Transportation Asset Management, Michael D. Meyer, NCHRP Project 20-68, 2007.

http://onlinepubs.trb.org/onlinepubs/t...P2068_Domestic_Scan_TAM_Final_Report.pdf

is also timely for DelDOT. Like most state DOTs, DelDOT must balance the commitment of resources to provide transportation services to the businesses and residents of Delaware while also supporting economic growth and development.

In its broadest sense asset management provides a framework. This framework will help DelDOT respond to land use changes, population growth, and changes in vehicle miles of travel (VMT) and freight traffic and related congestion, as well as support economic development. More challenging is balancing the demands for more capacity against repairing and renewing aging infrastructure, safety concerns, and managing emergency responses versus long-term investment. These competing needs for limited tax dollars are not unique to Delaware but are felt throughout the nation.

Asset management also supports enhanced communication and provides objective data to support and justify funding requests. As asset management is a data- driven process, the process of implementing asset management recognizes the role of data as an asset. Other overarching themes include a movement away from "worst first" to a focus on preservation first and the importance of connecting investments to overall goals and objectives measured using performance measures or key performance indicators (KPIs). By implementing asset management, DelDOT aims to improve current practices, focus on life-cycle/long-term impact analysis, and gain the ability to conduct trade-off analysis between preservation and new investment and among different asset classes.

1.3 Project Objectives

The objectives of this project were to

- Document the current state of the practice of asset management in DelDOT, gaps and issues.

- Develop a plan for implementing asset management as strategic decision support tool.

1.4 Project Overview

The project consisted of three phases. Phase I focused on education and training, where key asset management concepts were introduced to staff through a variety of mechanisms. Each of these mechanisms took place at different times throughout this phase of the project.

Mechanism 1: DelDOT Advisory Group. The project advisory group was assembled to be representative of the various parts of DelDOT involved in asset management. The members include DelDOT personnel from Planning, Finance, Maintenance, Traffic and Operations, Pavement Management and Bridge Management with different levels of responsibility. The members of the Advisory Group are listed in Appendix A. The DelDOT participants provided examples of existing asset management practices at DelDOT and identified gaps in the current practices. The Advisory Group also helped to identify participants for the training sessions and provided guidance on the technical level of the training materials presented to the participants in the training session, and logistics (time, location and date to encourage participation).

Mechanism 2: Asset Management Practices Scan. Completion of a scan of asset management practices in DelDOT. This involved interviewing key players and documenting the current state of the practice (irrespective of whether it is called asset management or not).

Mechanism 3: Presentations. Presentations were made at the DelDOT Transportation Solutions – Winter Expo 2007 (February 2007) and at the DelDOT Senior Leadership Team meeting (March 2007).

Mechanism 4: Training. Materials were developed for a one-day training session. The course covered the principles, concepts, components, techniques, and benefits of asset management. The training materials also included some group exercises. The training drew from the materials developed (and recently revised) for the National Highway Institute (NHI) asset management training course[4] and was modified to reflect issues specific to DelDOT. The NHI materials are based on the American Association of State Highway and Transportation Officials' (AASHTO) "Transportation Asset Management Guide." [5] The course was held on May 21, 2007. Twenty-five DelDOT employees from Maintenance, Traffic and Operations, Pavement Management, Bridge Management and Planning participated in the one-day training session and self-assessment of asset management practices in DelDOT. An evaluation of the training session was also distributed about a month after the training.

Phase II involved a self-assessment exercise. The self-assessment drew on the materials in the AASHTO Asset Management Guide, a self-assessment tool, and similar exercises conducted by Maryland State Highway Administration and the Utah Department of Transportation, modified to meet DelDOT's needs and the findings from Mechanism 2 (Asset Management Practices Scan) of Phase I. The self-assessment exercise was completed as part of the training sessions (Mechanism 4, Phase I). The results of the self-assessment were summarized.

---

[4] NHI Asset Management Training Course - FHWA-NHI-131106 - http://www.nhi.fhwa.dot.gov/coursedesc.asp?coursenum=1130 Accessed 3/9/06.

[5] Transportation Asset Management Guide, Prepared under NCHRP 20-24(11), November 2002. http://assetmanagement.transportation.org/tam/aashto.nsf/All+Documents/DE491AB9466DEA9185256DE8004EC44D/$FILE/TAMG-1%20Final.pdf

Phase III was the development of a strategy for implementing asset management. This phase involved thorough analysis of the results of the self-assessment exercise and the inputs of the project advisory commitment.

1.5 Report Outline

This report documents the research effort. Chapter 2 focuses on existing asset management practices at DelDOT. Chapter 3 describes the training. Chapter 4 presents the self-assessment exercise and the results of the exercise. Chapter 5 presents conclusions and an implementation plan. Appendices list the members of the DelDOT Advisory Group, provide background material on the training and self-assessment, and document the results of the self-assessment exercise.

2 Asset Management at DelDOT

Asset management is something that DelDOT is already doing in some areas. The question is how to use asset management to make the best use of limited resources and use asset management techniques in all disciplines. The process relies on performance measures and appropriate goals that must then be supported by sufficient and accurate data. Asset management also shifts the focus to the long-term effects of short-term solutions recognizing that the expenditures on physical assets are investments in the future and reflect responsible stewardship. Finally, asset management is necessary if DelDOT is really going to do more with less.

2.1 Current Practices

Asset management is not a term currently used at DelDOT; however, the principles of good asset management are embodied in long-term planning. The role of asset management in current practices is most easily recognized through a number of commonly used tools and programs including the following:

- Statewide Transportation Improvement Plan – performance measures
- Pavement Management
- Bridge Management
- MAXIMO
- DelTrac
- Highway Performance Monitoring System
- Travel Time Monitoring Survey
- Highway Safety Improvement Program

The following section reviews several of these tools to illustrate the concepts of asset management.

2.2 Tools

A variety of databases and tools supports asset management activities at DelDOT. While not comprehensive, Table 1 provides a select list of these systems.

Table 1. DelDOT Asset Management Related Databases and Systems

Name	Description
BCAT	Barcode Asset Traffic – inventory of signal locations
BCIS	Financial management system (to be replaced by statewide accounting system)
FACTS	Project financial system
Falcon	Plan Archive
HPMS	Highway Performance Monitoring System
HSIP	Highway Safety Improvement Program
INFORM	GIS data that links data between groups and supports video logging data
M4	Equipment
MAXIMO	Maintenance Management Systems
NBI	National Bridge Inventory
PMS	Pavement Management System
Pontis	Bridge Management Systems
Primavera	Scheduling software
PSS	Paving in Suburban Streets
RIMS	Roadway Inventory Management System
URS	Stormwater drainage data collection system and work order generation

The highlighted databases and systems are described in more detail.

Highway Performance Monitoring System

The Highway Performance Monitoring System (HPMS) is a database representing a sample of the nation's highways including information on extent, condition, performance, use, and operating characteristics. The database has been continuously collected since 1978. The data are used to determine highway system condition, performance, and investment needs for the Biennial Report to Congress on the Status and Condition of the

Nation's Roads and Bridges. HPMS can be utilized to track changes in the highway system over time and thereby support strategic (long-term) decision making.

The data also serve as an input to the Highway Economic Requirements System (HERS), a policy tool used to explore the implications of various performance goals and budget constraints. HERS includes a fairly elaborate modeling system for pavement ride, congestion, crashes, and emissions and has been modified to serve as a tool for states – HERS-ST – where "ST" refers to the state version of HERS. To date, Delaware has not used HERS-ST[6].

MAXIMO

MAXIMO is a COTS (Commercial Off the Shelf) maintenance management system. MAXIMO is Oracle based and includes data for work done on all of Delaware's roadways. Modules include inventory, standard operating procedures, work orders, preventive maintenance schedules, purchasing, and resource tacking (including labor). MAXIMO also tracks legislative queries and citizen queries. Implementation began in 2002. The system is widely used for roadway-related activities and is evolving for fleet and signs. Customized reports allow for identification of problem areas (for example, the 10 most expensive activities) or summaries of the year's activities (for example, number of bags of trash picked up). The system also provides the support documentation for billing, which is particularly important for disasters, as the Federal Emergency Management Agency (FEMA) requires rigorous documentation of requests for reimbursement.

---

6 Federal Highway Administration (FHWA), HERS-ST v.2.0 Technical Report 2005, U.S. Department of Transportation.

The focus of MAXIMO is at the tactical and operational level. As such, the database currently serves as a data repository. At the same time, this database can also be used at the strategic level.

Pavement Management

DelDOT implemented its Pavement Management System (PMS) in 2002. The system is used to develop the agency's paving and rehabilitation program using the following steps:

- Data collection using a windshield survey.
- Calculation of Overall Pavement Condition (OPC) based on extent and severity of distresses.
- Identification of candidate paving projects based on a threshold for a specific class of road.
- Field review.
- Scoring based on condition, functional classification, average daily traffic (ADT), special conditions and other modifiers.
- Prioritization of projects based on scope.
- Scoping involving identification of a remedy and assembly of projects based on estimates of costs, approval and grouping.
- Contracting.
- Implementation.

The continual refinements made to the PMS include coordination among projects, connection to safety programs. and other linkages.

Pontis Bridge Management

Each state is required to collect data for the National Bridge Inventory (NBI). DelDOT also collects data using the Pontis Bridge Management System. To collect this data, bridge inspections are conducted at least every two years. Work orders for bridge inspections are generated from MAXIMO and the inspection is also used to generate

MAXIMO work orders for maintenance and repair. The Pontis data is also used to help prioritize treatments, repair and replacement[7].

Statewide Long Range Transportation Plan and Performance Measures

The Statewide Long Range Transportation Plan is a rigorous planning process that supports the Governor's Livable Delaware initiative. The plan is intended to document what is needed to build, maintain and operate the state's transportation system. The plan uses performance measures to guide progress. These performance measures are also needed to support asset management. In 2007 DelDOT undertook an effort to streamline the performance measures used throughout the department. The objective is to develop performance measures that are comprehensible and comprehensive, as well as measurable.

Examples of current performance measures include the following:

Structurally Deficient Bridges

- Deficiency is determined through inspection.
- Deficiency helps determine rehabilitation and replacement decisions.
- Any necessary closures will affect traffic patterns, signage, signal operations, expected pavement wear.
- Percent Pavement Ranked as Good/Excellent
- Users can recognize pavement conditions through rideability.
- Favorable pavement conditions reduce wear on vehicles and improve safety.

---

7 Stidger, Ruth W. , "Bridge Conditions Inch Upward," Better Roads Magazine November 2006.

http://www.betterroads.com/content/Issue-Story.45.0.html?no_cache=1&tx_magissue_pi1%5BshowUid%5D=625

- Scheduling preventative maintenance can prolong pavement life.
- Percent Drainage Work Plan Completed
- Water is one of the worst enemies of roadways.
- Proper drainage will reduce future maintenance and reconstruction.

Examples of proposed performance measures include the following:

Vehicle Travel Time

- Auto Vehicle Location system will be implemented to measure travel time consistency.
- Incident Management Detection
- Electronic detection system used to find incidents and initiate a response
- Vehicle Delay Traveler Information
- Delay information conveyed to travelers on 1380 AM and via a website.
- Time from the incident detection to broadcast will be measured

Stormwater

A drainage inventory and assessment has been completed for all metropolitan areas in New Castle County and Sussex County as part of the National Pollutant Discharge Elimination System (NPDES). The process is governed by the US Environmental Protection Agency (EPA). Work orders are currently maintained in MAXIMO with a viewer to provide access to the information but not available to update data. Eventually the drainage inventory will be added to MAXIMO.

2.3 Issues

The DelDOT Advisory Group was also able to identify gaps and needs (Mechanism 1 in Phase I). Examples include the following:

- Identifying new assets developed to increase capacity (for example, additional lanes or widening) is challenging. FACTS may help to track projected additions, but a more explicit link to inventory is important for functions such as asset valuation and air quality assessment.

- HPMS reports have been difficult to complete due to availability of and access to data.

- Links among systems such as the HSIP and PMS are not explicit.

- There are opportunities to make better use of the data in MAXIMO.

- No one has a holistic view of all the systems.

- HSIP cost/ benefit calculations do not take into account pavement resurfacing projects.

- Need a documented data model for moving forward.

- Definitional issues.

- Data quality can be an issue.

- Need processes for updating inventories.

Other opportunities identified included the following:

- Oracle (which DelDOT uses) is good at building relationships among data.

- Other assets should be included:

- Transit – equipment, park and ride facilities, bus stops, and garages

- Buildings, fleet, signs, guardrail, traffic signals, ITS features, striping, drainage, curbs and sidewalks

- Bike facilities

- Airports

- Community Transportation Fund (CTF)

- Port of Wilmington

- Ferry

- Golf course

Ultimately, asset management should be able to help with “right sizing.” For example, over several years, DelDOT has added many roads but no additional trucks. This also needs to be extended to personnel.

Finally, the organizational structure of DelDOT does not currently support comprehensive asset management. For example, the DelDOT project life cycle as shown in Figure 1 highlights the missing links among the planning and project development phases and the construction and maintenance and operation phases.

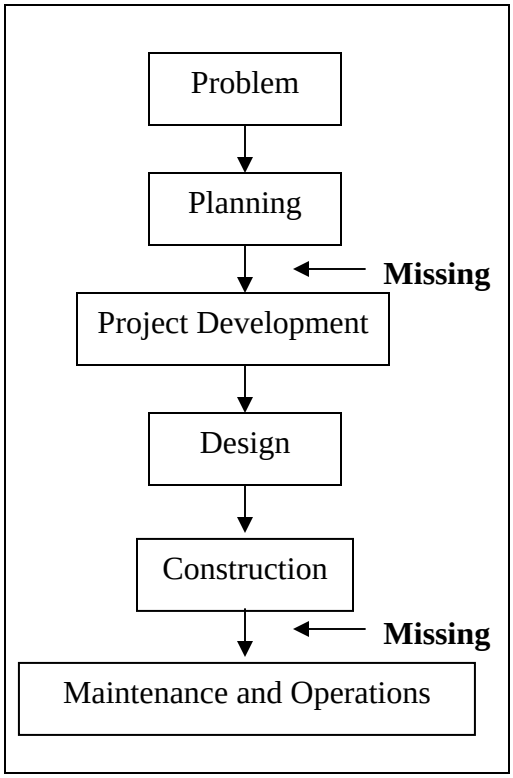


Figure 1. Project Life Cycle

3 Training

3.1 Content, Materials and Delivery

Materials were developed for a one-day training session by the University of Delaware team with input from the DelDOT Asset Management Advisory Group. The training was based largely on the materials developed (and recently revised) for the National Highway Institute (NHI) asset management training course[8] and modified to reflect DelDOT-specific issues. The course covered the principles, concepts, components, techniques, and benefits of asset management. The concepts covered are shown in Table 2. The NHI materials are based on the AASHTO's "Transportation Asset Management Guide."[9] Participants were also given a list of relevant resources.

Table 2. Concepts Covered in Asset Management Training

• Asset attributes • Asset classes • Asset valuation • Assets • Benefit/cost analysis • Condition • Cost effectiveness • Customers • Decision support tools • Deficiencies • Failure	• Inventory • Knowledge management • Level of service • Life cycle analysis (including life cycle cost analysis) • Linear referencing system • Performance • Preservation • Prediction	• Prioritization • System monitoring and feedback • Remaining service life (effective life, residual economic life) • Resource allocation • Risk • Spatial data • Stakeholders

[8] NHI Asset Management Training Course - FHWA-NHI-131106 - http://www.nhi.fhwa.dot.gov/coursedesc.asp?coursenum=1130 Accessed 3/9/06.

[9] Transportation Asset Management Guide, Prepared under NCHRP 20-24(11), November 2002. http://assetmanagement.transportation.org/tam/aashto.nsf/All+Documents/DE491AB9466DEA9185256DE8004EC44D/$FILE/TAMG-1%20Final.pdf

Five modules were developed. Each module consists of a series of PowerPoint slides. Two group exercises were also developed to give participants an opportunity to apply the concepts covered in the modules and discuss issues. Participants were organized into groups to ensure representation in each group of the various functional areas.

The participants in the training session also completed the self-assessment exercises. The self-assessment exercise was broken into three segments so that participants completed a segment after a module or a group exercise. The agenda for the training session is included in Appendix B.

The UD team delivered the training on May 21, 2007. Twenty-five DelDOT employees from Maintenance, Traffic and Operations, Pavement Management, Bridge Management and Planning participated in the one-day training session and self- assessment of asset management practices in DelDOT. Each training participant was provided with a binder with the course materials, group exercise, self-assessment, and a copy of the asset management guide.

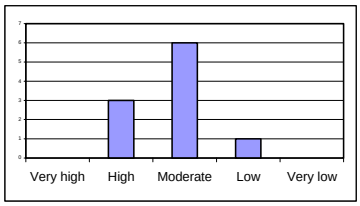
3.2 Training Evaluation

An evaluation of the training session was distributed to all participants about a month after the training. The survey that was used to evaluate the training sessions is included in Appendix C. Ten participants completed the evaluation. Figure 2 summarizes the results. Participants were also asked to make recommendations to improve the training session. Narrative responses are summarized in Table 3.

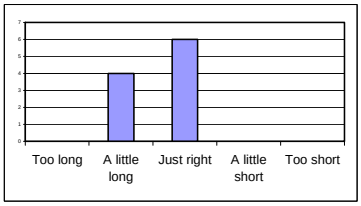
While the majority of respondents indicated that their knowledge did not change as a result of the training session, they also indicated that the length, page and content of the session were about right.

Question	Min	Max	Average	Median
How long have you worked at DelDOT? (years)	1	36	15.3	15.5
How long have you worked with any of the systems? (years)	0	15	7	5.5

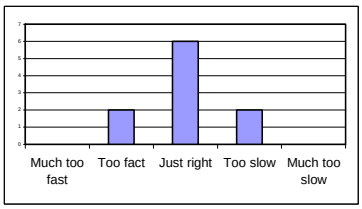
Your knowledge of asset management prior to the session:	Very high	High	Moderate	Low	Very low
Responses	0	3	6	1	0



Length of the session:	Too long	A little long	Just right	A little short	Too short
Responses	0	4	6	0	0



Pace of the session:	Much too fast	Too fact	Just right	Too slow	Much too slow
Responses	0	2	6	2	0



Content of the session:	Much too easy	Too easy	Just right	Too difficult	Much too difficult
Responses	0	4	4	1	0

Exercises:	Much too easy	Too easy	Just right	Too difficult	Much too difficult
Responses	0	2	5	2	0

Your knowledge of asset management after the session:	Very high	High	Moderate	Low	Very low
Responses	0	5	5	0	0

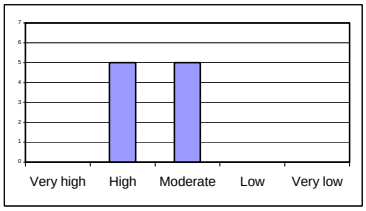


Figure 2. Evaluation Results

Table 3. Recommendations Regarding Training

- More detail on applications for different systems
- Trying to understand how my system will be affected by asset management concept
- Session seemed rushed towards the end. Did not really get the presentations for the last few sections, just did the self-assessments. For me, it would have been helpful to spend a little more time on the presentations and explain things a little more, so that I could better understand what was being asked of me on the self-assessments. I did like the exercises; they broke up the presentations and reinforced some of the ideas.
- Based on how we are doing asset management and at the level I use it the exercises were not appropriate. I did learn some good information and feel like I have a high level of asset management for how I use it but there were many more areas I would not have thought of as asset management. Thanks
- If possible I would shorten the lecture part.
- I would cover the reasons for asset management in 15 minutes, and then get into specifics that we as managers really need to know or act upon.
- I thought the interaction was positive. I would like to see more how some our existing systems, specifically could be incorporated into the sessions.

4 DelDOT Self Assessment

4.1 Process

The self-assessment exercise draws on the AASHTO Asset Management Guide self assessment tool, GAP-X, an online tool marketed by GHD consulting and experiences in Maryland and Utah. The self-assessment focuses on existing processes and behaviors by functional areas – operations management and information, project selection and prioritization, strategic planning, performance, preservation, etc. The responses to the survey were distinguished by functional area – decision makers, maintenance and traffic. The group identified as "decision makers" included the participants from pavement management, bridge management and planning. Not all questions were asked of all groups because some aspects of asset management are not relevant to all functional areas. Although 25 employees participated in the training only 22 completed the self-assessment. The responses came from:

- Decision Makers – 10
- Traffic – 7
- Maintenance – 5

A sample self-assessment exercise for decision makers is included in Appendix D. The results of the self-assessment are described in the following section.

4.2 Results

Preliminary results from the self-assessment identified some areas with inconsistent knowledge (for example, referencing systems). The survey results serve as a means for evaluating asset management areas requiring attention. Proposed actions include but are not limited to

- Documentation and dissemination of available tools, and current processes and practices
- Promotion of existing tools
- Communication of current practices
- Definition of terminology and performance measures
- Identification of gaps in data and processes
- Assessment of needs for new tools and processes
- Linking of policies and decision making
- Development of policies and strategies
- Demonstration of organizational commitment
- Additional training
- Continuation of existing activities

A short summary of the self-assessment was prepared, and more careful analysis was then conducted. This section of the report provides the overview of the self-assessment results; documents the detailed analysis, observations and needs; and makes recommendations on the basis of the analysis for integrating asset management into the DelDOT decision-making processes and operations.

Overview of Self Assessment Results

General

- Answers were widely dispersed for many questions.
- Customer service is already in place and used.

Maintenance

- Geographic referencing needs improvement.
- Risk reduction is not engrained in the decision-making process.

- Employees are knowledgeable about the GIS and maintenance management systems.

- Employees were almost completely evenly distributed on their views of the asset spatial data completeness.

- Life-cycle cost histories are lacking.

- Agency's project selection is generally based on cost estimates and existing program delivery methods, assumes accurate revenue prediction, and solicits user input.

- Processes are needed for reviewing maintenance manuals and analyzing maintenance programs.

- By unanimous consent, the agency monitors system performance and compares these values to targets projected for its capital preservation program.

- Views on decision support tools vary.

- Little knowledge exists for personnel strategies.

- Processes are in place for customer service.

- A few comments indicated that DelDOT districts need to be more uniform in their methods.

Traffic

- Inventory of assets is not up-to-date.

- Knowledge on asset processes is generally limited.

- Input is needed for GIS from more groups.

- Emergency response system is functionally not used and incorrect.

- Risk assessment data is non-existent.

- Information technology needs improvement. Data can not be accessed as quickly as personnel would like.

- Decision support tools are not used.

- Personnel strategies are lacking.

- Customer service is effectively in place.

Decision Making

- Two comments stated that information on condition of assets is collected regularly, but the inventory is not up-to-date.
- No life-cycle cost modeling system exists with unanimous results.
- There is no risk assessment data.
- Projects generally are consistent with resource allocation, based on realistic estimates, and inputs are certainly collected from affected parties.
- Information on performance of assets is collected.
- There are issues with linking performance measures to resource allocation.
- Knowledge on maintenance processes and programs varies.
- Maintenance manuals and policy could be improved.
- Preservation methods need improvement.
- Trade-off analyses are lacking.
- An IT strategy exists and is recognized by the employees.
- Information systems were not user-friendly.
- Little knowledge exists on personnel strategies.
- Organizational issues need improvement.
- Customer relation strategies are already in place.

4.3 Self-assessment Results, Observations and Needs

To obtain a clear picture of the responses to the self-assessment, UD researchers grouped the questions into fourteen broad categories and plotted histograms of the responses of each of the three groups – decision makers, maintenance and traffic functional areas of the training participants. The categories (and their sub-categories) are listed in Table 4. The histograms provided a clear visual picture of the consistency or diversity of opinions about the state of various aspects of asset management both within and between

functional areas. Inconsistencies in responses suggest uneven knowledge of tools, processes and practices among functional areas. Consistent positive responses identified strengths, and consistent negative responses identified gaps. Based on these observations, needs were identified. This analysis is included in Appendix E.

4.4 Recommendations

The following recommendations are based on the analysis in Appendix E.

Action items within the agency include the following:

- Demonstrate organizational commitment to asset management
- Promote the role MAXIMO can play in responding to complaints and inquiries, and life-cycle assessment
- Link asset management with emergency response plans, policy guidance through decision making, performance measures and a life-cycle approach, and programs through performance measures and resource allocation
- Conduct training in areas related to asset management
- Continue communication with and involvement of the public and politicians
- Develop strategies to
- Improve data quality,
- Build an asset management team,
- Address areas requiring documentation and dissemination of policies, processes and tools,
- Identify and address gaps in the asset management process, and
- Address asset management related issues.

Areas requiring additional documentation and dissemination of existing policies, processes and tools include

- Data and information:

    - Available data to support asset management including data warehouses, plans and drawings information, operations and maintenance manuals, condition assessment records, knowledge management
    - Asset register system, condition assessment, and asset disposal
    - Historical cost data, asset value, and asset life.
- Systems
    - Maintenance management systems
    - Maintenance analysis systems
    - Emergency response plans
    - Job resource management system
    - Monitoring systems
- Processes
    - Renewal decision making
    - Project ranking
    - Decision making including trade-offs between capital and operations
    - Change management
    - Human resource management
- Tools
    - Mobile computing

Possible gaps in the asset management process require an assessment of whether the gap actually exists, the need to fill the gaps, and strategies for addressing the gap. Gaps include

- Data (e.g., traffic signals, stormwater, drainage, guardrail)
- Forecasting tools (e.g. costs, condition, performance, remaining life)
- Maintenance analysis systems
- Management of stores/stocks and spare parts

- Risk assessment information system
- Life-cycle cost modeling
- Work accomplished
- Integration of information
- Collection of performance data
- Risk and emergency data
- Other issues to be addressed include
- Usability and accessibility of information
- Definition and assessment of data quality
- Access to mapping and communication tools

Table 4. Categories of Responses Used in the Self-Assessment

Categories	Subcategories	
Agency Asset Management Practices	Agency Practices and Processes	
Systems	Maintenance Inventory Risk and Emergency Customer Relations Project Management Data Decision Support Tools	Life-Cycle Cost Analysis Manual and Documents Performance and Condition Agency Practices and Processes Use of Systems for Analysis Usability and Accessibility
Policies	Life Cycle Cost Analysis Performance and Condition Trade Off Analysis and Project Selection	Maintenance and Preservation Customer Relations
Performance	Agency Practices and Processes Systems Data and Information Inventory	Project Selection and Resource Allocation Policies Decision Support Tools Customer Relations
Inventory	Agency Practices and Processes	Systems Data and Information
Data	Risk and Emergency Operations Project Management Historical Asset Valuation	Trade-Off Analysis Inventory Performance and Condition Maintenance Agency Practices and Processes
Information	Performance Accessibility Strategy	Forecasting Manuals and Documents
Decision Support Tools	Project Management Performance	Other
Life-Cycle Cost Analysis	Maintenance Agency Practices and Processes Systems Data Inventory	Policies Program Management Life Cycle Cost Analysis Customer Relations Performance
Maintenance Preservation	Systems Agency Processes and Practices Data and Information Inventory	Manuals and Documents Policies Trade Off Analysis Life Cycle Cost Analysis
Operations	Agency Practices and Processes Manuals and Documents Systems	Data and Information Trade Off Analysis and Project Selection
Manuals and Documents	Operations Systems	Maintenance Inventory
Company Culture and Development	Atmosphere Knowledge Management	Business and Personnel Development Staff Inventory
Customer Relations	Surveys and Reports Long Term Planning	Complaints and External Input Policies

5 Conclusions and Implementation Plan

5.1 Conclusions

Asset management is widely used throughout DelDOT. Several very successful databases, systems and tools support the decision-making process and a strategic approach to managing the transportation assets of the state. Through discussions with DelDOT personnel, training sessions, and the self-assessment exercise, this project identified areas in which the various existing systems can be more tightly linked and adapted to meet the needs of DelDOT. Information is also required to ensure that all DelDOT staff is knowledgeable about the capabilities and limitations of these systems. Opportunities to more closely integrate the data were documented. The self-assessment surveys also pointed to areas in which DelDOT is successful, such as responding to customers using MAXIMO, the maintenance management system, and the use of MAXIMO, pavement management, and bridge management.

Based on observations and documented experiences in other similar organizations, to successfully implement asset management throughout the department, DelDOT needs the following:

- A champion for asset management.
- Strategies to shift the mentality from worst first to preservation first.
- A good framework for new inventory areas, such as drainage and traffic signals.
- All of this must be accomplished without imposing significant additional burdens on individuals or the organization. The following plan suggests actions for implementing many of the recommendations identified in the self-assessment.

5.2 Implementation Plan

The implementation plan focuses on two key actions:

Action 1. Establish an Asset Management Working Group

The Asset Management Working Group will bring together representatives from all sections to review the current asset management practices across all modes, develop resources and research needs, and encourage dialogue and wide dissemination of information through meetings and publications.

Goals of this cross-functional working group include:

- Develop and refine DelDOT's Asset Management Strategy.
- Compile and maintain a set of parameters with metadata relevant to asset management. The parameters will provide consistency and compatibility as DelDOT expands the current asset inventory.
- Establish formal links among operations, business activities and finance and serve as a clearinghouse for relevant information.
- Provide a venue for discussing and moving forward to integrate MAXIMO with pavement and traffic activities.

Action 2. Develop an Asset Management Manual

The objective is to develop an asset management manual that would serve as a web-based resource and make the existing systems more useful as individuals are able to comprehend the resources available. The manual would also provide connections among existing stovepipes and between policy and decision making. As an evolving document to which DelDOT employees contribute, this manual becomes an avenue for addressing the gaps identified in the self-assessment process. The development of the manual could be overseen by the asset management working group.

5.3 Barriers

The single most significant barrier to accomplishing this implementation plan is staff time. Our project DelDOT Project Advisory Group included extremely knowledgeable

individuals and had a broad base of experience that was important to the project. However, scheduling time with busy people is a challenge.

The process also requires upper management support. Given the constraints and challenges that all DOT's are facing, it may be difficult to get buy-in.

5.4 Other Activities

There are many related asset management activities ongoing in other states as well as National Cooperative Highway Research Program (NCHRP) projects. For example, "Project 20-74. Developing an Asset Management Plan for the Interstate Highway System" will be completed this calendar year[10]. The objective of this project is "to develop a practical framework for applying asset management principles and practices to the interstate highway system." Applying the results of this project to some key corridors in Delaware may be an effective way to explore ways to link performance measures with asset management and integrate concepts of risk management.

[10] http://www.trb.org/TRBNet/ProjectDisplay.asp?ProjectID=660, Accessed 2/27/08

APPENDIX A. ADVISORY COMMITTEE

NAME	Affiliation	Email
Ralph Reeb	DelDOT, Planning	Ralph.Reeb@state.de.us
Teresa Gardner (Project Manager)	DelDOT, Planning	Teresa.Gardner@state.de.us
Bill Newnom	DelDOT, Finance	bill.newnom@state.de.us
Randy Cole	DelDOT	Randy.Cole@state.de.us
Curt Cole	DelDOT, Maintenance and Operations	curt.cole@state.de.us
Brenda Gardels	DelDOT, Maintenance and Operations	Brenda.Gardels@state.de.us
Don Burris	DelDOT, IT	Don.Burris@state.de.us
Jennifer Pinkerton	DelDOT, Pavements	jennifer.Pinkerton@state.de.us
Jim Clacher	DelDOT	Jim.Clacher@state.de.us
Soneji Jiten	DelDOT, Bridge	jiten.soneji@state.de.us
Barry Benton	DelDOT	Barry.Benton@state.de.us
Mark Eastburn	DelDOT, Planning	mark.eastburn@state.de.us
Jim Bunting	DelDOT, Traffic	jim.bunting@state.de.us
David Adams	University of Delaware	
Daisuke Mizusawa	University of Delaware	
Rachel Nathman	University of Delaware	
Sue McNeil	University of Delaware	smcneil@udel.edu

APPENDIX B. TRAINING AGENDA

Course Agenda

Module 1 - Introduction	9:00 am – 9:15 am
Module 2 - Asset Management Principles	9:15 am – 9:45 am
Break	9:45 am – 10:00 am
Module 3 - Asset Management Tools and Techniques and Exercise	10:00 am – 11:30am
Self assessment – Phase 1	11:30 am – 11:45am
Lunch	11:45 am – 12:45 pm
Module 4 - Performance	12:45 pm – 1:15 pm
Self assessment – Phase 2	1:15 pm – 1:25 pm
Exercise	1:25 pm – 2:10 pm
Break	2:10 pm – 2:25 pm
Self assessment – Phase 3	2:25 pm – 2:35 pm
Module 5 - Implementation and Wrap-Up	2:35 pm – 2:50 pm
Self assessment – Phase 4	2:50 pm – 3:00 pm

APPENDIX C. EVALUATION OF TRAINING

Evaluation

Asset Management Training

Delaware Department of Transportation and University of Delaware

Thank you for participating in the Asset Management Training on May 21. Our objective was to better understand DelDOT and the gaps in the asset management process based on your responses to the self-assessment survey. We also hope that you learned something about asset management.

Please complete the following questions and return to Sue McNeil via email (smcneil@udel.edu) or fax (302 831 3640). Please return the survey by **noon, Monday June 18.** Responses will not be attributed to individuals so your name will not be recorded.

How long have you worked at DelDOT? _____

How long have you worked with any of the systems? _____

Rate each statement by circling the descriptor that matches your experience

Your knowledge of asset management prior to the session:	Very high	High	Moderate	Low	Very low
Length of the session:	Too long	A little long	Just right	A little short	Too short
Pace of the session:	Much too fast	Too fact	Just right	Too slow	Much too slow

Content of the session:	Much too easy	Too easy	Just right	Too difficult	Much too difficult
Exercises:	Much too easy	Too easy	Just right	Too difficult	Much too difficult
Your knowledge of asset management after the session:	Very high	High	Moderate	Low	Very low

Do you have any recommendations for improving the session? If so, please describe.

APPENDIX D. SELF ASSESSMENT EXERCISE

Three sets of self assessment exercises were compiled representing the three different groups participating in the training – decision makers, maintenance and traffic. The following questions – for the maintenance group – illustrate the exercise.

DELDOT ASSET MANAGEMENT SELF ASSESSMENT SURVEY - MAINTENANCE

Section 1 OPERATION, MANAGEMENT, AND INFORMATION ON ASSETS

Please answer the following questions on the overall agency system:

	Strongly Disagree	Disagree	Agree	Strongly Agree	Not Sure
Our agency continually seeks to improve the efficiency of data collection (e.g., through sampling techniques, use of automated equipment, other methods appropriate to our transportation system).		1	3	3	
Our agency has a complete and up-to-date inventory of our major assets. Information on the condition of our assets is collected regularly.	1	4		2	
Our agency has established standards for geographic referencing that allow us to bring together information for different asset classes.		5	1	1	

Please answer the following questions on asset processes:

	Little or no knowledge	Little knowledge & ad hoc processes	Good knowledge & ad hoc processes	Consistent processes & partially documented	Extensive knowledge & partially documented	Fully documented & externally audited
Processes for making optimized asset renewal decisions by choosing the most economical solution time to renew / replace an asset. (eg. Does the process include all options for life extension including non asset solutions using life cycle cost analysis?)		4	2	1		
Processes for determining what assets to collect performance data on and for undertaking the collection. (eg. How well is the asset performing? Is there a data standard defining this?)		1	3	2	1	
Processes for undertaking asset valuations. (eg. Are asset valuations undertaken and is the method documented? Is there a method to assess the quality of that valuation?)		3	1	1	1	1
Processes for determining the effective lives or residual economic lives of all assets in the register. (eg. Are these lives based on real data?)		1	4	1	1	

	Little or no knowledge	Little knowledge & ad hoc processes	Good knowledge & ad hoc processes	Consistent processes & partially documented	Extensive knowledge & partially documented	Fully documented & externally audited
Processes for determining what historical cost data should be collected on individual assets and how should this be archived. (eg. Can all the historic costs associated with a critical asset be reported?)		3	4			
Processes for predicting failure modes of assets and are the consequences of failure identified? (eg. The way in which the organization predicts the likely failure modes for individual assets or its components.)		3	2	2		
Processes for analyzing risks, including the understanding of its make up and the ranking of the risks. (eg. Which part of the business represents the greatest risk? What is the greatest risk?)	1	3	1	2		
Processes for managing risk reduction, including the assessment of mitigation options. (eg. How should the risk be mitigated and how are the risks tracked and reported?)		5		1	1	
Processes for rationalizing the existing asset portfolio and disposal of unwanted assets. (eg. Identifying assets for disposal, mothballing or transfer to improve business effectiveness to reduce cost and release funds for other purposes.)	1	2	4			
Processes for disposing of assets. The processes for good governance and ethical behavior in this area. (eg. Are these assets removed from the asset register and on other asset systems, eg. The GIS?)	2	2	2	1		
Processes for developing and maintaining operation manuals. (eg. Are new assets automatically included and how often are they reviewed? How should operators update the manuals when procedures change?)		2	5			

Please answer the following questions on management systems:

	None	Card/paper system or spreadsheet	Developed in-house - eg. MS Access	Externally developed & most functionality utilized	Externally developed - interfaced with other systems & functionality fully utilized
Complaints or Enquiries System. (eg. System to store the details and track customer complaints and enquires from receipt to conclusion.)		4	3		1
Asset Register System. (eg. System to store asset hierarchy and attributes for all assets that make up the asset system.)		2	2	3	
Geographic Information System. (eg. System to spatially store asset locations and key attributes for all distributed and linear / networked assets including the base locations of assets.)		1	1	5	
Maintenance Management System. (eg. System to manage maintenance activities	1		1	4	1
Job Resource Management System. (eg. System to create and track work orders covering labor, plant, specialist tools and materials.)			2	5	
Inventory Spares and Purchasing System. (eg. System to track quantity and purchasing of spare parts. This system is linked to the construction and maintenance / operations systems and staff needs.)	1	1	1	4	
Asset Failure Prediction. (eg. Prediction of failure in terms of capacity , reliability, condition, performance and outages/ emergency failures. These allow the organization to model the full range of level of service failures.)	5			2	
Risk Assessment Information System. (eg. System used for undertaking and storing risk assessments for both the consequences of failure and probability of failure.)	4		2	1	
Data Warehouse. (eg. System to store, manage and report on data from other information systems. This system should complete basic manipulation and produce regular reports.)	1	1	2	2	
Life Cycle Cost Modeling System. (eg. System for modeling the life cycle costs of different asset options and solutions for new assets where no spent costs are involved. It allows all supply options to be considered.)	3		3		

	None	Card/paper system or spreadsheet	Developed in-house - eg. MS Access	Externally developed & most functionality utilized	Externally developed - interfaced with other systems & functionality fully utilized
Maintenance Analysis Systems. (e.g. Systems that perform Reliability Centered Maintenance type analysis.)	4		1	1	
Store/Stock Optimization Systems. (eg. Systems for optimizing the level of stores and spare parts to be carried for like assets across the organization.)	2	2		2	
Plans and Drawings Information System. (eg. System to manage, store and access the detailed drawings of all facilities and buildings.)	2		3	2	
Operations and Maintenance Manuals Storage System. (eg. Electronic System to store and track operations and maintenance manual materials.)	2		4	1	
Emergency Response Plans Information System. (eg. System to store and track emergency response plans, linked through to the asset register in accordance with the data standard.)	2	2	2		
Knowledge Management System. (eg. System to store papers, guidelines, manuals, policies in relation to life cycle Asset Management of the organisation asset portfolio etc.)	2	1	3	1	
Condition Assessment Records System. (eg. System to store condition data, and to analyse this with respect to the parameters or required levels of service.)		1	4	2	

Please indicate the extent of each data type:

	No Data	35% Accurate & complete	50% Accurate & complete	65% Accurate & complete	80% Accurate & complete	95% Accurate & complete
Asset Spatial Data. (eg. Spatial data stored within the GIS. Especially, all distributed linear assets and locations of larger facilities.)	1	1	1	1	2	1
Drawing / Plans. (eg. Drawings and plans of assets and facilities.)	1			3	1	2
Basic physical attributes. (eg. Size, material, installation date, model etc.)	1		2	1	1	2
Detailed physical attributes. (eg. Manufacturer, spare parts and numbers etc.)	2	1	1		1	2
Asset condition data. (eg. Rating of asset condition data.)			4		1	2
Asset performance data. (eg. Recording and rating of asset performance.)	2		3		1	1
Life Cycle Cost Histories. (eg. Stored history of life cycle cost analysis calculations.)	5	1	1			
Risk Assessment Data. (eg. Risk assessment data including probability and consequence of failure, and the subsequent business risk exposure.)	4	2	1			

Please indicate the extent to which each tool is used:

	None	Developed business case	Aging technology or some usage	Business wide usage	Business wide usage - interfaced with other systems
Mobile Computing Facilities. (eg. Pocket PC's, laptops and tablets PC's to be used by field operations and maintenace staff for rapid data entry and live access and updating of work orders.)	1	2	3	1	

	Assets are unable to be grouped	Assets can be grouped in one way only	Assets can be grouped in two or more ways,	Assets can be grouped in any way
Asset Categorization. (eg. Ability to group assets by type, location, material, facility etc. for reporting and manipulation.)	1		4	2

	None	Service type	Facility or system level	Asset type level	Asset level	Maintenance managed item level
Asset Hierarchical Structure. (eg. The level (maintenance managed item) to which asset information is collected and the ability to amalgamate asset costs and performance.)	3			2	1	

Section 2 PROJECT INFORMATION, SELECTION, PRIORITIZATION, AND MANAGEMENT

Please answer the following questions on planning and programming:

	Strongly Disagree	Disagree	Agree	Strongly Agree	Not Sure
Policy guidance on resource allocation allows our agency sufficient flexibility to pursue a performance-based approach.		4	3		
Criteria used to set program priorities, select projects, and allocate resources are consistent with stated policy objectives and defined performance measures.		2	5		
Our agency's programs are consistent with realistic projections of future revenues.		2	4	1	
Our agency's programs are based on realistic estimates of costs, benefits, and impacts on system performance.		1	5	1	
Our agency solicits input from all affected parties to ensure that project scope is consistent with objectives of the project.		2	4	1	
Our agency uses well-defined program delivery measures to track adherence to project scope, schedule, and budget.		1	5	1	

	Little or no knowledge	Little knowledge & ad hoc processes	Good knowledge & ad hoc processes	Consistent processes & partially documented	Extensive knowledge & partially documented	Fully documented & externally audited
Processes for controlling inventory or stock. (eg. Are work orders linked to the required spare parts? Are these spare parts ordered in advance of completing the work order?)	2	1	2	1	1	
Processes for planning future work load and required resources. (eg. Does the organization predict and balance future work load for different skills and numbers of staff for all life cycle functions?)		4	2		1	
Processes for prioritizing work orders. (eg. Are work orders allocated an rating or criticality score? Are these based on the risk to the business?)			4	2	1	
	No Data	35% Accurate & complete	50% Accurate & complete	65% Accurate & complete	80% Accurate & complete	95% Accurate & complete
Works and / or resource management data. (eg. The data related to the resource elements of work order history including labor, plant and materials work performed, in both capital and recurrent activities.)	1		2		4	
Cost history data. (eg. Full cost history of maintenance and operation activities together with depreciation and capital use charges where applicable.)	3			2	1	1
Data for costing of options. (eg. Cost summary for standard construction and rehabilitation techniques, maintenance and operational activities and options.)	2	1		2	1	1

Section 3 LONG TERM, STRATEGIC PLANNING

Please answer the following questions on strategic planning.

	Strongly Disagree	Disagree	Agree	Strongly Agree	Not Sure
Policies support a long-term, life-cycle approach to evaluating investment benefits and costs.		4	3		

Section 4 MAINTENANCE

Please answer the following questions on maintenance strategies:

	Strongly Disagree	Disagree	Agree	Strongly Agree	Not Sure
Our agency monitors actual system performance and compares these values to targets projected for its maintenance and operations program.		2	4		1
	Little or no knowledge	Little knowledge & ad hoc processes	Good knowledge & ad hoc processes	Consistent processes & partially documented	Extensive knowledge & partially documented
Processes for tracking and reporting maintenance costs. (eg. Are these costs available at an maintenance managed item level and capable of being amalgamated to a facility or asset level and being reported on?)			6	1	
Processes for maintenance planning. (eg. Is there a process for defining how each asset / asset type will be maintained? What is the basis for determining the maintenance procedure or activity for a single asset? Does this process cover all assets?)		1	5	1	
Processes for maintenance scheduling. (eg. How does the organization determine the maintenance schedule or intervals for the prescribed maintenance activity?)		2	4	1	
Processes for monitoring and controlling the maintenance program. (eg. Is there adequate reporting and feedback from field staff and information systems to enable the complete understanding of what is happening to the assets?)		2	4	1	
Processes for recording and reporting maintenance costs down to the mainteance managed item level. (eg. Are asset costs reported and accessible? Is there a clear policy on what is required ?)		2	2	3	
Processes for developing and maintaining contents of the Maintenance Manuals and Instructions. (eg. Are new assets automatically included and how often are they reviewed? What is the process by which the responsible staff can update them? Is the format specified?)	1	5	1		
Processes for reviewing and analyzing maintenance programs. (eg. Is this a systematic process? Are the trigger points and processes understood by all?)		6		1	
Processes for developing maintenance strategies that incorporate the overall business drivers for maintenace, capital and system performance. (eg. Is there a corporate wide approach to developing maintenance strategies that covers all assets and amalgamate to higher levels?)		4	2	1	

	No Data	35% Accurate & complete	50% Accurate & complete	65% Accurate & complete	80% Accurate & complete
Maintenance Data. (eg. Detailed maintenance history including activity and timing.)		2	2	2	1
	None	Under development	Documented in some business areas	Documented & covering whole business	Documented & fully implemented across whole business
Quality of the Maintenance Manuals and Instructions. (eg. Do these exist and cover all business units/divisions and assets types?)		2	5		
Maintenace policy that defines where the organisation undertakes maintenance of its assets. (eg. Does a corporate wide policy exist and is it related to business goals and cost analysis ?)	1	1	4		1

Section 5 PRESERVATION

Please answer the following questions on preservation:

	Strongly Disagree	Disagree	Agree	Strongly Agree	Not Sure
Policy guidance supports preservation of existing infrastructure assets.		3	3		1
Capital versus maintenance expenditure tradeoffs are explicitly considered in the preservation of assets like pavements and bridges.		2	5		
The preservation program budget is based upon analyses of least-life-cycle cost rather than exclusive reliance on worst-first strategies.		1	4		2
Our agency monitors actual system performance and compares these values to targets projected for its capital preservation program.			7		

Section 6 TRADE OFF ANALYSIS

Please answer the following questions regarding the analysis of trade-offs:

	Strongly Disagree	Disagree	Agree	Strongly Agree	Not Sure
Capital versus maintenance expenditure tradeoffs are explicitly considered in the preservation of assets like pavements and bridges.		3	1		3
Capital versus operations tradeoffs are explicitly considered in seeking to improve traffic movement.		2	1		4

Section 7 DATA STRATEGY AND ACCESSIBILITY

Please answer the following questions regarding data accessibility and information:

	Strongly Disagree	Disagree	Agree	Strongly Agree	Not Sure
Agency managers and staff at different levels can quickly and conveniently obtain information they need about asset characteristics, location, usage, condition, or performance.		4	2		
	None	Developed business case	Implementation has started	Some systems are interfaced/integrated	All required system are interfaced/integrated - no data is duplicated
Information Systems are well integrated. (eg. The information systems are linked and data can be accessed from different access / entry points, eg. GIS /CMMS. Only one point of data update is required.)	1	4		1	

	Local access only	Developed business case	Some sites connected	All remote sites connected with some slow speed connections	All remote sites connected with high speed connections
Access and Response of Information Systems. (eg. Staff have ready access to the information systems and response times are acceptable for both data entry and update.)	1	1	4		

Section 8 DECISION SUPPORT TOOLS AND INFORMATION SYSTEMS

Please answer the following questions on decision support tools/information systems.

	Strongly Disagree	Disagree	Agree	Strongly Agree	Not Sure
Information on actual work accomplishments and costs is used to improve the cost-projection capabilities of our asset management systems.		1	4		1
Information on changes in asset condition over time is used to improve forecasts of asset life and deterioration in our asset management systems.		2	3		1
Our agency uses asset management decision-support tools to: Calculate and report actual system performance		2	3		1
Our agency uses asset management decision-support tools to: Identify system deficiencies or needs			4	1	1
Our agency uses asset management decision-support tools to: Rank candidate projects for the capital program			3	1	2
Our agency uses asset management decision support tools to: Forecast future system performance given a proposed program of projects		2	2		1
Our agency uses asset management decision-support tools to: Forecast future system performance under different mixes of investment levels by program category		1	2	1	2
Our agency can easily produce map displays showing needs/deficiencies for different asset classes and planned/programmed projects.		4	2		
Information on actual work accomplishments and costs is used to improve the cost-projection capabilities of our asset management systems.		1	4		1
User friendliness of information systems. (eg. Are the information easy to use, quick to learn and make data input / extraction easy?)		4	2		

Section 9 PEOPLE ISSUES

Please answer the following questions regarding personnel:

	Little or no knowledge	Little knowledge & ad hoc processes	Good knowledge & ad hoc processes	Consistent processes & partially documented	Extensive knowledge & partially documented	Fully documented & externally audited
Processes to manage and implement change through the business. (eg. How does the organization respond to change? What mechanisms have been put in place to assist the change process and make it part of the culture?)	2	4	1			
Processes for reviewing whether the appropriate skills and staff numbers are available. (eg. Can the required skills be accessed in both Asset Management and project work? Do you have a process to justify staffing levels from best appropriate Asset Management practices?)	3	3	1			
Processes for managing human resources across the business. (eg. Staffing skills and numbers are known and predictions are made of future needs? New staff are inducted and trained in Asset Management to suit needs? Succession planning is catered for?)	4	3				
Processes for the development and implementation of training programs. (eg. Are regular training sessions held? Have skill deficiencies been identified? Is training matched to the business needs?)	2	3	2			
Processes for the management of knowledge throughout the business. (eg. How does the business update and manage critical business and sector knowledge? How is this disseminated to staff?)	3	2	2			
	None	Under development	Documented in some business areas	Documented & covering whole business	Documented & fully implemented across whole business	
Working knowledge of the profile of the organizations staff skills and ages. (eg. Has a skill and age matrix been developed?)	6		1			
Good attitude and culture. (eg. Does the organization have a 'can do' attitude? Is the staff culture and attitude/enthusiasm treated as critical by the organization)	1	2	3	1		

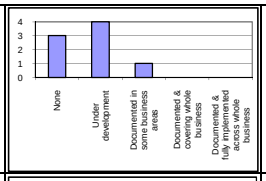
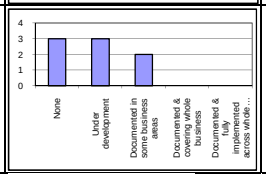
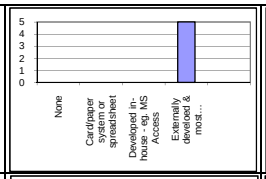
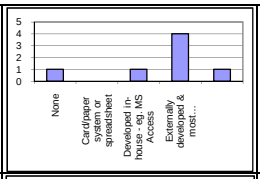
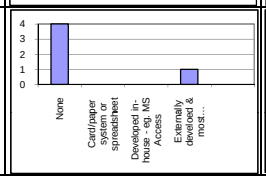
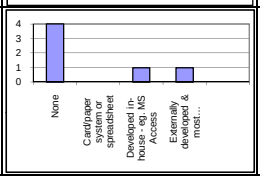
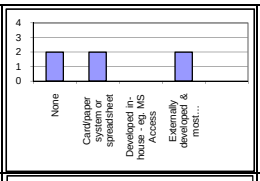
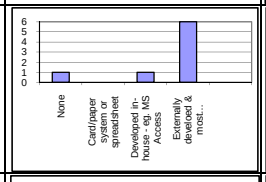
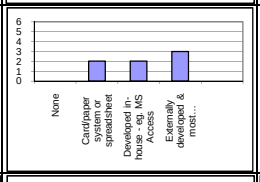
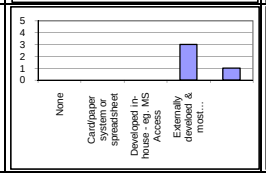
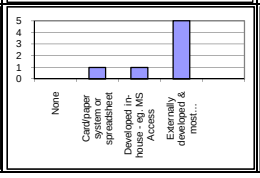
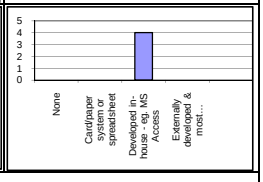
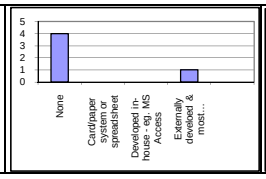
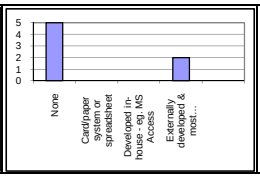
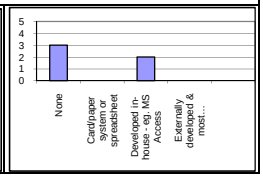
Section 10 CUSTOMER RELATIONS/COLLABORATION

Please answer the following questions regarding customer relations:

	Strongly Disagree	Disagree	Agree	Strongly Agree	Not Sure
Policy guidance considers customer perceptions and expectations.		2	5		
Our customers contribute to the process that formulates policy goals and objectives.		1	6		
Our agency regularly communicates to customers and other stakeholders our accomplishments in meeting policy objectives.		1	6		
Our agency works with political leaders and other stakeholders to present funding options and consequences as part of our budget proposal.			6	1	
We periodically distribute reports of performance measures relevant to customer/stakeholder satisfaction with transportation system and services.		1	4	1	1
Our agency regularly collects customer perceptions of asset condition and performance.		2	3		1

	Little or no knowledge	Little knowledge & ad hoc processes	Good knowledge & ad hoc processes	Consistent processes & partially documented	Extensive knowledge & partially documented	Fully documented & externally audited
Processes for undertaking, analyzing and responding to customer and stakeholder surveys. (eg. Are surveys conducted and reported on?)	2	2	2	1		
Processes for working with customers, regulators and other stakeholders during long term strategic planning. (eg. Informing, seeking and incorporating feedback.)	2	2	2	1		
Processes for handling customer and stakeholder complaints. (eg. Are these tracked through the business from receipt to resolution? Is the customer kept informed of the progress of their complaint?)	2	1	3	1		

APPENDIX E. SELF ASSESSMENT RESULTS

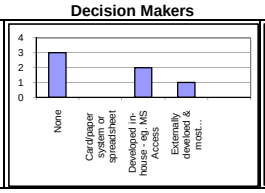
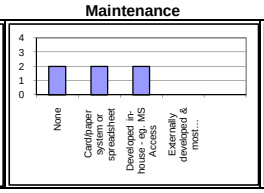
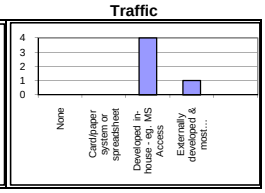
	Decision Makers	Maintenance	Traffic
Agency Asset Management Practices			
AGENCY PRACTICES AND PROCESSES			
114. Organization commitment to **Asset Management**. (eg. Is this documented in corporate policy / business plans, organizational objectives and mission statements in such a way as to show its importance to the business?)			
115. **Asset Management** roles and responsibilities. (eg. Are they clearly defined right across and down the organization? Are they linked to job specifications?)			
Systems			
MAINTENANCE			
24. Maintenance Management System. (eg. System to manage maintenance activities			
32. Maintenance Analysis Systems. (e.g. Systems that perform Reliability Centered Maintenance type analysis.)			
INVENTORY			
33. Store/Stock Optimization Systems. (eg. Systems for optimizing the level of stores and spare parts to be carried for like assets across the organization.)			
22. Asset Register System. (eg. System to store asset hierarchy and attributes for all assets that make up the asset system.)			
23. Geographic Information System. (eg. System to spatially store asset locations and key attributes for all distributed and linear / networked assets including the base locations of assets.)			
RISK AND EMERGENCY			
28. Risk Assessment Information System. (eg. System used for undertaking and storing risk assessments for both the consequences of failure and probability of failure.)			

	Observation	Needs
114. Organization commitment to **Asset Management**. (eg. Is this documented in corporate policy / business plans, organizational objectives and mission statements in such a way as to show its importance to the business?)	Decision Makers think organizational commitment to asset management is not sufficient.	• Develop AM policies and strategies; demonstration of organizational commitment.
115. **Asset Management** roles and responsibilities. (eg. Are they clearly defined right across and down the organization? Are they linked to job specifications?)	Decision Makers think roles and responsibilities are not clear and/or are currently being developed.	• Develop AM policies and strategies.

24. Maintenance Management System. (eg. System to manage maintenance activities	All decision makers think maintenance management system is externally developed. Maintenance personnel identify in-house and externally developed application.	• Communicate context and capabilities of existing maintenance system.
32. Maintenance Analysis Systems. (e.g. Systems that perform Reliability Centered Maintenance type analysis.)	Most decision makers and maintenance personnel think there is no maintenance analysis system. Some maintenance personnel address in-house and externally developed application.	• Determine if maintenance analysis systems are needed.

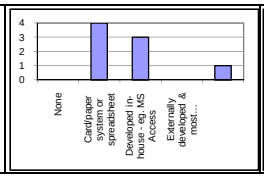
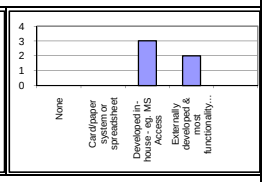
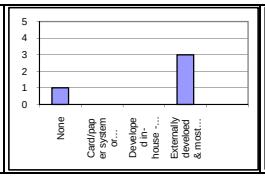
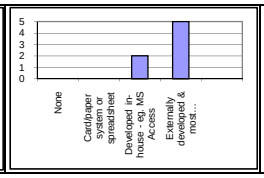
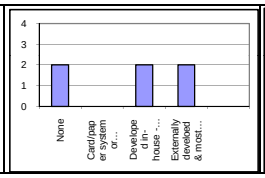
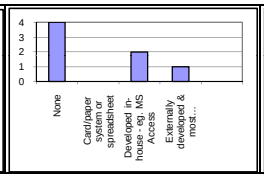
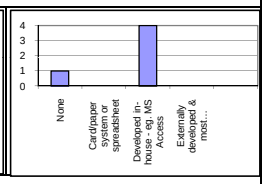
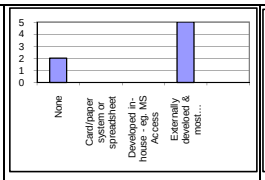
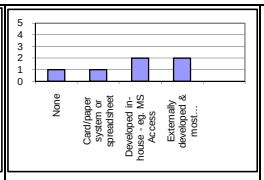
33. Store/Stock Optimization Systems. (eg. Systems for optimizing the level of stores and spare parts to be carried for like assets across the organization.)	The evaluations of maintenance personnel for store/stock optimization systems are equally divided into none, card/paper or spreadsheet, and externally developed.	• Assess the opportunities for better management of stores and spare parts.
22. Asset Register System. (eg. System to store asset hierarchy and attributes for all assets that make up the asset system.)	The majority of decision makers think asset register system is externally developed. Maintenance personnel specify three kinds of system.	• Communicate context and capabilities of existing systems as needed.
23. Geographic Information System. (eg. System to spatially store asset locations and key attributes for all distributed and linear / networked assets including the base locations of assets.)	The majority of decision makers and maintenance personnel think GIS is externally developed, while traffic personnel think GIS is an in-house application.	• Communicate context and capabilities of existing systems as needed.

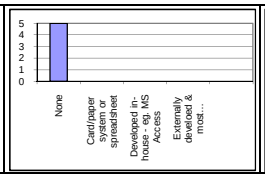
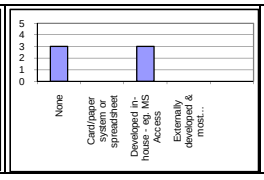
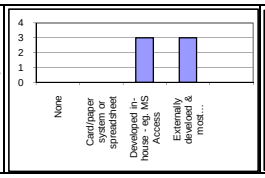
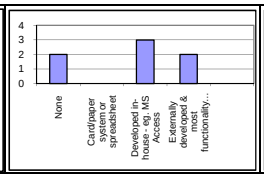
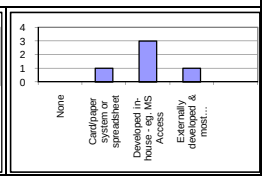
28. Risk Assessment Information System. (eg. System used for undertaking and storing risk assessments for both the consequences of failure and probability of failure.)	Decision makers and maintenance personnel think risk assessment information system is externally developed, while traffic personnel think the system is developed in-house. Also, many (60-80%) personnel think there is no system.	• Determine needs for DelDOT. • Define what is meant by a "risk assessment information system."

	Decision Makers	Maintenance	Traffic
36. Emergency Response Plans Information System. (eg. System to store and track emergency response plans, linked through to the asset register in accordance with the data standard.)			

Labels

None
Card/paper system or spreadsheet
Developed in-house eg. MS Access
Externally developed & most functionality utilized
Externally developed-interfaced with other systems & functionality fully utilized

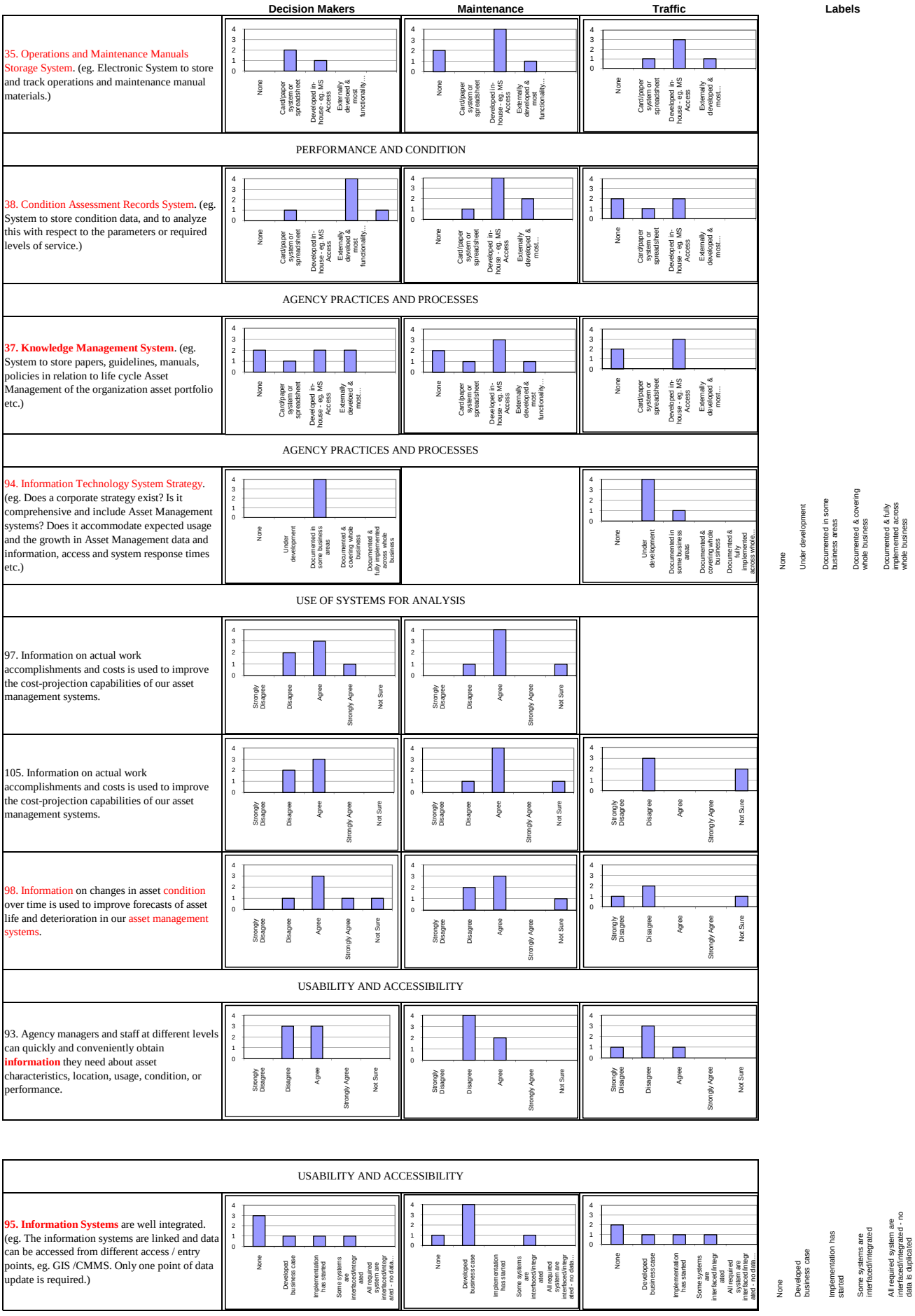
CUSTOMER RELATIONS			
21. Complaints or Enquiries System. (eg. System to store the details and track customer complaints and enquires from receipt to conclusion.)			
PROJECT MANAGEMENT			
25. Job Resource Management System. (eg. System to create and track **work orders** covering labor, plant, specialist tools and materials.)			
DATA			
29. Data Warehouse. (eg. System to store, manage and report on data from other information systems. This system should complete basic manipulation and produce regular reports.)			
DECISION SUPPORT TOOLS			
30. Optimized Renewal Decision Making - Modeling **System**. (eg. System for optimal prediction of renewal timing and options analysis for **life extensions of existing assets.**)			

LIFE CYCLE COST ANALYSIS			
31. Life Cycle Cost Modeling System. (eg. System for modeling the life cycle costs of different asset options and solutions for new assets where no spent costs are involved. It allows all supply options to be considered.)			
MANUAL AND DOCUMENTS			
34. Plans and Drawings Information System. (eg. System to manage, store and access the detailed drawings of all facilities and buildings.)			

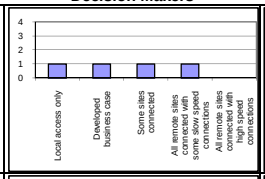
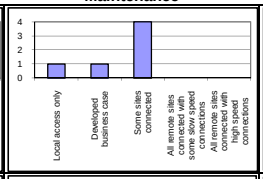
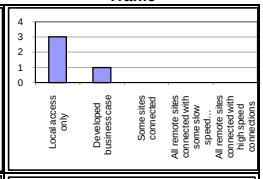
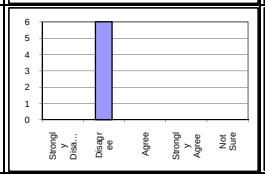
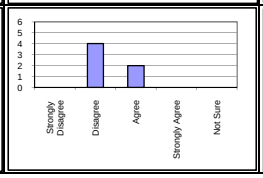
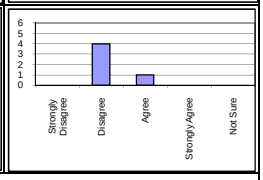
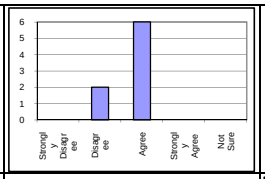
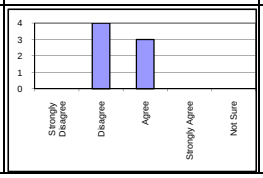
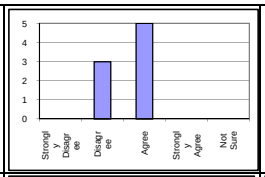
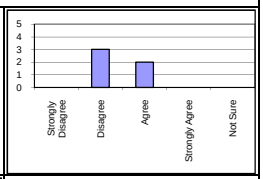
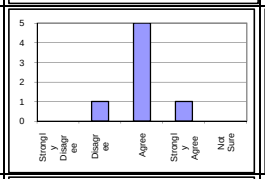
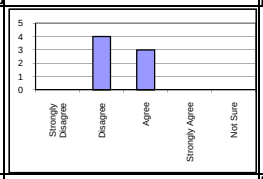
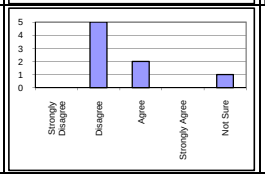
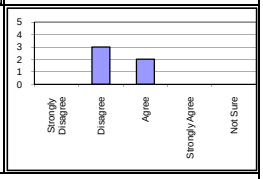
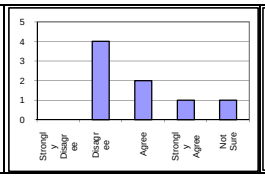
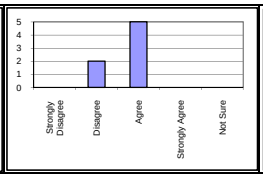
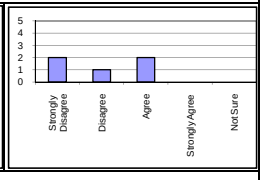
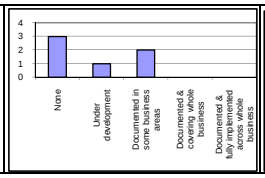
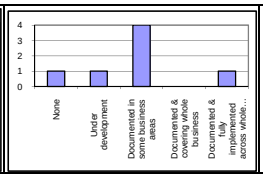
Labels

None
Card/paper system or spreadsheet
Developed in-house eg. MS Access
Externally developed & most functionality utilized
Externally developed-interfaced with other systems & functionality fully utilized

	Observation	Needs
36. Emergency Response Plans Information System. (eg. System to store and track emergency response plans, linked through to the asset register in accordance with the data standard.)	All groups address emergency response plans information system developed in-house. Also, card/paper or spreadsheet (maintenance personnel) and the system externally developed (decision makers and traffic personnel) are addressed. Many (30-50%) personnel in decision makers and maintenance think there is no system.	• Disseminate information regarding DelDOT's emergency response plan. • Update the plan in the context of asset management.
21. Complaints or Enquiries System. (eg. System to store the details and track customer complaints and enquires from receipt to conclusion.)	Maintenance personnel identify a card/paper or spreadsheet as a format of complaints or enquiries system.	• Promote role Maximo can play in addressing complaints and inquiries and link to asset management.
25. Job Resource Management System. (eg. System to create and track **work orders** covering labor, plant, specialist tools and materials.)	The majority of decision makers and maintenance think job resource management system is externally developed. Some maintenance personnel think the system is developed in-house or externally.	• Ensure capabilities of systems are known. • Document and disseminate information about the system.
29. Data Warehouse. (eg. System to store, manage and report on data from other information systems. This system should complete basic manipulation and produce regular reports.)	Decision makers and maintenance personnel think that the data warehouse is developed in-house or externally, while traffic personnel think it is develop in-house only. Also, some think there is no data warehouse.	• Identify and communicate what data is widely available. • Identify additional needs.
30. Optimized Renewal Decision Making - Modeling **System**. (eg. System for optimal prediction of renewal timing and options analysis for **life extensions of existing assets.**)	Most decision makers think optimized renewal decision making modeling system is externally developed. Maintenance personnel address various styles, including card/paper or spreadsheet, in-house and externally developed applications. Maintenance personnel did not necessarily relate to the capabilities offered by the pavement and bridge management systems.	• Identify areas where the different groups can benefit from decision support tools. • Conduct relevant training.
31. Life Cycle Cost Modeling System. (eg. System for modeling the life cycle costs of different asset options and solutions for new assets where no spent costs are involved. It allows all supply options to be considered.)	All decision makers think there is no life cycle cost modeling system. Maintenance personnel think there is an in-house system or no system.	• Develop and share appropriate tools.
34. Plans and Drawings Information System. (eg. System to manage, store and access the detailed drawings of all facilities and buildings.)	All groups think plans and drawings information system is developed in house and externally developed.	• Document and disseminate information of capabilities.


Decision Makers
Maintenance
Traffic
Labels
35. Operations and Maintenance Manuals Storage System. (eg. Electronic System to store and track operations and maintenance manual materials.)
None
Card/paper system or spreadsheet
Developed in-house - eg. MS Access
Externally developed & most functionality...
PERFORMANCE AND CONDITION
38. Condition Assessment Records System. (eg. System to store condition data, and to analyze this with respect to the parameters or required levels of service.)
AGENCY PRACTICES AND PROCESSES
37. Knowledge Management System. (eg. System to store papers, guidelines, manuals, policies in relation to life cycle Asset Management of the organization asset portfolio etc.)
AGENCY PRACTICES AND PROCESSES
94. Information Technology System Strategy. (eg. Does a corporate strategy exist? Is it comprehensive and include Asset Management systems? Does it accommodate expected usage and the growth in Asset Management data and information, access and system response times etc.)
Under development
Documented in some business areas
Documented & covering whole business
Documented & fully implemented across whole business
USE OF SYSTEMS FOR ANALYSIS
97. Information on actual work accomplishments and costs is used to improve the cost-projection capabilities of our asset management systems.
Strongly Disagree
Disagree
Agree
Strongly Agree
Not Sure
105. Information on actual work accomplishments and costs is used to improve the cost-projection capabilities of our asset management systems.
98. Information on changes in asset condition over time is used to improve forecasts of asset life and deterioration in our asset management systems.
USABILITY AND ACCESSIBILITY
93. Agency managers and staff at different levels can quickly and conveniently obtain information they need about asset characteristics, location, usage, condition, or performance.
USABILITY AND ACCESSIBILITY
95. Information Systems are well integrated. (eg. The information systems are linked and data can be accessed from different access / entry points, eg. GIS /CMMS. Only one point of data update is required.)
Developed business case
Implementation has started
Some systems are interfaced/integrated
All required system are interfaced/integrated - no data is duplicated

	Observation	Needs
35. Operations and Maintenance Manuals Storage System. (eg. Electronic System to store and track operations and maintenance manual materials.)	All groups address different formats of operations and maintenance manuals storage system. Some maintenance personnel think there is no storage system.	• Document and disseminate information about operations and maintenance manuals storage system.
38. Condition Assessment Records System. (eg. System to store condition data, and to analyze this with respect to the parameters or required levels of service.)	All groups address diverse formats of condition assessment records system. Several traffic personnel think there is no record system.	• Identify missing areas (eg. Traffic signals) in condition assessment records system. • Determine required knowledge by area. • Disseminate relevant and appropriate information.
37. Knowledge Management System. (eg. System to store papers, guidelines, manuals, policies in relation to life cycle Asset Management of the organization asset portfolio etc.)	Decision makers and maintenance personnel address same knowledge management system types. Traffic personnel address different type.	• Document systems and processes. • Disseminate relevant and appropriate information.
94. Information Technology System Strategy. (eg. Does a corporate strategy exist? Is it comprehensive and include Asset Management systems? Does it accommodate expected usage and the growth in Asset Management data and information, access and system response times etc.)	Decision makers think information technology system strategy is documented in some business, while traffic personnel think the strategy is under development.	
97. Information on actual work accomplishments and costs is used to improve the cost-projection capabilities of our asset management systems.	The majority of decision makers and maintenance personnel agree information is used to improve the cost-projection capabilities, while traffic personnel disagree.	• Identify areas needing improvement.
105. Information on actual work accomplishments and costs is used to improve the cost-projection capabilities of our asset management systems.	The majority of decision makers and maintenance personnel agree information is used to improve the cost-projection capabilities, while traffic personnel disagree.	• Introduce concepts to traffic area.
98. Information on changes in asset condition over time is used to improve forecasts of asset life and deterioration in our asset management systems.	The majority of decision makers and maintenance personnel agree information is used to improve forecasts of asset life and deterioration, while traffic personnel disagree.	• Introduce concepts to traffic area.
93. Agency managers and staff at different levels can quickly and conveniently obtain **information** they need about asset characteristics, location, usage, condition, or performance.	The evaluations of operational levels (maintenance and traffic groups) for information accessibility are not good especially. Decision makers' evaluations are equally divided into agree and disagree.	• Identify areas needing improvement.
95. Information Systems are well integrated. (eg. The information systems are linked and data can be accessed from different access / entry points, eg. GIS /CMMS. Only one point of data update is required.)	In all groups, some personnel recognize some integration of information systems. Some personnel in all groups think there is no integration.	• Identify what kinds of information should be integrated. • Communicate current status.

	Decision Makers	Maintenance	Traffic
96. Access and Response of **Information Systems**. (eg. Staff have ready access to the information systems and response times are acceptable for both data entry and update.)			
106. User friendliness of **information systems**. (eg. Are the information easy to use, quick to learn and make data input / extraction easy?)			
Policies			
LIFE CYCLE COST ANALYSIS			
56. Policy guidance encourages resource allocation and project selection based on cost-effectiveness or benefit/cost analysis.			
69. Policies support a long-term, life-cycle approach to evaluating investment benefits and costs.			
PERFORMANCE AND CONDITION			
70. Policy guidance on resource allocation allows our agency sufficient flexibility to pursue a performance-based approach.			
57. Policy guidance on resource allocation allows our agency sufficient flexibility to pursue a performance-based approach.			
71. Our agency's goals and objectives are linked to specific performance measures and evaluation criteria for resource allocation.			
TRADE OFF ANALYSIS AND PROJECT SELECTION			
58. Criteria used to set program priorities, select projects, and allocate resources are consistent with stated policy objectives and defined performance measures.			
MAINTENANCE AND PRESERVATION			
86. Maintenance policy that defines where the organization undertakes maintenance of its assets. (eg. Does a corporate wide policy exist and is it related to business goals and cost analysis ?)			
MAINTENANCE AND PRESERVATION			

Labels

Local access only
Developed business case
Some sites connected
All remote sites connected with some slow speed connections
All remote sites connected with high speed connections

None
Under development
Documented in some business areas
Documented & covering whole business
Documented & fully implemented across whole business

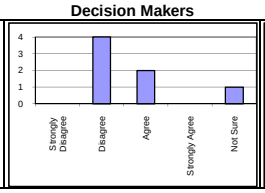
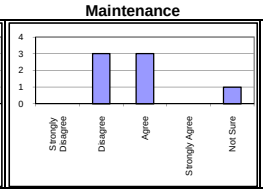
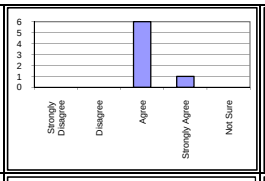
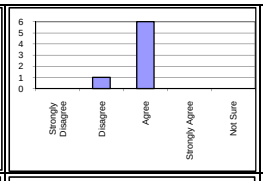
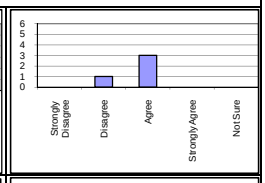
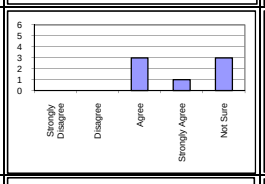
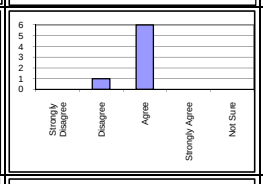
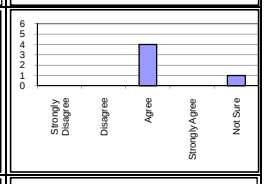
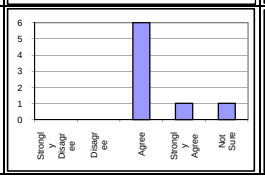
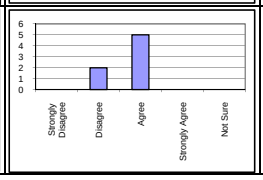
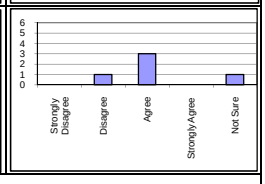
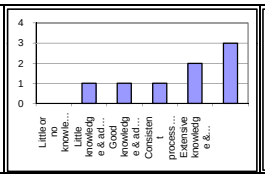
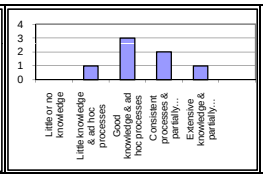
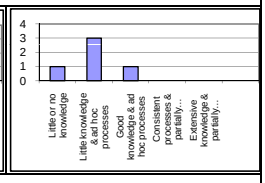
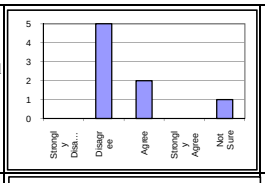
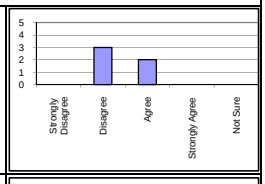
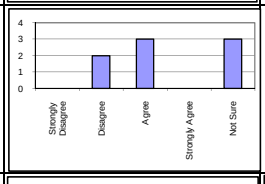
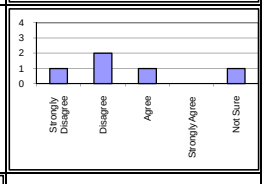
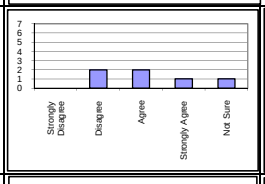
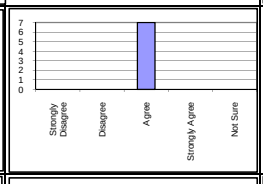
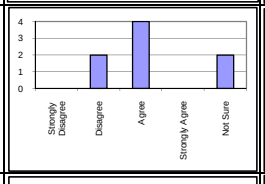
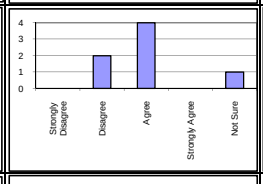
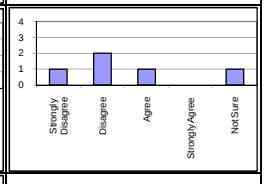
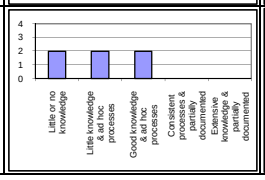
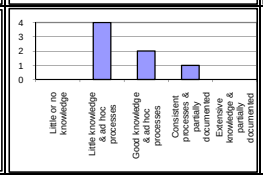
	Observation	Needs
96. Access and Response of **Information Systems**. (eg. Staff have ready access to the information systems and response times are acceptable for both data entry and update.)	The evaluations of decision makers for access and response of information systems spread over four answers. The majority of maintenance personnel think some sites are connected, while that of traffic personnel think local access only.	• Ensure that all personnel have access to good information.
106. User friendliness of **information systems**. (eg. Are the information easy to use, quick to learn and make data input / extraction easy?)	All decision makers disagree information systems are user friendly. Also, the majority of operational levels (maintenance and traffic groups) disagree with user friendliness.	• Understand issues and develop a strategy to respond.

56. Policy guidance encourages resource allocation and project selection based on cost-effectiveness or benefit/cost analysis.	The majority of decision makers agree policy guidance encourages resource allocation and project selection based on economic analyses.	• Educate decision makers to understand how they can link policy guidance with project selection.
69. Policies support a long-term, life-cycle approach to evaluating investment benefits and costs.	The majority of maintenance personnel disagree policies support a long-term life-cycle approach.	• Modify policies to connect to a long-term, life-cycle approach.

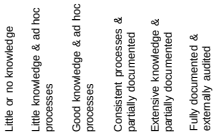
70. Policy guidance on resource allocation allows our agency sufficient flexibility to pursue a performance-based approach.	The majority of decision makers agree policy guidance on resource allocation allows DelDOT sufficient flexibility to pursue a performance-based approach, while the majority of traffic personnel disagree.	• Link policies and decision making to performance measures.
57. Policy guidance on resource allocation allows our agency sufficient flexibility to pursue a performance-based approach.	Most decision makers agree policy guidance on resource allocation allows DelDOT sufficient flexibility to pursue a performance-based approach, while the majority of maintenance personnel disagree.	• Link policies and decision making to performance measures.
71. Our agency's goals and objectives are linked to specific performance measures and evaluation criteria for resource allocation.	The majority of decision makers and traffic personnel disagree DelDOT's goals and objectives are linked to specific performance measures and evaluation criteria for resource allocation.	• Integrate ongoing performance management efforts with decision making.

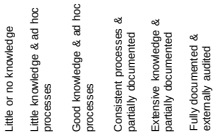
58. Criteria used to set program priorities, select projects, and allocate resources are consistent with stated policy objectives and defined performance measures.	The majority of decision makers and traffic personnel disagree criteria are consistent with stated policy objectives and performance measures, while that of maintenance personnel agree.	• Link criteria, policy objectives and performance measures.

86. Maintenance policy that defines where the organization undertakes maintenance of its assets. (eg. Does a corporate wide policy exist and is it related to business goals and cost analysis ?)	The majority of decision makers think maintenance policy does not exist or is under development, while that of maintenance personnel think the policy is documented.	• Link criteria, policy objectives and performance measures including maintenance policies.

	Decision Makers	Maintenance	Traffic
87. Policy guidance supports **preservation** of existing infrastructure assets.			
CUSTOMER RELATIONS			
118. Our agency regularly communicates to **customers and other stakeholders** our accomplishments in meeting **policy** objectives.			
117. Our **customers** contribute to the process that formulates **policy goals and objectives**.			
116. Policy guidance considers **customer perceptions and expectations**.			
Performance			
AGENCY PRACTICES AND PROCESS			
5. Processes for determining what **assets** to collect **performance data** on and for undertaking the collection. (eg. How well is the asset performing? Is there a data standard defining this?)			
AGENCY PRACTICES AND PROCESS			
71. Our agency's **goals and objectives** are linked to specific **performance measures** and evaluation criteria for **resource allocation**.			
73. Our agency monitors actual system performance and compares these values to targets projected for its capital preservation program.			
90. Our agency monitors actual system performance and compares these values to targets projected for its capital preservation program.			
74. Our agency monitors actual system performance and compares these values to targets projected for its maintenance and operations program.			
83. Processes for developing **maintenance strategies** that incorporate the overall business drivers for maintenance, capital and system **performance**. (eg. Is there a corporate wide approach to developing maintenance strategies that covers all assets and amalgamate to higher levels?)			

Labels





	Observation	Needs
87. Policy guidance supports **preservation** of existing infrastructure assets.	The majority of decision makers disagree policy guidance supports preservation of existing assets. Maintenance personnel's evaluations are equally divided into agree and disagree.	• Link criteria, policy objectives and performance measures including preservation. • Document and dissemination preservation policy.

118. Our agency regularly communicates to **customers and other stakeholders** our accomplishments in meeting **policy** objectives.	All decision makers and the majority of maintenance and traffic personnel agree DelDOT regularly communicates accomplishments to stakeholders.	• Continue to communicate accomplishments.
117. Our **customers** contribute to the process that formulates **policy goals and objectives**.	The majority of all groups agree customers contribute to the process formulating policy goals and objectives.	• Continue public involvement efforts.
116. Policy guidance considers **customer perceptions and expectations**.	The majority of all groups agree policy guidance consider customer perceptions and expectation.	• Continue public involvement efforts.

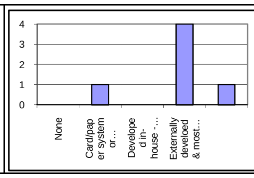
5. Processes for determining what **assets** to collect **performance data** on and for undertaking the collection. (eg. How well is the asset performing? Is there a data standard defining this?)	Decision makers and maintenance personnel think they have good knowledge about processes for performance data collection, while traffic personnel do not.	• Determine required knowledge of traffic personnel and develop strategy.

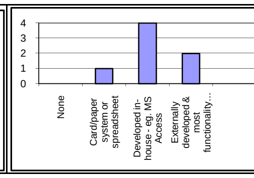
71. Our agency's **goals and objectives** are linked to specific **performance measures** and evaluation criteria for **resource allocation**.	The majority of decision makers and traffic personnel disagree DelDOT's goals and objectives are linked to specific performance measures and evaluation criteria for resource allocation.	• Integrate ongoing performance management efforts with decision making.
73. Our agency monitors actual system performance and compares these values to targets projected for its capital preservation program.	The majority of decision makers agree DelDOT monitors system performance and compares these values to targets for capital preservation program, while that of traffic personnel disagree.	• Provide context to all personnel regarding relationship between performance and programs.
90. Our agency monitors actual system performance and compares these values to targets projected for its capital preservation program.	The majority of decision makers and whole maintenance personnel agree DelDOT monitors actual system performance and compares these values to targets for capital preservation program.	• Provide context to decision makers.
74. Our agency monitors actual system performance and compares these values to targets projected for its maintenance and operations program.	The majority of decision makers agree DelDOT monitors system performance and compares these values to targets for maintenance and operations program, while that of traffic personnel disagree.	• Document and disseminate information about monitoring systems.
83. Processes for developing **maintenance strategies** that incorporate the overall business drivers for maintenance, capital and system **performance**. (eg. Is there a corporate wide approach to developing maintenance strategies that covers all assets and amalgamate to higher levels?)	The majority of decision makers and maintenance personnel think they have little knowledge about processes for developing maintenance strategies.	• Formalize process for developing maintenance strategies.

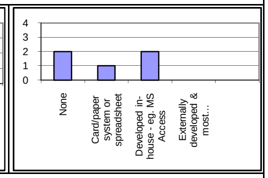
	Decision Makers	Maintenance	Traffic	Labels

SYSTEMS

38. Condition Assessment Records System. (eg. System to store condition data, and to analyze this with respect to the parameters or required levels of service.)



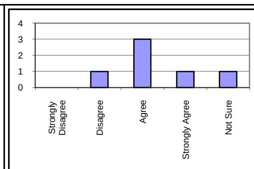


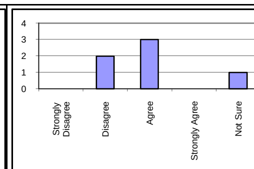


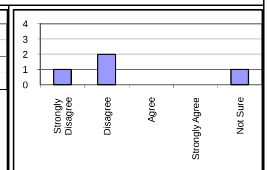
Labels: None; Card/paper system or spreadsheet; Developed in-house eg. MS Access; Externally developed & most functionally utilized; Externally developed- interfaced with other systems & functionality fully utilized

DATA AND INFORMATION

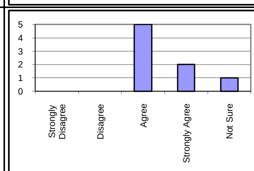
98. Information on changes in asset condition over time is used to improve forecasts of asset life and deterioration in our asset management systems.

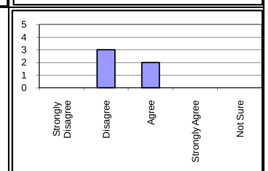




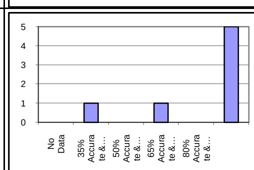


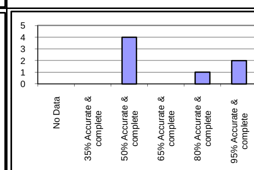
72. Our agency regularly collects information on the performance of our assets (e.g., serviceability, ride quality, capacity, operations, and safety improvements).

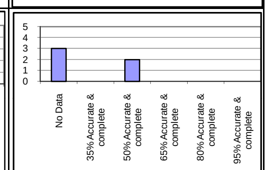




44. Asset condition data. (eg. Rating of asset condition data.)

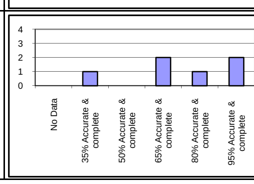


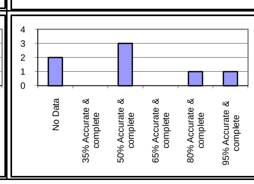


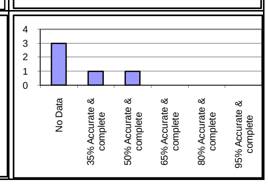


Labels: No Data; 35% Accurate & complete; 50% Accurate & complete; 65% Accurate & complete; 80 % Accurate & complete; 95 % Accurate & complete

45. Asset performance data. (eg. Recording and rating of asset performance.)

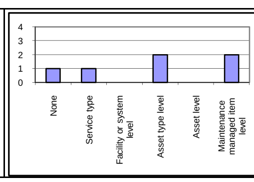


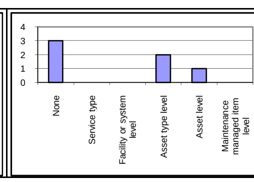


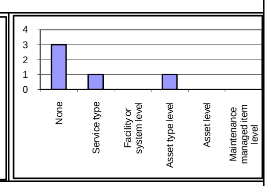


INVENTORY

54. Asset Hierarchical Structure. (eg. The level (maintenance managed item) to which asset information is collected and the ability to amalgamate asset costs and performance.)



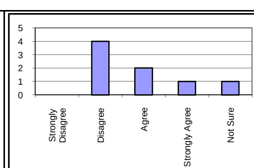


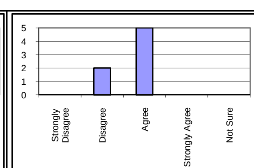


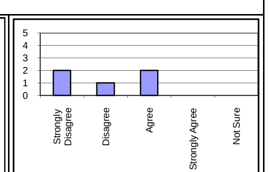
Labels: None; Service type; Facility or system level; Asset type level; Asset level; Maintenance managed

PROJECT SELECTION AND RESOURCE ALLOCATION

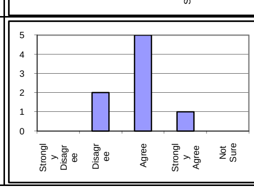
58. Criteria used to set program priorities, select projects, and allocate resources are consistent with stated policy objectives and defined performance measures.

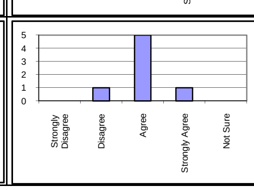






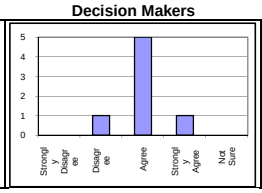
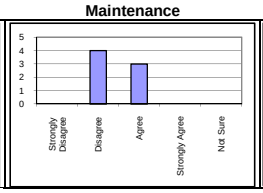
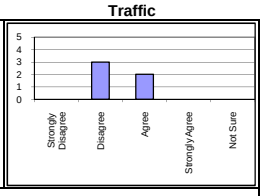
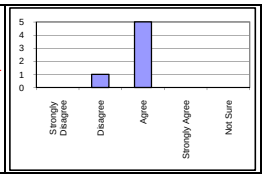
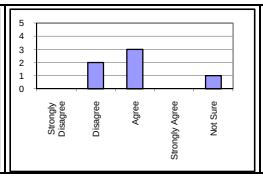
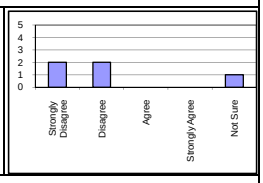
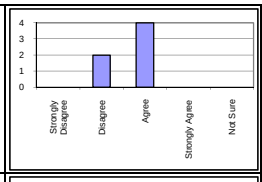
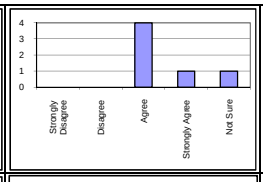
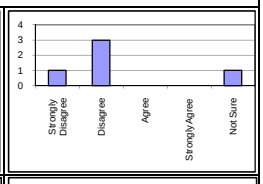
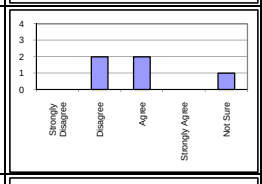
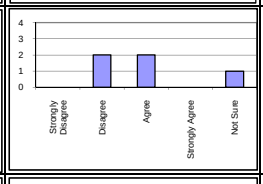
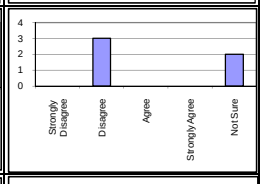
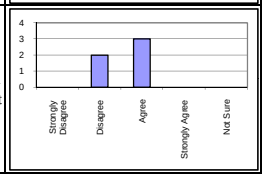
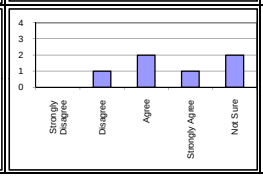
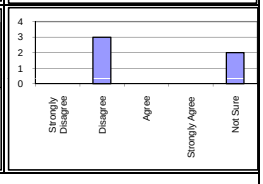
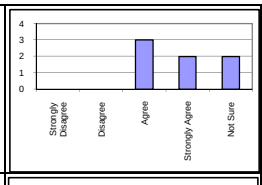
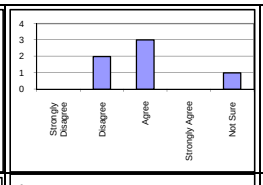
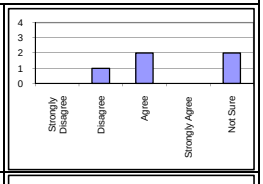
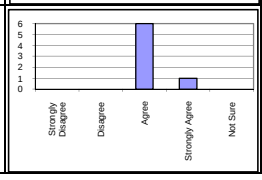
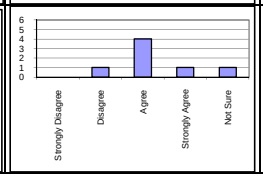
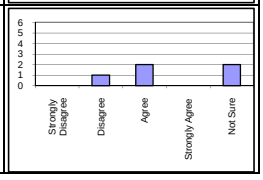
60. Our agency's programs are based on realistic estimates of costs, benefits, and impacts on system performance.





POLICIES

	Observation	Needs
38. Condition Assessment Records System. (eg. System to store condition data, and to analyze this with respect to the parameters or required levels of service.)	All groups address diverse formats of condition assessment records system. Several traffic personnel think there is no record system.	• Identify missing areas (eg. Traffic signals) in condition assessment records system. • Determine required knowledge by area. • Disseminate relevant and appropriate information.
98. Information on changes in asset condition over time is used to improve forecasts of asset life and deterioration in our asset management systems.	The majority of decision makers and maintenance personnel agree information is used to improve forecasts of asset life and deterioration, while traffic personnel disagree.	• Introduce concepts to traffic area.
72. Our agency regularly collects information on the performance of our assets (e.g., serviceability, ride quality, capacity, operations, and safety improvements).	Decision makers think DelDOT regularly collects asset performance, while traffic personnel do not.	• Document and disseminate information about data collection.
44. Asset condition data. (eg. Rating of asset condition data.)	Decision makers think asset condition and performance data are accurate, while operational level (i.e., maintenance and traffic personnel) thinks they are less accurate.	• Assess data quality and identify areas for improvement. • Document data quality.
45. Asset performance data. (eg. Recording and rating of asset performance.)	Decision makers think asset condition and performance data are accurate, while operational level (i.e., maintenance and traffic personnel) thinks they are less accurate.	• Define performance. • Assess data needs. • Document and communicate data quality.
54. Asset Hierarchical Structure. (eg. The level (maintenance managed item) to which asset information is collected and the ability to amalgamate asset costs and performance.)	All groups have different perspectives on asset categorization and hierarchical structure. Some personnel in all groups think there is no asset hierarchical structure.	• Document and communicate available data and structure.
58. Criteria used to set program priorities, select projects, and allocate resources are consistent with stated policy objectives and defined performance measures.	The majority of decision makers and traffic personnel disagree criteria are consistent with stated policy objectives and performance measures, while that of maintenance personnel agree.	• Link criteria, policy objectives and performance measures.
60. Our agency's programs are based on realistic estimates of costs, benefits, and impacts on system performance.	The majority of decision makers and maintenance personnel agree DelDOT's programs are based on realistic estimates of costs, benefits, and impacts on performance.	• Document and disseminate project selection.

	Decision Makers	Maintenance	Traffic
57 and 70. Policy guidance on resource allocation allows our agency sufficient flexibility to pursue a performance-based approach.			
DECISION SUPPORT TOOLS			
99. Our agency uses asset management decision-support tools to calculate and report actual system performance.			
DECISION SUPPORT TOOLS			
100. Our agency uses asset management decision-support tools to: Identify system deficiencies or needs.			
102. Our agency uses asset management decision support tools to: Forecast future system performance given a proposed program of projects			
103. Our agency uses asset management decision-support tools to: Forecast future system performance under different mixes of investment levels by program category			
CUSTOMER RELATIONS			
122. Our agency regularly collects customer perceptions of asset condition and performance.			
121. We periodically distribute reports of performance measures relevant to customer/stakeholder satisfaction with transportation system and services.			

Labels

Little or no knowledge

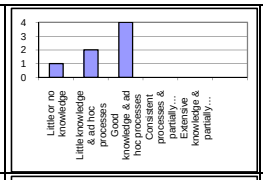
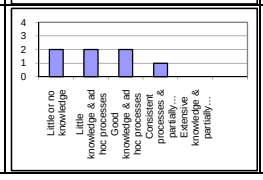
Little knowledge & ad hoc processes

Good knowledge & ad hoc processes

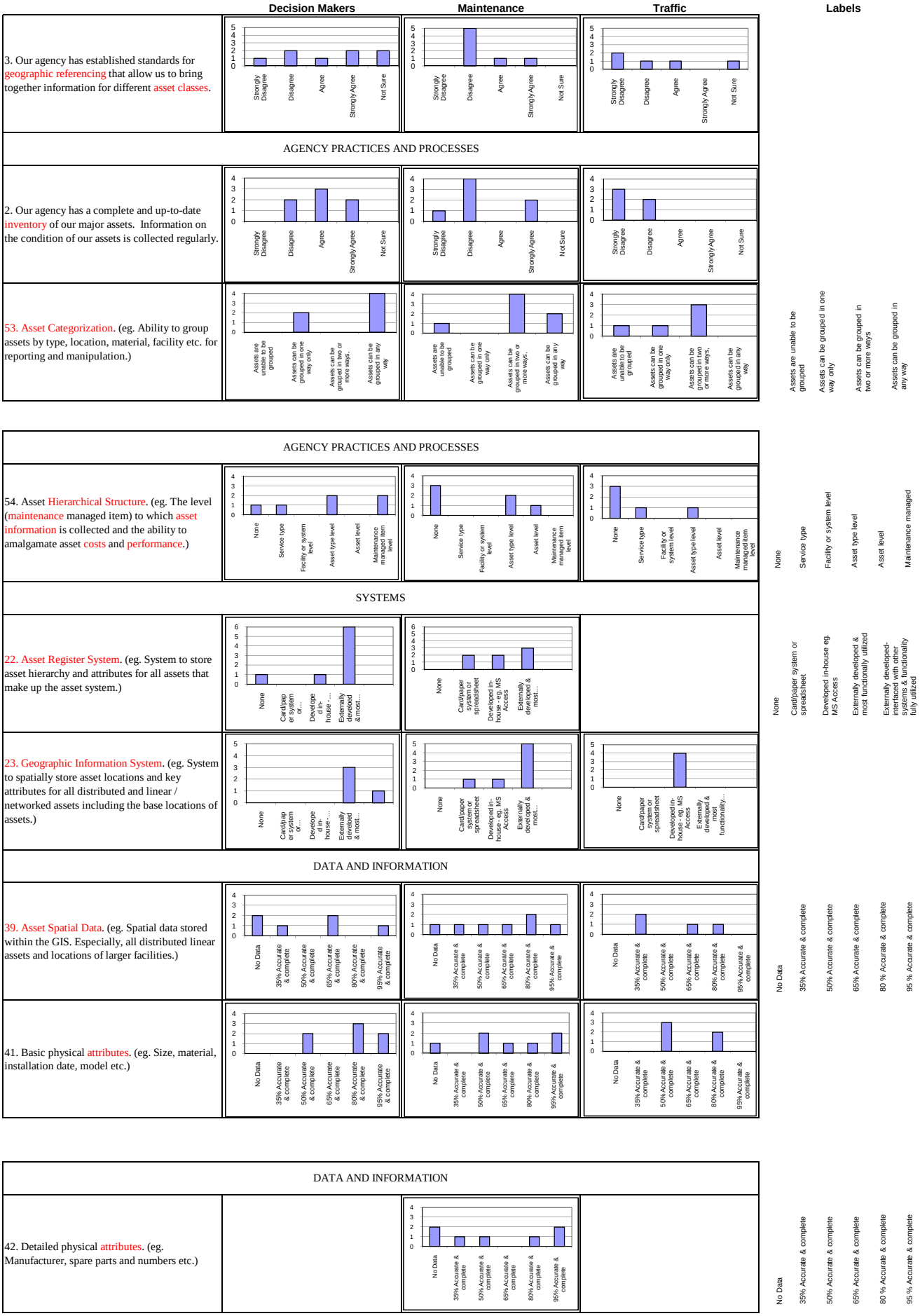
Consistent processes & partially documented

Extensive knowledge & partially documented

Fully documented & externally audited

Inventory			
AGENCY PRACTICES AND PROCESSES			
16. Processes for rationalizing the existing asset portfolio and disposal of unwanted assets. (eg. Identifying assets for disposal, mothballing or transfer to improve business effectiveness to reduce cost and release funds for other purposes.)			
17. Processes for disposing of assets. The processes for good governance and ethical behavior in this area. (eg. Are these assets removed from the asset register and on other asset systems, eg. The GIS?)			

	Observation	Needs
57 and 70. Policy guidance on resource allocation allows our agency sufficient flexibility to pursue a performance-based approach.	Most decision makers agree policy guidance on resource allocation allows DelDOT sufficient flexibility to pursue a performance-based approach, while the majority of maintenance personnel disagree.	• Document and communicate policy guidance relating resource allocation and performance.
99. Our agency uses asset management decision-support tools to calculate and report actual system performance.	The majority of decision makers and maintenance personnel agree DelDOT uses asset management decision-support tools to calculate and report actual system performance, while traffic personnel disagree.	• Document and communicate tools to calculate and report condition.
100. Our agency uses asset management decision-support tools to: Identify system deficiencies or needs.	Most decision makers and all maintenance personnel agree decision-support tools are used to identify system deficiencies or needs. However, no one agree in traffic group.	• Document and communicate tools to identify system deficiencies and needs.
102. Our agency uses asset management decision support tools to: Forecast future system performance given a proposed program of projects	The majority of decision makers and maintenance personnel agree DelDOT uses asset management decision-support tools to forecast future system performance given a proposed program of projects, while traffic personnel disagree.	• Identify gaps in forecasting tools. • Document and communicate existing tools.
103. Our agency uses asset management decision-support tools to: Forecast future system performance under different mixes of investment levels by program category	The majority of decision makers and maintenance personnel agree DelDOT uses asset management decision-support tools to forecast future system performance under different mixes of investment levels by program category, while traffic personnel disagree.	• Identify gaps in forecasting tools. • Document and communicate existing tools.
122. Our agency regularly collects customer perceptions of asset condition and performance.	The majority of all groups agree DelDOT regularly collects customer perceptions of asset conditions and performance. All decision makers agree.	• Document and disseminate customer survey results.
121. We periodically distribute reports of performance measures relevant to customer/stakeholder satisfaction with transportation system and services.	The majority of all groups agree DelDOT periodically distribute reports of performance measures relevant to stakeholders satisfaction with system and services. All decision makers agree.	• Document and disseminate customer survey results.
16. Processes for rationalizing the existing asset portfolio and disposal of unwanted assets. (eg. Identifying assets for disposal, mothballing or transfer to improve business effectiveness to reduce cost and release funds for other purposes.)	Maintenance personnel relatively have good knowledge about processes for rationalizing the existing asset portfolio and disposal of unwanted assets. However, they don't have much knowledge about processes for disposing of assets.	• Document and disseminate the processes for disposing of assets.
17. Processes for disposing of assets. The processes for good governance and ethical behavior in this area. (eg. Are these assets removed from the asset register and on other asset systems, eg. The GIS?)	Maintenance personnel relatively have good knowledge about processes for rationalizing the existing asset portfolio and disposal of unwanted assets. However, they don't have much knowledge about processes for disposing of assets.	• Document and disseminate processes for disposing of assets.


Decision Makers
Maintenance
Traffic
Labels
3. Our agency has established standards for geographic referencing that allow us to bring together information for different asset classes.
Strongly Disagree
Disagree
Agree
Strongly Agree
Not Sure
AGENCY PRACTICES AND PROCESSES
2. Our agency has a complete and up-to-date inventory of our major assets. Information on the condition of our assets is collected regularly.
53. Asset Categorization. (eg. Ability to group assets by type, location, material, facility etc. for reporting and manipulation.)
Assets are unable to be grouped
Assets can be grouped in one way only
Assets can be grouped in two or more ways.
Assets can be grouped in any way
Assets can be grouped in two or more ways
AGENCY PRACTICES AND PROCESSES
54. Asset Hierarchical Structure. (eg. The level (maintenance managed item) to which asset information is collected and the ability to amalgamate asset costs and performance.)
None
Service type
Facility or system level
Asset type level
Asset level
Maintenance managed item level
SYSTEMS
22. Asset Register System. (eg. System to store asset hierarchy and attributes for all assets that make up the asset system.)
Card/paper system or spreadsheet
Developed in-house - eg. MS Access
Externally developed & most...
Externally developed & most functionality utilized
Externally developed-interfaced with other systems & functionality fully utilized
23. Geographic Information System. (eg. System to spatially store asset locations and key attributes for all distributed and linear / networked assets including the base locations of assets.)
DATA AND INFORMATION
39. Asset Spatial Data. (eg. Spatial data stored within the GIS. Especially, all distributed linear assets and locations of larger facilities.)
No Data
35% Accurate & complete
50% Accurate & complete
65% Accurate & complete
80% Accurate & complete
95% Accurate & complete
41. Basic physical attributes. (eg. Size, material, installation date, model etc.)
42. Detailed physical attributes. (eg. Manufacturer, spare parts and numbers etc.)

	Observation	Needs
3. Our agency has established standards for geographic referencing that allow us to bring together information for different asset classes.	Decision makers' evaluations for the establishment of standards for geographic referencing are equally spread over agreement and disagreement. Majority of operational levels feel standards have not been established.	• Document and disseminate information about geographic referencing.

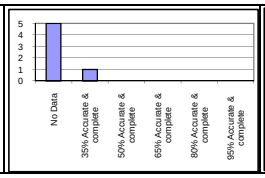
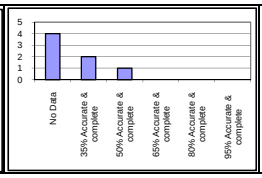
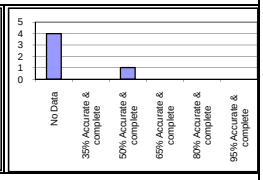
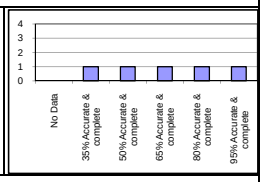
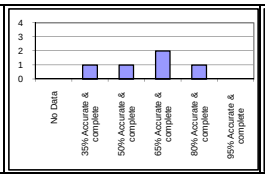
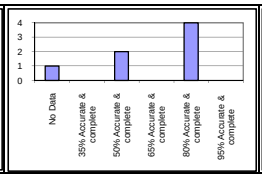
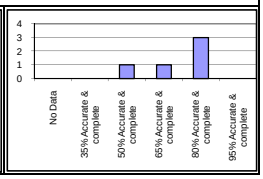
2. Our agency has a complete and up-to-date inventory of our major assets. Information on the condition of our assets is collected regularly.	Decision makers tend to agree DelDOT has a complete and up-to-date inventory, while operational levels (maintenance and traffic groups) tend to disagree.	• Document and disseminate information about data collection and inventory.
53. Asset Categorization. (eg. Ability to group assets by type, location, material, facility etc. for reporting and manipulation.)	All groups have different perspectives on asset categorization and hierarchical structure.	• Document and disseminate information on asset categorization.

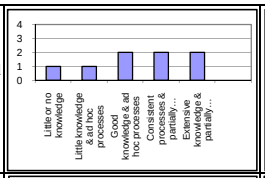
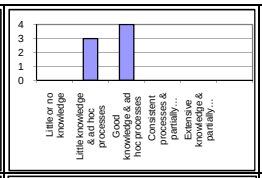
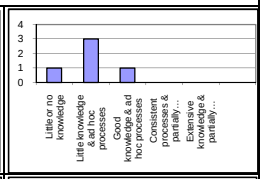
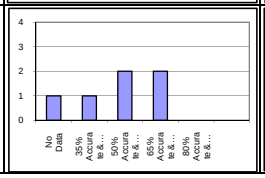
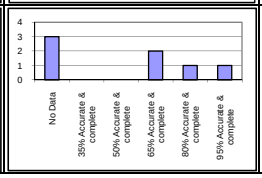
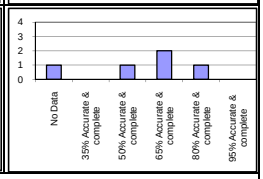
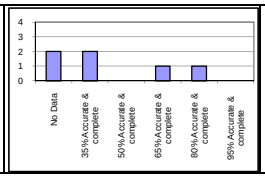
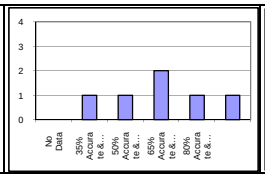
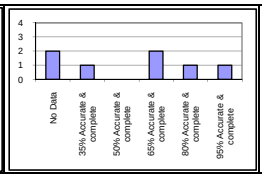
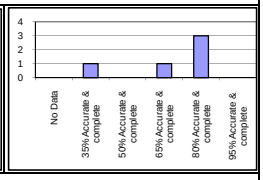
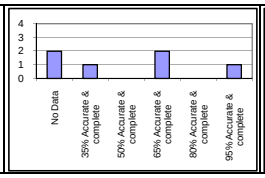
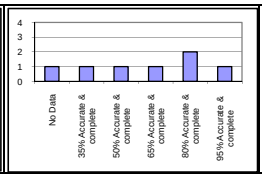
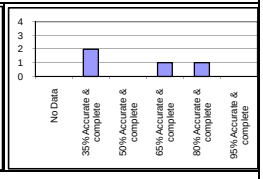
54. Asset Hierarchical Structure. (eg. The level (maintenance managed item) to which asset information is collected and the ability to amalgamate asset costs and performance.)	All groups have different perspectives on asset categorization and hierarchical structure. Some personnel in all groups think there is no asset hierarchical structure.	• Document and communicate available data and structure.

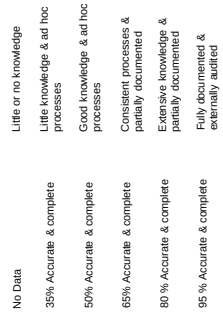
22. Asset Register System. (eg. System to store asset hierarchy and attributes for all assets that make up the asset system.)	The majority of decision makers think asset register system is externally developed. Maintenance personnel specify three kinds of system.	• Document and disseminate information on asset register system.
23. Geographic Information System. (eg. System to spatially store asset locations and key attributes for all distributed and linear / networked assets including the base locations of assets.)	The majority of decision makers and maintenance personnel think GIS is externally developed, while traffic personnel think GIS is an in-house application.	• Identify maintenance related data that is not integrated into GIS. • Develop a plan for integration.

39. Asset Spatial Data. (eg. Spatial data stored within the GIS. Especially, all distributed linear assets and locations of larger facilities.)	The evaluations of all groups for the accuracy of asset special data are spread over from low to high. Some personnel think no special data are available.	• Communicate role of spatial data. • Assess data quality.
41. Basic physical attributes. (eg. Size, material, installation date, model etc.)	Regarding basic physical attributes, all groups think they are accurate more than 50%.	• Develop strategy to improve data quality. • Continue to improve data quality.

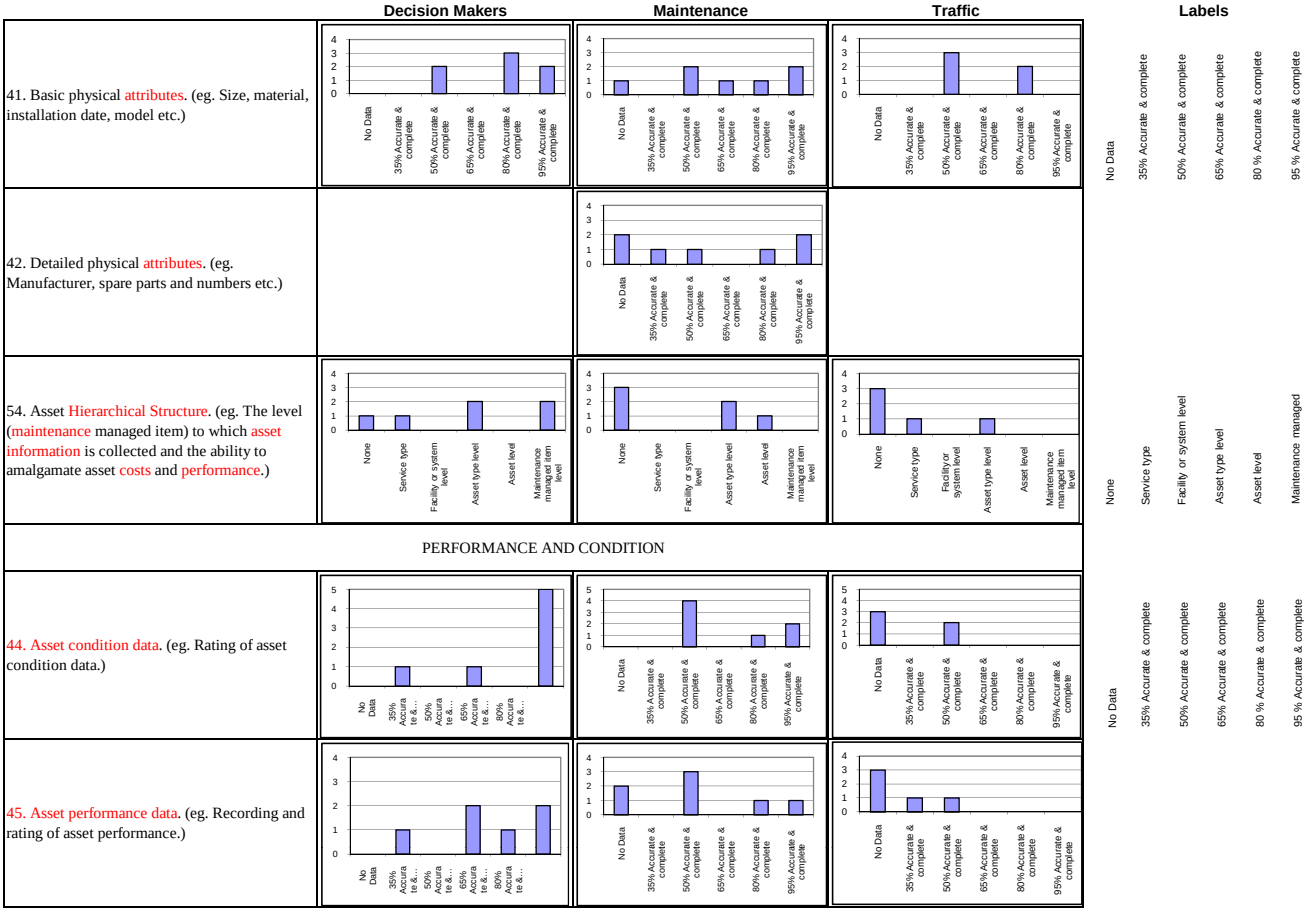
42. Detailed physical attributes. (eg. Manufacturer, spare parts and numbers etc.)	The evaluations of maintenance personnel for the accuracy of detailed physical attributes are divided into low and high. Some think no data are available.	• Document and disseminate information about physical attributes.

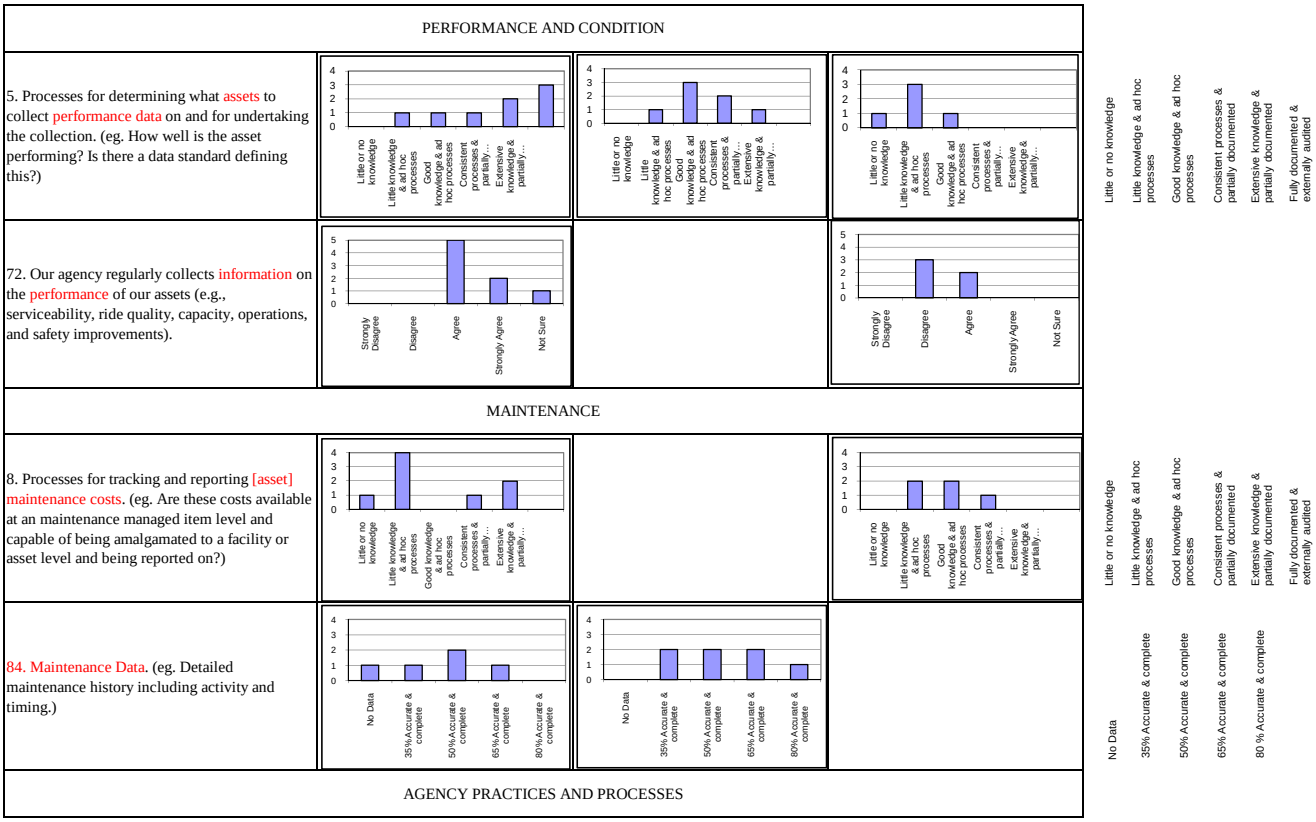
	Decision Makers	Maintenance	Traffic
Data			
RISK AND EMERGENCY			
47. Risk Assessment Data. (eg. Risk assessment data including probability and consequence of failure, and the subsequent business risk exposure.)			
OPERATIONS			
48. Operations Data. (eg. Operations history and data on failure consequences management.)			
PROJECT MANAGEMENT			
49 and 66. Works and / or resource management data. (eg. The data related to the resource elements of work order history including labor, plant and materials work performed, in both capital and recurrent activities.)			

HISTORICAL			
9. Processes for determining what historical cost data should be collected on individual assets and how should this be archived. (eg. Can all the historic costs associated with a critical asset be reported?)			
50 and 67. Cost history data. (eg. Full cost history of maintenance and operation activities together with depreciation and capital use charges where applicable.)			
ASSET VALUATION			
43. Asset valuation data. (eg. Current asset replacement values / historical value and written down depreciated values.)			
TRADE OFF ANALYSIS			
51 and 68. Data for costing of options. (eg. Cost summary for standard construction and rehabilitation techniques, maintenance and operational activities and options.)			
INVENTORY			
39. Asset Spatial Data. (eg. Spatial data stored within the GIS. Especially, all distributed linear assets and locations of larger facilities.)			
INVENTORY			

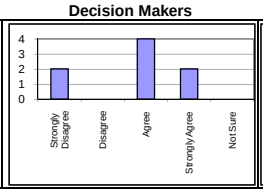
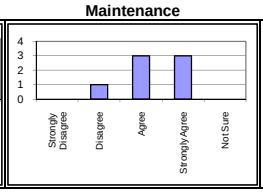
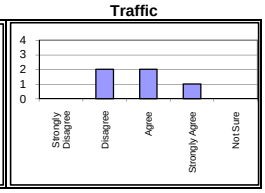


	Observation	Needs
47. Risk Assessment Data. (eg. Risk assessment data including probability and consequence of failure, and the subsequent business risk exposure.)	Many personnel (60-80%) in all groups think there is no risk assessment data. The rest of personnel think the accuracy of risk assessment data are 50% or below.	• Assess need for risk and emergency data including: - Identify what kinds of data are needed. - Define accuracy and determine required level of accuracy.
48. Operations Data. (eg. Operations history and data on failure consequences management.)	The evaluations of traffic personnel for the accuracy of operations data are diverse.	• Document and disseminate information regarding operations data including: - Define accuracy. - Investigate what causes inaccuracy. - Determine required level of accuracy.
49 and 66. Works and / or resource management data. (eg. The data related to the resource elements of work order history including labor, plant and materials work performed, in both capital and recurrent activities.)	The majority of all groups think generally works and resource management data are accurate.	• Continue to improve data accuracy. • Document and disseminate information about the data.
9. Processes for determining what historical cost data should be collected on individual assets and how should this be archived. (eg. Can all the historic costs associated with a critical asset be reported?)	Decision makers and maintenance personnel feel they have relatively good knowledge about processes for historical cost data collection and archive compared to maintenance and traffic personnel.	• Document and disseminate the processes for historical cost data collection and archive.
50 and 67. Cost history data. (eg. Full cost history of maintenance and operation activities together with depreciation and capital use charges where applicable.)	Decision makers think historical cost data are less accurate, while traffic personnel think accurate. The majority of maintenance personnel think historical cost data are accurate, although the minority think the data are not available.	• Document and disseminate cost history data including: - Define accuracy - Investigate inaccuracy - Determine required level of accuracy
43. Asset valuation data. (eg. Current asset replacement values / historical value and written down depreciated values.)	Decision makers feel asset valuation data are less accurate.	• Document and disseminate asset valuation data including: - Define accuracy - Investigate inaccuracy - Determine required level of accuracy
51 and 68. Data for costing of options. (eg. Cost summary for standard construction and rehabilitation techniques, maintenance and operational activities and options.)	The majority think data for costing of options are relatively accurate.	• Document and disseminate information about data for costing of options. • Continue to improve quality.
39. Asset Spatial Data. (eg. Spatial data stored within the GIS. Especially, all distributed linear assets and locations of larger facilities.)	The evaluations of the accuracy of asset spatial data spread out in all groups.	• Communicate role of spatial data. • Assess data quality.


Decision Makers
Maintenance
Traffic
Labels
41. Basic physical attributes. (eg. Size, material, installation date, model etc.)
42. Detailed physical attributes. (eg. Manufacturer, spare parts and numbers etc.)
54. Asset Hierarchical Structure. (eg. The level (maintenance managed item) to which asset information is collected and the ability to amalgamate asset costs and performance.)
PERFORMANCE AND CONDITION
44. Asset condition data. (eg. Rating of asset condition data.)
45. Asset performance data. (eg. Recording and rating of asset performance.)
No Data
35% Accurate & complete
50% Accurate & complete
65% Accurate & complete
80% Accurate & complete
95% Accurate & complete
None
Service type
Facility or system level
Asset type level
Asset level
Maintenance managed item level

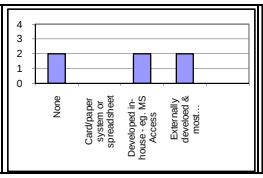
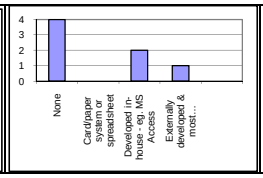
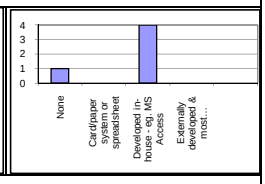
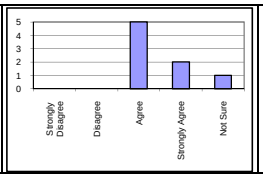
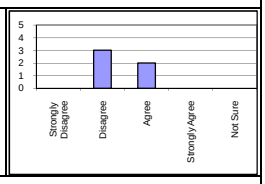
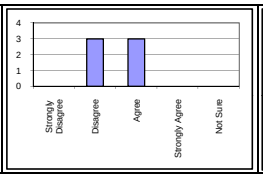
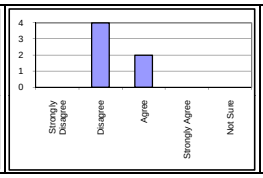
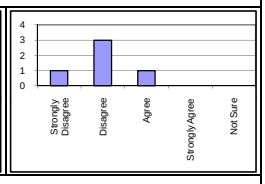
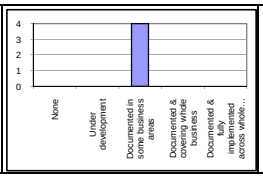
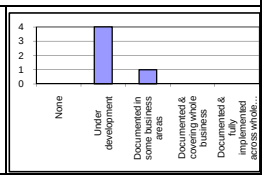

PERFORMANCE AND CONDITION
5. Processes for determining what assets to collect performance data on and for undertaking the collection. (eg. How well is the asset performing? Is there a data standard defining this?)
72. Our agency regularly collects information on the performance of our assets (e.g., serviceability, ride quality, capacity, operations, and safety improvements).
MAINTENANCE
8. Processes for tracking and reporting [asset] maintenance costs. (eg. Are these costs available at an maintenance managed item level and capable of being amalgamated to a facility or asset level and being reported on?)
84. Maintenance Data. (eg. Detailed maintenance history including activity and timing.)
AGENCY PRACTICES AND PROCESSES
Little or no knowledge
Little knowledge & ad hoc processes
Good knowledge & ad hoc processes
Consistent processes & partially...
Extensive knowledge & partially...
Strongly Disagree
Disagree
Agree
Strongly Agree
Not Sure
No Data
35% Accurate & complete
50% Accurate & complete
65% Accurate & complete
80% Accurate & complete

	Observation	Needs
41. Basic physical attributes. (eg. Size, material, installation date, model etc.)	Decision makers and maintenance personnel think basic physical attributes are accurate more than traffic personnel.	• Develop strategy to improve data quality. • Continue to improve data quality.
42. Detailed physical attributes. (eg. Manufacturer, spare parts and numbers etc.)	The evaluations of the accuracy of detailed physical attributes is divided into less accurate and accurate.	• Document and disseminate information about physical attributes.
54. Asset Hierarchical Structure. (eg. The level (maintenance managed item) to which asset information is collected and the ability to amalgamate asset costs and performance.)	All groups address various asset hierarchical structure. Half of maintenance personnel think there is no such a structure.	• Document and communicate available data and structure.
44. Asset condition data. (eg. Rating of asset condition data.)	Decision makers think asset condition and performance data are accurate, while operational level (i.e., maintenance and traffic personnel) thinks they are less accurate.	• Assess data quality and identify areas for improvement. • Document data quality.
45. Asset performance data. (eg. Recording and rating of asset performance.)	Decision makers think asset condition and performance data are accurate, while operational level (i.e., maintenance and traffic personnel) thinks they are less accurate.	• Assess data quality and identify areas for improvement. • Document data quality.
5. Processes for determining what assets to collect performance data on and for undertaking the collection. (eg. How well is the asset performing? Is there a data standard defining this?)	Decision makers and maintenance personnel think they have good knowledge about processes for performance data collection, while traffic personnel do not.	• Determine required knowledge of traffic personnel and develop strategy.
72. Our agency regularly collects information on the performance of our assets (e.g., serviceability, ride quality, capacity, operations, and safety improvements).	Decision makers think DelDOT regularly collects asset performance, while traffic personnel do not.	• Document and disseminate information about data collection.
8. Processes for tracking and reporting [asset] maintenance costs. (eg. Are these costs available at an maintenance managed item level and capable of being amalgamated to a facility or asset level and being reported on?)	The majority of traffic personnel have good knowledge about processes for tracking and reporting maintenance costs, but that of decision makers does not.	• Document and disseminate the processes.
84. Maintenance Data. (eg. Detailed maintenance history including activity and timing.)	Decision makers and maintenance personnel feel maintenance data are less accurate.	• Document and disseminate cost history data including: - Define accuracy - Investigate inaccuracy - Determine required level of accuracy

	Decision Makers	Maintenance	Traffic
1. Our agency continually seeks to improve the efficiency of data collection (e.g., through sampling techniques, use of automated equipment, other methods appropriate to our transportation system).			

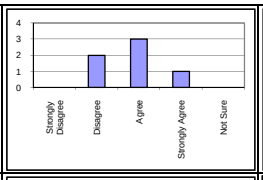
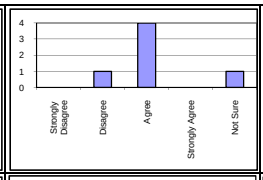
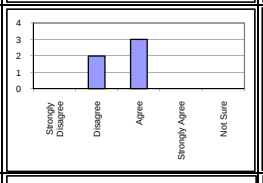
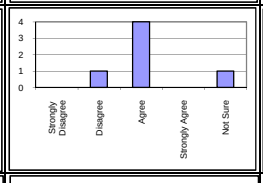
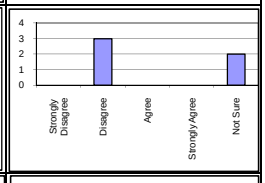
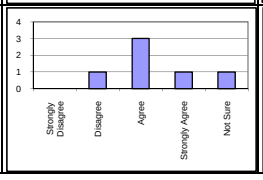
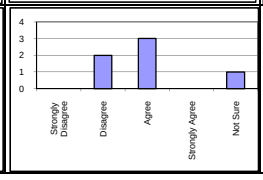
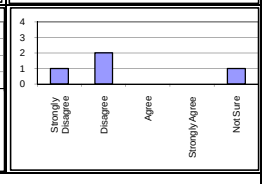
Labels

None
Card/paper system or spreadsheet
Developed in-house eg. MS Access
Externally developed & most functionality utilized
Externally developed-interfaced with other systems & functionality fully utilized

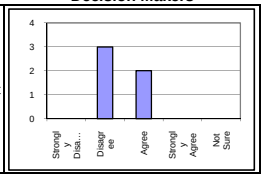
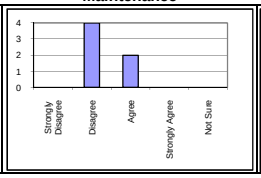
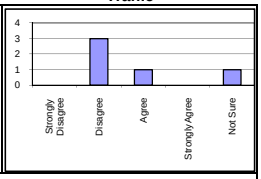
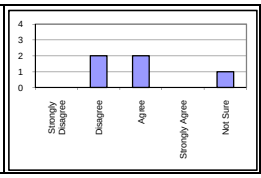
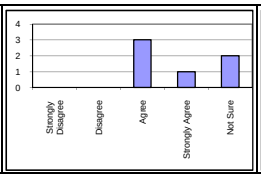
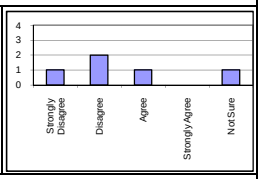
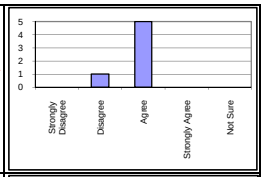
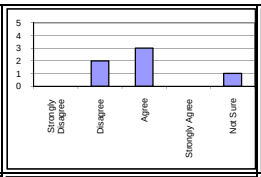
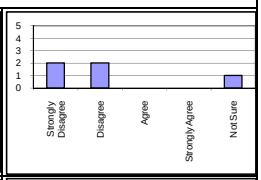
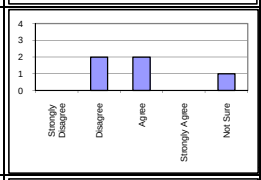
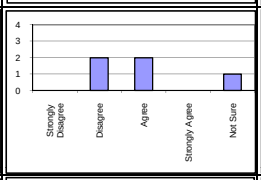
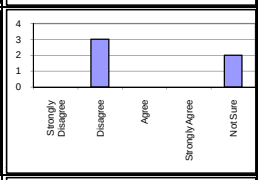
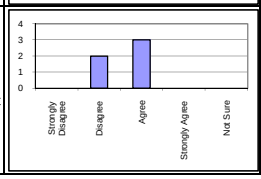
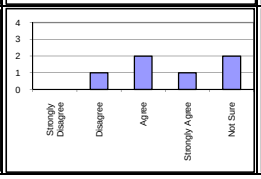
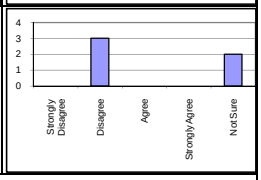
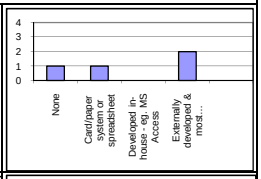
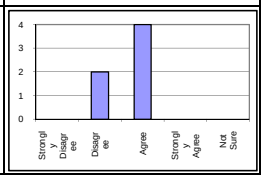
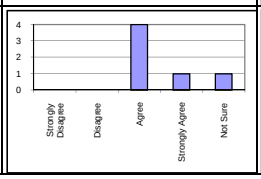
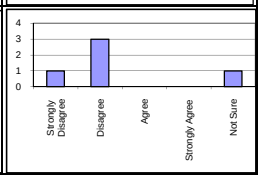
AGENCY PRACTICES AND PROCESSES			
29. Data Warehouse. (eg. System to store, manage and report on data from other information systems. This system should complete basic manipulation and produce regular reports.)			
Information			
PERFORMANCE			
72. Our agency regularly collects information on the performance of our assets (e.g., serviceability, ride quality, capacity, operations, and safety improvements).			
ACCESSIBILITY			
93. Agency managers and staff at different levels can quickly and conveniently obtain information they need about asset characteristics, location, usage, condition, or performance.			
STRATEGY			
94. Information Technology System Strategy. (eg. Does a corporate strategy exist? Is it comprehensive and include Asset Management systems? Does it accommodate expected usage and the growth in Asset Management data and information, access and system response times etc.)			

Labels

None
Under development
Documented in some business areas
Documented & covering whole business
Documented & fully implemented across whole business

FORECASTING			
97. Information on actual work accomplishments and costs is used to improve the cost-projection capabilities of our asset management systems.			
105. Information on actual work accomplishments and costs is used to improve the cost-projection capabilities of our asset management systems.			
98. Information on changes in asset condition over time is used to improve forecasts of asset life and deterioration in our asset management systems.			
MANUALS AND DOCUMENTS			

	Observation	Needs
1. Our agency continually seeks to improve the efficiency of data collection (e.g., through sampling techniques, use of automated equipment, other methods appropriate to our transportation system).	The majority of all groups agree on continual improvement in the efficiency of data collection in DelDOT.	• Document and disseminate information about data collection.
29. Data Warehouse. (eg. System to store, manage and report on data from other information systems. This system should complete basic manipulation and produce regular reports.)	All groups describe data warehouse are developed in-house or externally developed. Many personnel address there is no data warehouse.	• Identify and communicate what data is widely available. • Identify additional needs.
72. Our agency regularly collects information on the performance of our assets (e.g., serviceability, ride quality, capacity, operations, and safety improvements).	Decision makers think they have little knowledge about processes for maintenance planning, while maintenance personnel think they have good knowledge about the processes.	• Document and disseminate information about data collection.
93. Agency managers and staff at different levels can quickly and conveniently obtain information they need about asset characteristics, location, usage, condition, or performance.	The evaluations of operational levels (maintenance and traffic groups) for information accessibility are not good especially. Decision makers' evaluations are equally divided into agree and disagree.	• Identify areas needing improvement.
94. Information Technology System Strategy. (eg. Does a corporate strategy exist? Is it comprehensive and include Asset Management systems? Does it accommodate expected usage and the growth in Asset Management data and information, access and system response times etc.)	Decision makers think information technology system strategy is documented in some business, while traffic personnel think the strategy is under development.	
97. Information on actual work accomplishments and costs is used to improve the cost-projection capabilities of our asset management systems.	The majority of decision makers and maintenance personnel agree information is used to improve the cost-projection capabilities.	• Identify areas needing improvement.
105. Information on actual work accomplishments and costs is used to improve the cost-projection capabilities of our asset management systems.	The majority of decision makers and maintenance personnel agree information is used to improve the cost-projection capabilities, while traffic personnel disagree.	• Introduce concepts to traffic area.
98. Information on changes in asset condition over time is used to improve forecasts of asset life and deterioration in our asset management systems.	The majority of decision makers and maintenance personnel agree information is used to improve forecasts of asset life and deterioration, while traffic personnel disagree.	• Introduce concepts to traffic area.

	Decision Makers	Maintenance	Traffic
104. Our agency can easily produce map displays showing needs/deficiencies for different asset classes and planned/programmed projects.			
Decision Support Tools			
PROJECT MANAGEMENT			
101. Our agency uses asset management decision-support tools to: Rank candidate projects for the capital program			
PERFORMANCE			
99. Our agency uses asset management decision-support tools to: Calculate and report actual system performance			
102. Our agency uses asset management decision support tools to: Forecast future system performance given a proposed program of projects			
103. Our agency uses asset management decision-support tools to: Forecast future system performance under different mixes of investment levels by program category			
OTHER			
26. Predicting Asset Capacity and Utilization. (eg. Capacity modeling tools for determining / simulating current asset capacity, eg. Pipeline capacity / road traffic models etc.)			
100. Our agency uses asset management decision-support tools to: Identify system deficiencies or needs			

Labels

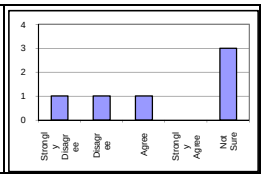
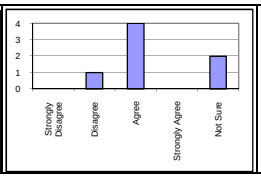
None

Card/paper system or spreadsheet

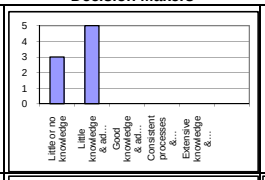
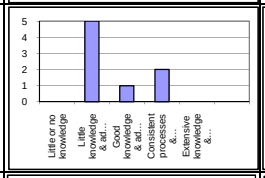
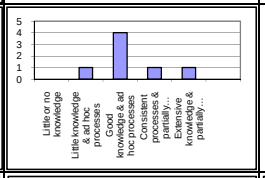
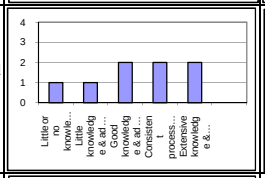
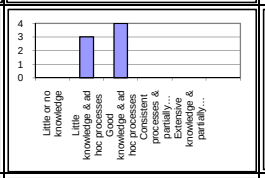
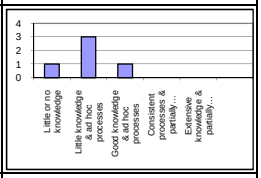
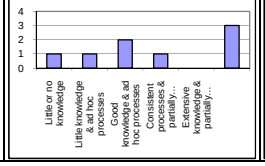
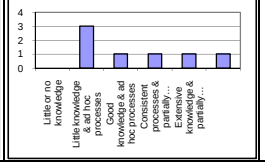
Developed in-house eg. MS Access

Externally developed & most functionally utilized

Externally developed-interfaced with other systems & functionally fully utilized

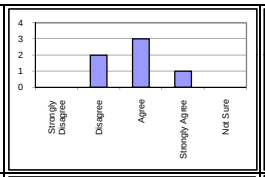
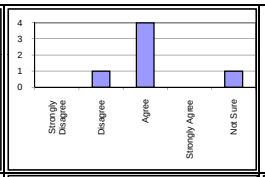
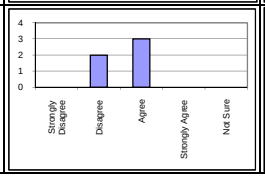
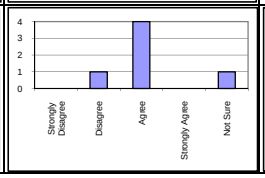
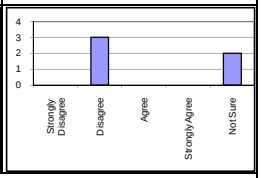
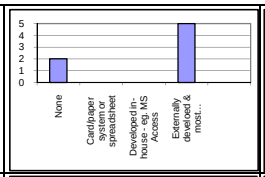
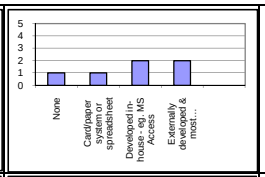
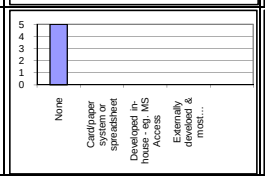
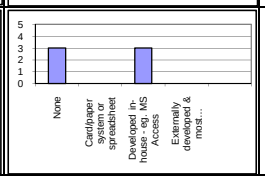
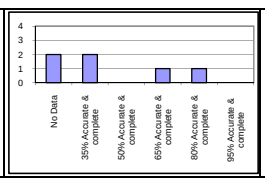
Life Cycle Cost Analysis	
MAINTENANCE	
89. The preservation program budget is based upon analyses of least-life-cycle cost rather than exclusive reliance on worst-first strategies.	 
AGENCY PRACTICES AND PROCESSES	

	Observation	Needs
104. Our agency can easily produce map displays showing needs/deficiencies for different asset classes and planned/programmed projects.	The majority of all groups think DelDOT cannot easily produce map display showing needs/deficiencies for assets and projects.	• Identify areas needing improvement.
101. Our agency uses asset management decision-support tools to: Rank candidate projects for the capital program	The evaluations of decision makers for decision-support tools to rank projects are equally divided into agree and disagree. The majority of maintenance personnel agree DelDOT uses the tools, while that of traffic personnel disagree.	• Document and communicate tools to rank candidate projects.
99. Our agency uses asset management decision-support tools to: Calculate and report actual system performance	The majority of decision makers and maintenance personnel think decision-support tools are used to calculate and report system performance, but traffic personnel do not.	• Document and communicate tools to calculate and report performance.
102. Our agency uses asset management decision support tools to: Forecast future system performance given a proposed program of projects	The evaluations of decision makers and maintenance personnel for the use of decision-support tools to forecast system performance given a proposed program are equally divided into agree and disagree. Most traffic personnel disagree with the use.	• Identify gaps in forecasting tools. • Document and communicate existing tools.
103. Our agency uses asset management decision-support tools to: Forecast future system performance under different mixes of investment levels by program category	The majority of decision makers and maintenance personnel think decision-support tools are used to forecast system performance under different mixes of investment, while traffic personnel disagree with it.	• Document and communicate tools to forecast future system performance.
26. Predicting Asset Capacity and Utilization. (eg. Capacity modeling tools for determining / simulating current asset capacity, eg. Pipeline capacity / road traffic models etc.)	Traffic personnel identify card/paper or spreadsheet and externally developed application as their asset capacity and utilization predicting tool.	• Document and disseminate information about prediction.
100. Our agency uses asset management decision-support tools to: Identify system deficiencies or needs	Most decision makers and all maintenance personnel agree decision-support tools are used to identify system deficiencies or needs. However, there is no consensus in the traffic group.	• Document and disseminate information about decision-support tools.
89. The preservation program budget is based upon analyses of least-life-cycle cost rather than exclusive reliance on worst-first strategies.	Some decision makers think the preservation program budget is based on worst-first strategies rather than analyses of least-life-cycle cost. Most maintenance personnel think the budget is based on analyses of least-life-cycle cost.	• Document and disseminate information about decision-support tools.

	Decision Makers	Maintenance	Traffic
12. Processes for assessing the life cycle cost of new assets where spent costs and existing configuration has no influence on the final solution. (eg. Are capital, maintenance and operational costs accounted for?)			
7. Processes for determining the effective lives or residual economic lives of all assets in the register. (eg. Are these lives based on real data?)			
9. Processes for determining what historical cost data should be collected on individual assets and how should this be archived. (eg. Can all the historic costs associated with a critical asset be reported?)			
6. Processes for undertaking asset valuations. (eg. Are asset valuations undertaken and is the method documented? Is there a method to assess the quality of that valuation?)			

Labels

- Little or no knowledge
- Little knowledge & ad hoc processes
- Good knowledge & ad hoc processes
- Consistent processes & partially documented
- Extensive knowledge & partially documented
- Fully documented & externally audited

AGENCY PRACTICES AND PROCESSES			
97. Information on actual work accomplishments and costs is used to improve the cost-projection capabilities of our asset management systems.			
105. Information on actual work accomplishments and costs is used to improve the cost-projection capabilities of our asset management systems.			
SYSTEMS			
30. Optimized Renewal Decision Making - Modeling System. (eg. System for optimal prediction of renewal timing and options analysis for life extensions of existing assets.)			
31. Life Cycle Cost Modeling System. (eg. System for modeling the life cycle costs of different asset options and solutions for new assets where no spent costs are involved. It allows all supply options to be considered.)			
DATA			
43. Asset valuation data. (eg. Current asset replacement values / historical value and written down depreciated values.)			

Labels

- None
- Card/paper system or spreadsheet
- Developed in-house eg. MS Access
- Externally developed & most functionally utilized
- Externally developed-interfaced with other systems & functionally fully utilized

DATA

Labels

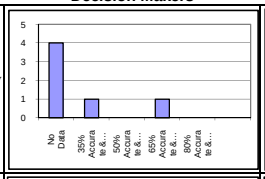
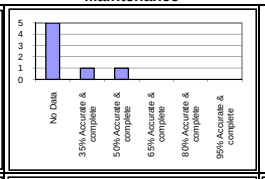
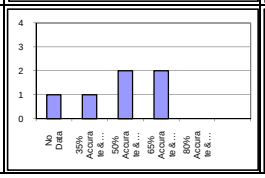
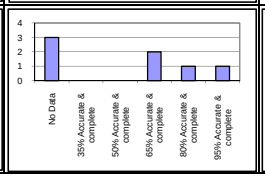
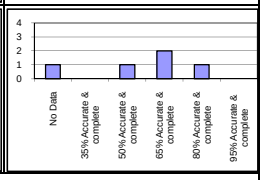
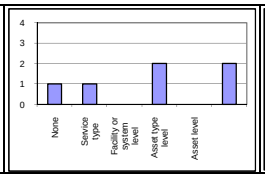
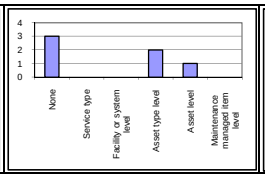
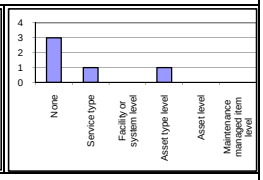
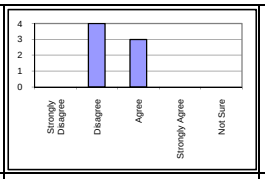
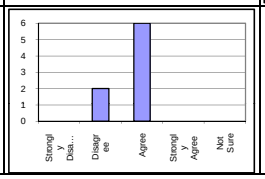
- No Data
- 35% Accurate & complete
- 50% Accurate & complete
- 65% Accurate & complete
- 80 % Accurate & complete
- 95 % Accurate & complete

	Observation	Needs
12. Processes for assessing the life cycle cost of new assets where spent costs and existing configuration has no influence on the final solution. (eg. Are capital, maintenance and operational costs accounted for?)	All decision makers think they have no or little knowledge about processes for assessing new assets' life cycle costs.	• Identify or develop processes. • Document and disseminate information about the processes for life cycle cost assessment.
7. Processes for determining the effective lives or residual economic lives of all assets in the register. (eg. Are these lives based on real data?)	Decision makers relatively think they have little knowledge about processes for determining assets' lives, while maintenance personnel think they have good knowledge.	• Document and disseminate information about the processes for determination of asset lives.
9. Processes for determining what historical cost data should be collected on individual assets and how should this be archived. (eg. Can all the historic costs associated with a critical asset be reported?)	The majority of decision makers and maintenance personnel think they have good knowledge about processes for determining collection and archive of historical data, while traffic personnel think they have little knowledge.	• Document and disseminate information about the processes for historical data.
6. Processes for undertaking asset valuations. (eg. Are asset valuations undertaken and is the method documented? Is there a method to assess the quality of that valuation?)	Decision makers and maintenance personnel are generally confident in having good knowledge about processes for undertaking asset valuations.	• Clarify the process.

97. Information on actual work accomplishments and costs is used to improve the cost-projection capabilities of our asset management systems.	The majority of decision makers and maintenance personnel agree information is used to improve the cost-projection capabilities.	• Identify areas needing improvement.
105. Information on actual work accomplishments and costs is used to improve the cost-projection capabilities of our asset management systems.	The majority of decision makers and maintenance personnel agree information is used to improve the cost-projection capabilities, while traffic personnel disagree.	• Introduce concepts to traffic area.

30. Optimized Renewal Decision Making - Modeling System. (eg. System for optimal prediction of renewal timing and options analysis for life extensions of existing assets.)	Most decision makers think optimized renewal decision making modeling system is externally developed. Maintenance personnel address various styles, including card/paper or spreadsheet, in-house and externally developed applications.	• Document and disseminate information about a decision making modeling system.
31. Life Cycle Cost Modeling System. (eg. System for modeling the life cycle costs of different asset options and solutions for new assets where no spent costs are involved. It allows all supply options to be considered.)	All decision makers think there is no life cycle cost modeling system. Maintenance personnel think there is an in-house system or no system.	• Verify capabilities of Maximo. • Identify gaps. • Develop strategy for addressing gaps.

43. Asset valuation data. (eg. Current asset replacement values / historical value and written down depreciated values.)	Decision makers' evaluations for the accuracy of asset valuation data divide into low and high. Also, some think there is no asset valuation data.	• Document and disseminate asset valuation data including: - Define accuracy - Investigate inaccuracy - Determine required level of accuracy

	Decision Makers	Maintenance	Traffic
46. Life Cycle Cost Histories. (eg. Stored history of life cycle cost analysis calculations.)			
50 and 67. Cost history data. (eg. Full cost history of maintenance and operation activities together with depreciation and capital use charges where applicable.)			
INVENTORY			
54. Asset Hierarchical Structure. (eg. The level (maintenance managed item) to which asset information is collected and the ability to amalgamate asset costs and performance.)			
POLICIES			
69. Policies support a long-term, life-cycle approach to evaluating investment benefits and costs.			
56. Policy guidance encourages resource allocation and project selection based on cost-effectiveness or benefit/cost analysis.			

Labels

None

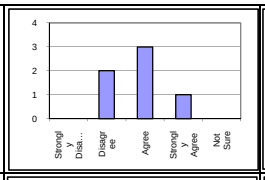
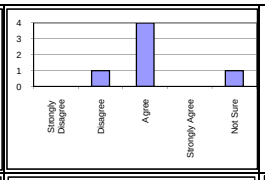
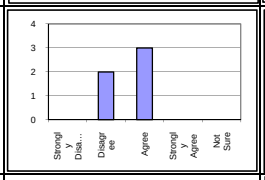
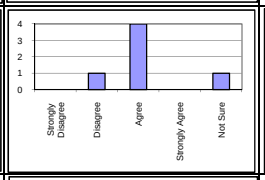
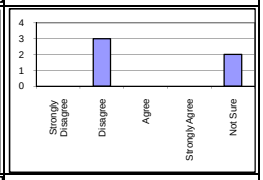
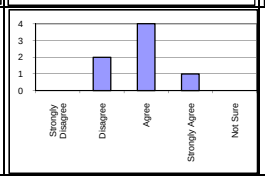
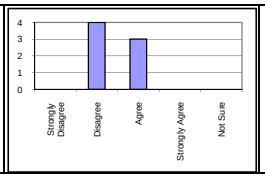
Service type

Facility or system level

Asset type level

Asset level

Maintenance managed item level

Long Term Strategic Planning and Forecasting			
PROGRAM MANAGEMENT			
97. Information on actual work accomplishments and costs is used to improve the cost-projection capabilities of our asset management systems.			
105. Information on actual work accomplishments and costs is used to improve the cost-projection capabilities of our asset management systems.			
59. Our agency's programs are consistent with realistic projections of future revenues.			
LIFE CYCLE COST ANALYSIS			
69. Policies support a long-term, life-cycle approach to evaluating investment benefits and costs.			
CUSTOMER RELATIONS			

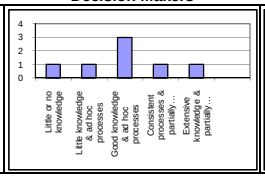
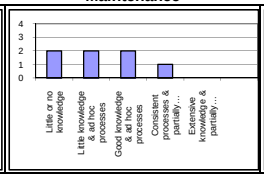
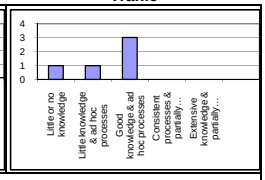
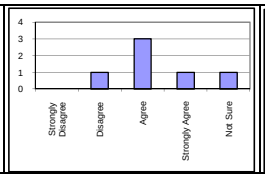
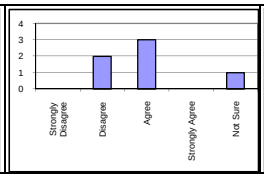
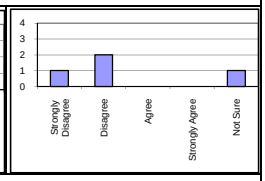
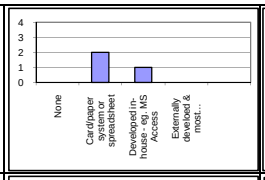
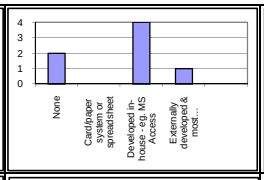
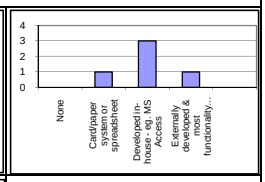
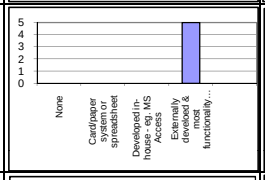
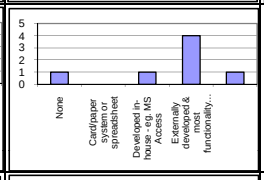
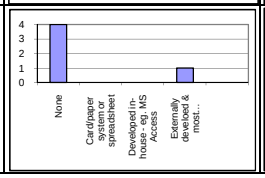
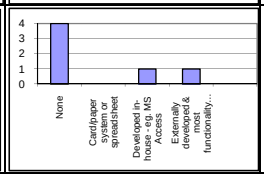
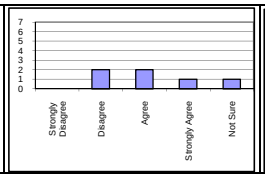
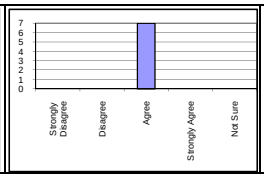
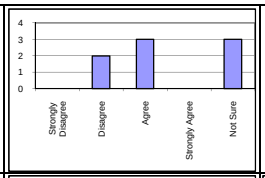
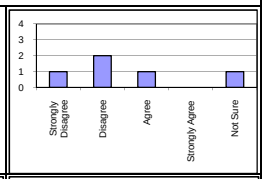
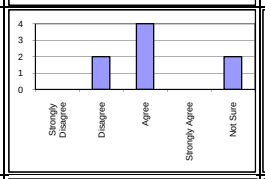
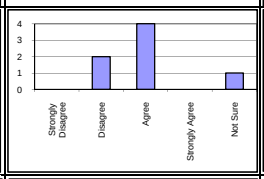
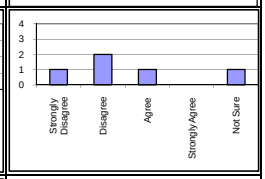
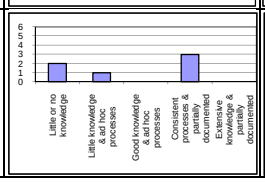
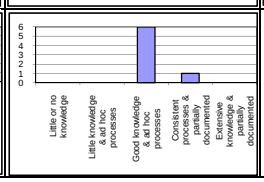
	Observation	Needs
46. Life Cycle Cost Histories. (eg. Stored history of life cycle cost analysis calculations.)	Most decision makers and maintenance personnel think there is no life cycle cost histories. Although some think there are histories, they think the accuracy is low.	• Document existing data. • Develop a plan. • Identify gaps in the data.
50 and 67. Cost history data. (eg. Full cost history of maintenance and operation activities together with depreciation and capital use charges where applicable.)	Most decision makers think cost history data are 50-65% accurate. Most maintenance and traffic personnel think the data are 65% accurate or more.	• Document and disseminate cost history data including: - Define accuracy - Investigate inaccuracy - Determine required level of accuracy

54. Asset Hierarchical Structure. (eg. The level (maintenance managed item) to which asset information is collected and the ability to amalgamate asset costs and performance.)	All groups address various asset hierarchical structure. 50% of maintenance personnel think there is no such a structure.	• Document and communicate available data and structure.

69. Policies support a long-term, life-cycle approach to evaluating investment benefits and costs.	The majority of maintenance personnel agree policies support a long-term life-cycle approach.	• Modify policies to connect to a long-term, life-cycle approach.
56. Policy guidance encourages resource allocation and project selection based on cost-effectiveness or benefit/cost analysis.	The majority of decision makers agree policy guidance encourages resource allocation and project selection based on economic analyses.	• Educate decision makers to understand how they can link policy guidance with project selection.

97. Information on actual work accomplishments and costs is used to improve the cost-projection capabilities of our asset management systems.	The majority of decision makers and maintenance personnel agree information is used to improve the cost-projection capabilities.	• Identify areas needing improvement.
105. Information on actual work accomplishments and costs is used to improve the cost-projection capabilities of our asset management systems.	The majority of decision makers and maintenance personnel agree information is used to improve the cost-projection capabilities, while traffic personnel disagree.	• Introduce concepts to traffic area.
59. Our agency's programs are consistent with realistic projections of future revenues.	The majority of maintenance personnel agree programs are consistent with realistic projections of future revenue.	• Document and disseminate DelDOT's programs associated with revenue projections.

69. Policies support a long-term, life-cycle approach to evaluating investment benefits and costs.	The majority of maintenance personnel agree policies support a long-term life-cycle approach.	• Modify policies to connect to a long-term, life-cycle approach.

	Decision Makers	Maintenance	Traffic
124. Processes for working with customers, regulators and other stakeholders during long term strategic planning. (eg. Informing, seeking and incorporating feedback.)			
PERFORMANCE			
98. Information on changes in asset condition over time is used to improve forecasts of asset life and deterioration in our asset management systems.			
Maintenance and Preservation			
SYSTEMS			
35. Operations and Maintenance Manuals Storage System. (eg. Electronic System to store and track operations and maintenance manual materials.)			
24. Maintenance Management System. (eg. System to manage maintenance activities			
32. Maintenance Analysis Systems. (e.g. Systems that perform Reliability Centered Maintenance type analysis.)			
AGENCY PROCESSES AND PRACTICES			
90. Our agency monitors actual system performance and compares these values to targets projected for its capital preservation program.			
AGENCY PROCESSES AND PRACTICES			
73. Our agency monitors actual system performance and compares these values to targets projected for its capital preservation program.			
74 and 75. Our agency monitors actual system performance and compares these values to targets projected for its maintenance and operations program.			
76. Processes for tracking and reporting maintenance costs. (eg. Are these costs available at an maintenance managed item level and capable of being amalgamated to a facility or asset level and being reported on?)			

Labels

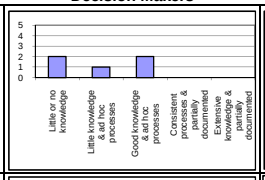
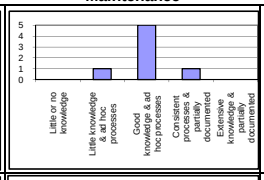
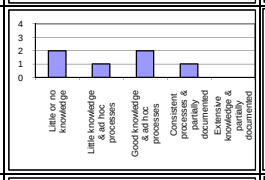
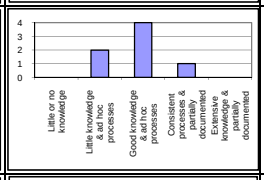
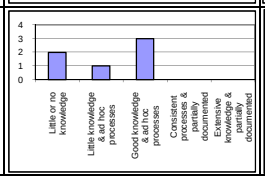
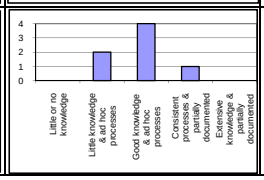
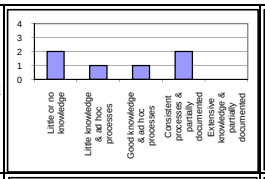
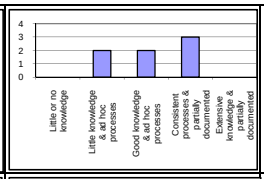
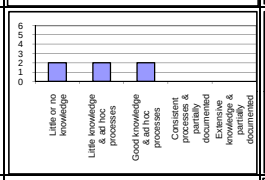
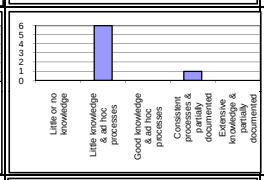
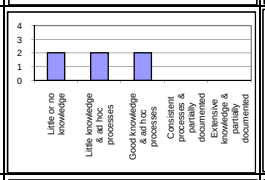
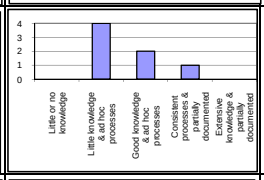
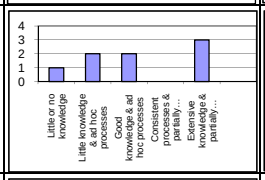
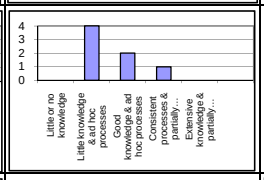
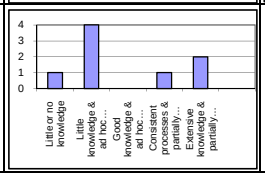
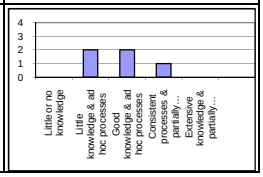
- Little or no knowledge
- Little knowledge & ad hoc processes
- Good knowledge & ad hoc processes
- Consistent processes & partially documented
- Extensive knowledge & partially documented
- Fully documented & externally audited

Labels

- None
- Card/paper system or spreadsheet
- Developed in-house eg. MS Access
- Externally developed & most functionality utilized
- Externally developed-interfaced with other systems & functionality fully utilized

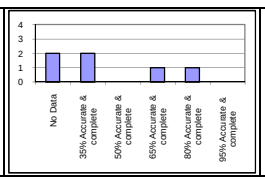
- Little or no knowledge
- Little knowledge & ad hoc processes
- Good knowledge & ad hoc processes
- Consistent processes & partially documented
- Extensive knowledge & partially documented
- Fully documented & externally audited

	Observation	Needs
124. Processes for working with customers, regulators and other stakeholders during long term strategic planning. (eg. Informing, seeking and incorporating feedback.)	The majority of decision makers and traffic personnel think they have good knowledge about processes for working with stakeholders during strategic planning, while that of maintenance personnel think they don't.	• Document and disseminate the processes.
98. Information on changes in asset condition over time is used to improve forecasts of asset life and deterioration in our asset management systems.	The majority of decision makers and maintenance personnel agree information is used to improve forecasts of asset life and deterioration, while traffic personnel disagree.	• Introduce concepts to traffic area.
35. Operations and Maintenance Manuals Storage System. (eg. Electronic System to store and track operations and maintenance manual materials.)	All groups address different formats of operations and maintenance manuals storage system. Some maintenance personnel think there is no storage system.	• Document and disseminate information about operations and maintenance manuals storage system.
24. Maintenance Management System. (eg. System to manage maintenance activities	All decision makers think maintenance management system is externally developed. Maintenance personnel identify in-house and externally developed application.	• Communicate context and capabilities of existing maintenance system.
32. Maintenance Analysis Systems. (e.g. Systems that perform Reliability Centered Maintenance type analysis.)	Most decision makers and maintenance personnel think there is no maintenance analysis system. Some maintenance personnel address in-house and externally developed application.	• Determine if maintenance analysis systems are needed.
90. Our agency monitors actual system performance and compares these values to targets projected for its capital preservation program.	The majority of decision makers and whole maintenance personnel agree DelDOT monitors actual system performance and compares these values to targets for capital preservation program.	• Document and disseminate information about monitoring systems.
73. Our agency monitors actual system performance and compares these values to targets projected for its capital preservation program.	The majority of decision makers agree DelDOT monitors system performance and compares these values to targets for capital preservation program, while that of traffic personnel disagree.	• Document and disseminate information about monitoring systems.
74 and 75. Our agency monitors actual system performance and compares these values to targets projected for its maintenance and operations program.	The majority of decision makers and maintenance personnel agree DelDOT monitors system performance and compares these values to targets for maintenance and operations program, while that of traffic personnel disagree.	• Document and disseminate information about monitoring systems.
76. Processes for tracking and reporting maintenance costs. (eg. Are these costs available at an maintenance managed item level and capable of being amalgamated to a facility or asset level and being reported on?)	The half of decision makers think they have good knowledge about processes for tracking and reporting maintenance costs and the rest of them think they have little knowledge about the processes. All maintenance personnel think they have good knowledge.	• Document and disseminate information about monitoring systems.

	Decision Makers	Maintenance	Traffic
77. Processes for maintenance planning. (eg. Is there a process for defining how each asset / asset type will be maintained? What is the basis for determining the maintenance procedure or activity for a single asset? Does this process cover all assets?)			
78. Processes for maintenance scheduling. (eg. How does the organization determine the maintenance schedule or intervals for the prescribed maintenance activity?)			
79. Processes for monitoring and controlling the maintenance program. (eg. Is there adequate reporting and feedback from field staff and information systems to enable the complete understanding of what is happening to the assets?)			
AGENCY PROCESSES AND PRACTICES			
80. Processes for recording and reporting maintenance costs down to the maintenance managed item level. (eg. Are asset costs reported and accessible? Is there a clear policy on what is required ?)			
82. Processes for reviewing and analyzing maintenance programs. (eg. Is this a systematic process? Are the trigger points and processes understood by all?)			
83. Processes for developing maintenance strategies that incorporate the overall business drivers for maintenance, capital and system performance. (eg. Is there a corporate wide approach to developing maintenance strategies that covers all assets and amalgamate to higher levels?)			
4. Processes for making optimized asset renewal decisions by choosing the most economical solution time to renew / replace an asset. (eg. Does the process include all options for life extension including non asset solutions using life cycle cost analysis?)			
8. Processes for tracking and reporting [asset] maintenance costs. (eg. Are these costs available at an maintenance managed item level and capable of being amalgamated to a facility or asset level and being reported on?)			

Labels

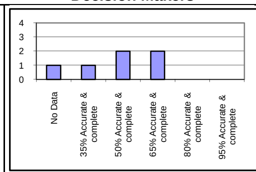
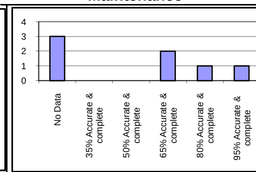
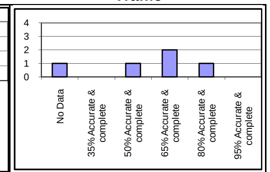
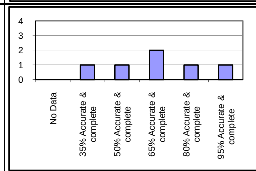
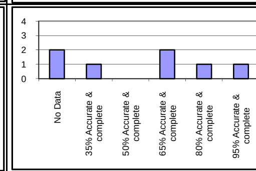
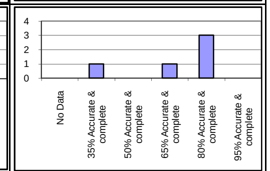
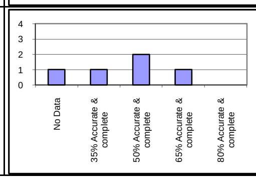
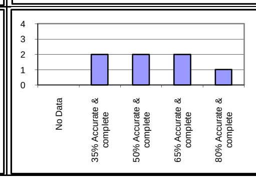
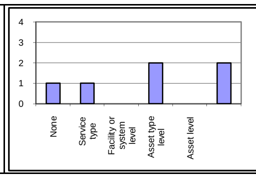
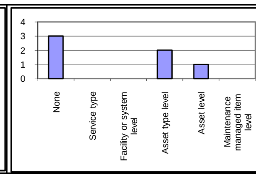
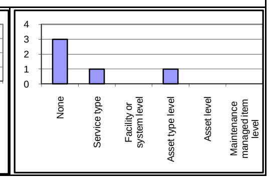
- Little or no knowledge
- Little knowledge & ad hoc processes
- Good knowledge & ad hoc processes
- Consistent processes & partially documented
- Extensive knowledge & partially documented
- Fully documented & externally audited

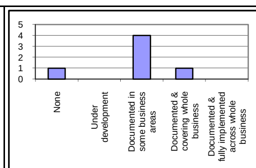
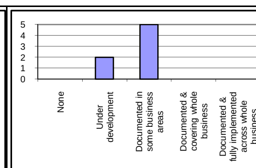
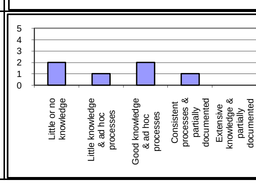
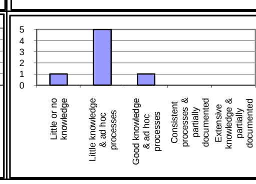
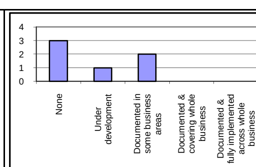
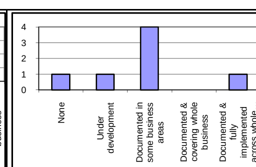
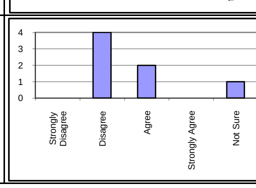
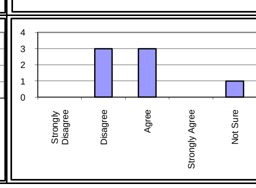
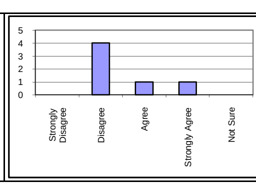
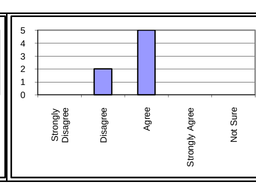
DATA AND INFORMATION			
43. Asset valuation data. (eg. Current asset replacement values / historical value and written down depreciated values.)			

Labels

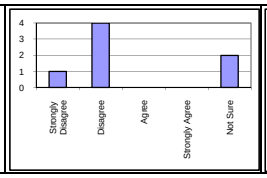
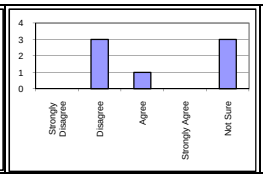
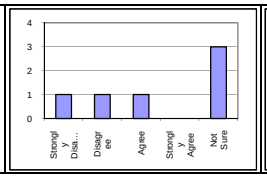
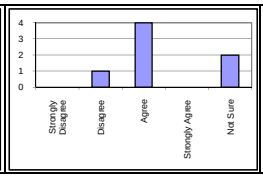
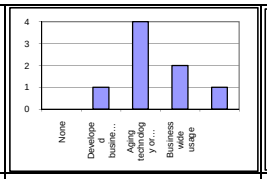
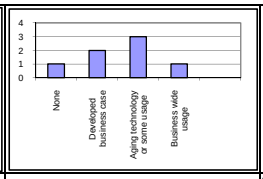
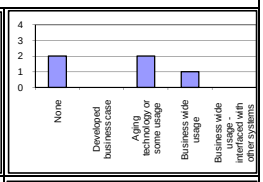
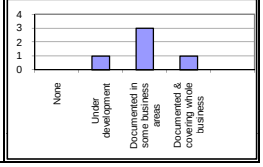
- No Data
- 35% Accurate & complete
- 50% Accurate & complete
- 65% Accurate & complete
- 80 % Accurate & complete
- 95 % Accurate & complete

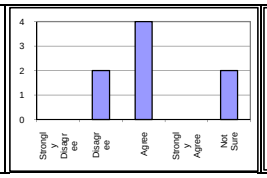
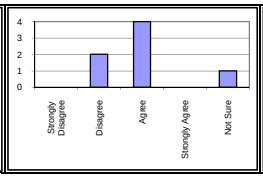
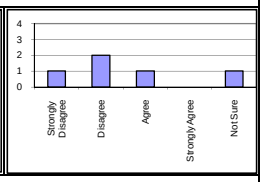
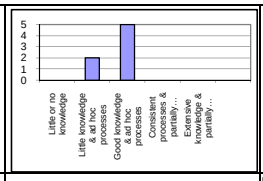
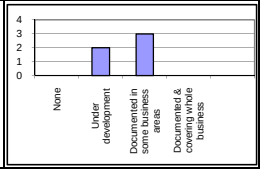
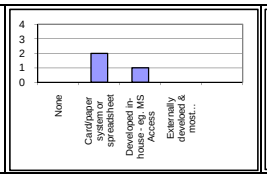
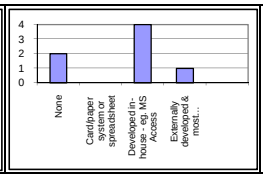
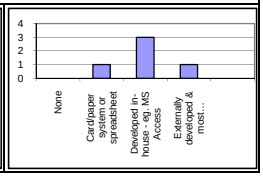
	Observation	Needs
77. Processes for maintenance planning. (eg. Is there a process for defining how each asset / asset type will be maintained? What is the basis for determining the maintenance procedure or activity for a single asset? Does this process cover all assets?)	The majority of decision makers think they have little knowledge about processes for maintenance planning, while that of maintenance personnel think they have good knowledge.	• Document and disseminate the processes.
78. Processes for maintenance scheduling. (eg. How does the organization determine the maintenance schedule or intervals for the prescribed maintenance activity?)	The half of decision makers think they have good knowledge about processes for maintenance scheduling and the rest of them think they have little knowledge about the processes. The majority of maintenance personnel think they have good knowledge.	• Document and disseminate the processes.
79. Processes for monitoring and controlling the maintenance program. (eg. Is there adequate reporting and feedback from field staff and information systems to enable the complete understanding of what is happening to the assets?)	The half of decision makers think they have good knowledge about processes for monitoring and controlling the maintenance program and the rest of them think they have little knowledge about the processes. The majority of maintenance personnel think they have good knowledge.	• Document and disseminate the processes.
80. Processes for recording and reporting maintenance costs down to the maintenance managed item level. (eg. Are asset costs reported and accessible? Is there a clear policy on what is required ?)	The half of decision makers think they have good knowledge about processes for recording and reporting maintenance costs down to the maintenance managed item level and the rest of them think they have little knowledge about the processes. The majority of maintenance personnel think they have good knowledge.	• Document and disseminate the processes.
82. Processes for reviewing and analyzing maintenance programs. (eg. Is this a systematic process? Are the trigger points and processes understood by all?)	The majority of decision makers and maintenance personnel think they have little knowledge about processes for reviewing and analyzing maintenance programs.	• Document and disseminate the processes.
83. Processes for developing maintenance strategies that incorporate the overall business drivers for maintenance, capital and system performance. (eg. Is there a corporate wide approach to developing maintenance strategies that covers all assets and amalgamate to higher levels?)	The majority of decision makers and maintenance personnel think they have little knowledge about processes for developing maintenance strategies.	• Document and disseminate the processes.
4. Processes for making optimized asset renewal decisions by choosing the most economical solution time to renew / replace an asset. (eg. Does the process include all options for life extension including non asset solutions using life cycle cost analysis?)	The majority of decision makers think they have good knowledge about processes for making optimized asset renewal decisions, while that of maintenance personnel think they don't.	• Document and disseminate the processes.
8. Processes for tracking and reporting [asset] maintenance costs. (eg. Are these costs available at an maintenance managed item level and capable of being amalgamated to a facility or asset level and being reported on?)	The majority of traffic personnel think they have knowledge about processes for tracking and reporting maintenance costs, while that of decision makers think they don't.	• Document and disseminate the processes.
43. Asset valuation data. (eg. Current asset replacement values / historical value and written down depreciated values.)	Decision makers feel asset valuation data are less accurate.	• Document and disseminate asset valuation data including: - Define accuracy - Investigate inaccuracy - Determine required level of accuracy

	Decision Makers	Maintenance	Traffic	Labels
50 and 67. Cost history data. (eg. Full cost history of maintenance and operation activities together with depreciation and capital use charges where applicable.)				
51 and 68. Data for costing of options. (eg. Cost summary for standard construction and rehabilitation techniques, maintenance and operational activities and options.)				
84. Maintenance Data. (eg. Detailed maintenance history including activity and timing.)				No Data; 35% Accurate & complete; 50% Accurate & complete; 65% Accurate & complete; 80 % Accurate & complete
INVENTORY				
54. Asset Hierarchical Structure. (eg. The level (maintenance managed item) to which asset information is collected and the ability to amalgamate asset costs and performance.)				None; Service type; Facility or system level; Asset type level; Asset level; Maintenance managed item level

MANUALS AND DOCUMENTS			
85. Quality of the Maintenance Manuals and Instructions. (eg. Do these exist and cover all business units/divisions and assets types?)			None; Under development; Documented in some business areas; Documented & covering whole business; Documented & fully implemented across whole business
81. Processes for developing and maintaining contents of the Maintenance Manuals and Instructions. (eg. Are new assets automatically included and how often are they reviewed? What is the process by which the responsible staff can update them? Is the format specified?)			Little or no knowledge; Little knowledge & ad hoc processes; Good knowledge & ad hoc processes; Consistent processes & partially documented; Extensive knowledge & partially documented; Fully documented & externally audited
POLICIES			
86. Maintenance policy that defines where the organization undertakes maintenance of its assets. (eg. Does a corporate wide policy exist and is it related to business goals and cost analysis ?)			None; Under development; Documented in some business areas; Documented & covering whole business; Documented & fully implemented across whole business
87. Policy guidance supports preservation of existing infrastructure assets.			
TRADE OFF ANALYSIS			
88. Capital versus maintenance expenditure tradeoffs are explicitly considered in the preservation of assets like pavements and bridges.			

	Observation	Needs
50 and 67. Cost history data. (eg. Full cost history of maintenance and operation activities together with depreciation and capital use charges where applicable.)	Most decision makers think cost history data are 50-65% accurate. The majority of maintenance personnel think historical cost data are 65% accurate or more, although the minority think the data are not available. Most traffic personnel think the data are 65% accurate.	• Document and disseminate cost history data including: - Define accuracy - Investigate inaccuracy - Determine required level of accuracy
51 and 68. Data for costing of options. (eg. Cost summary for standard construction and rehabilitation techniques, maintenance and operational activities and options.)	The majority of all groups think data for costing of options are relatively accurate.	• Document and disseminate cost history data including: - Define accuracy - Investigate inaccuracy - Determine required level of accuracy
84. Maintenance Data. (eg. Detailed maintenance history including activity and timing.)	Decision makers think maintenance data are 50% accurate (range: 35-65%). Maintenance personnel think almost 50% accurate as well (range: 35-80%).	• Document and disseminate cost history data including: - Define accuracy - Investigate inaccuracy - Determine required level of accuracy
54. Asset Hierarchical Structure. (eg. The level (maintenance managed item) to which asset information is collected and the ability to amalgamate asset costs and performance.)	All groups address various asset hierarchical structure. Half of maintenance personnel think there is no such a structure.	• Document and communicate available data and structure.
85. Quality of the Maintenance Manuals and Instructions. (eg. Do these exist and cover all business units/divisions and assets types?)	The majority of decision makers and maintenance personnel think maintenance manuals and instructions are documented in some business.	• Document and disseminate maintenance manuals and instructions.
81. Processes for developing and maintaining contents of the Maintenance Manuals and Instructions. (eg. Are new assets automatically included and how often are they reviewed? What is the process by which the responsible staff can update them? Is the format specified?)	The half of decision makers think they have good knowledge about processes for developing and maintaining contents of maintenance manuals and instructions and the rest of them think they have little knowledge about the processes. Most maintenance personnel think they have little knowledge.	• Document and disseminate the process.
86. Maintenance policy that defines where the organization undertakes maintenance of its assets. (eg. Does a corporate wide policy exist and is it related to business goals and cost analysis ?)	The majority of decision makers think maintenance policy does not exist or is under development, while that of maintenance personnel think the policy is documented.	• Document and disseminate maintenance policy.
87. Policy guidance supports preservation of existing infrastructure assets.	The majority of decision makers disagree policy guidance supports preservation of existing assets. Maintenance personnel's evaluations are equally divided into agree and disagree.	• Link criteria, policy objectives and performance measures including preservation. • Document and disseminate preservation policy.
88. Capital versus maintenance expenditure tradeoffs are explicitly considered in the preservation of assets like pavements and bridges.	The majority of decision makers disagree capital versus maintenance expenditure tradeoffs are explicitly considered in assets preservation, while that of maintenance personnel agree.	• Document and disseminate expenditure tradeoffs.

	Decision Makers	Maintenance	Traffic
TRADE OFF ANALYSIS			
91. Capital versus maintenance expenditure tradeoffs are explicitly considered in the preservation of assets like pavements and bridges.			
LIFE CYCLE COST ANALYSIS			
89. The preservation program budget is based upon analyses of least-life-cycle cost rather than exclusive reliance on worst-first strategies.			
Operations			
AGENCY PRACTICES AND PROCESSES			
52. Mobile Computing Facilities. (eg. Pocket PC's, laptops and tablets PC's to be used by field operations and maintenance staff for rapid data entry and live access and updating of work orders.)			
19. Quality of the actual Operating Procedures, which relate to the successful operation of all assets in relation to normal and emergency operations. (eg. Do these exist, cover all areas and assets down to the maintenance managed item level ?)			

	Decision Makers	Maintenance	Traffic
AGENCY PRACTICES AND PROCESSES			
74 and 75. Our agency monitors actual system performance and compares these values to targets projected for its maintenance and operations program.			
MANUALS AND DOCUMENTS			
18. Processes for developing and maintaining operation manuals. (eg. Are new assets automatically included and how often are they reviewed? How should operators update the manuals when procedures change?)			
20. Quality of the actual Operating Manuals and Standards. (eg. What form should do they take and does the manuals cover all assets?)			
SYSTEMS			
35. Operations and Maintenance Manuals Storage System. (eg. Electronic System to store and track operations and maintenance manual materials.)			

Labels

None
Developed business case
Aging technology or some usage
Business wide usage
Business wide usage - interfaced with other systems

None
Under development
Documented in some business areas
Documented & covering whole business
Documented & fully implemented across whole business

Little or no knowledge
Little knowledge & ad hoc processes
Good knowledge & ad hoc processes
Consistent processes & partially documented
Extensive knowledge & partially documented
Fully documented & externally audited

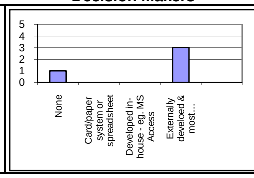
None
Card/paper system or spreadsheet
Developed in-house eg.
Externally developed &
Externally developed- interfaced with other systems & functionality fully utilized

	Observation	Needs
91. Capital versus maintenance expenditure tradeoffs are explicitly considered in the preservation of assets like pavements and bridges.	The majority of decision makers and maintenance personnel disagree capital versus maintenance expenditure tradeoffs are explicitly considered in asset preservation. Several are not sure about this question. Although this question is completely same as question 88, the figures are different from question 88.	• Identify gaps in expenditure tradeoffs. • Document and disseminate expenditure tradeoffs.
89. The preservation program budget is based upon analyses of least-life-cycle cost rather than exclusive reliance on worst-first strategies.	Some decision makers think the preservation program budget is based on worst-first strategies rather than analyses of least-life-cycle cost. Most maintenance personnel think the budget is based on analyses of least-life-cycle cost.	• Identify gaps in a life cycle cost analysis. • Document and disseminate the analysis.
52. Mobile Computing Facilities. (eg. Pocket PC's, laptops and tablets PC's to be used by field operations and maintenance staff for rapid data entry and live access and updating of work orders.)	The evaluations of all groups for mobile computing facilities are diverse. Aging technology or some usage is highest. Several think no facilities exist.	• Document and disseminate mobile computing facilities.
19. Quality of the actual Operating Procedures, which relate to the successful operation of all assets in relation to normal and emergency operations. (eg. Do these exist, cover all areas and assets down to the maintenance managed item level ?)	The majority of traffic personnel think actual operating procedures are documented.	• Document and disseminate operating procedures.
74 and 75. Our agency monitors actual system performance and compares these values to targets projected for its maintenance and operations program.	The majority of decision makers and maintenance personnel agree DelDOT monitors system performance and compares these values to targets for maintenance and operations program, while that of traffic personnel disagree.	• Document and disseminate information about monitoring systems.
18. Processes for developing and maintaining operation manuals. (eg. Are new assets automatically included and how often are they reviewed? How should operators update the manuals when procedures change?)	The majority of maintenance personnel have good knowledge about processes for developing and maintaining operation manuals.	• Document and disseminate the processes.
20. Quality of the actual Operating Manuals and Standards. (eg. What form should do they take and does the manuals cover all assets?)	The majority of traffic personnel think operating manuals and standards are documented in some business.	• Document and disseminate operating manuals and standards.
35. Operations and Maintenance Manuals Storage System. (eg. Electronic System to store and track operations and maintenance manual materials.)	All groups address different formats of operations and maintenance manuals storage system. Some maintenance personnel think there is no storage system.	• Document and disseminate information about the operations and maintenance manuals storage system.

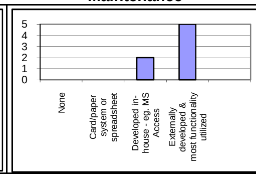
	Decision Makers	Maintenance	Traffic	Labels

25. Job Resource Management System. (eg. System to create and track work orders covering labor, plant, specialist tools and materials.)

Decision Makers:



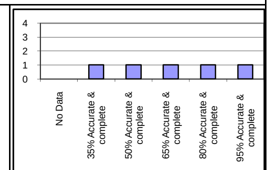
Maintenance:



DATA AND INFORMATION

48. Operations Data. (eg. Operations history and data on failure consequences management.)

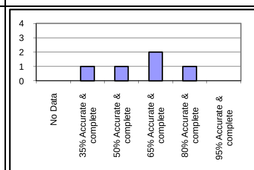
Traffic:



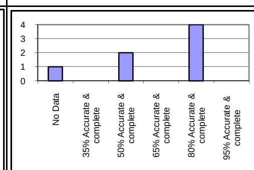
Labels: No Data; 35% Accurate & complete; 50% Accurate & complete; 65% Accurate & complete; 80 % Accurate & complete; 95 % Accurate & complete

49 and 66. Works and / or resource management data. (eg. The data related to the resource elements of work order history including labor, plant and materials work performed, in both capital and recurrent activities.)

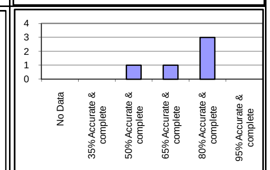
Decision Makers:



Maintenance:

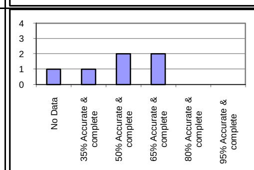


Traffic:

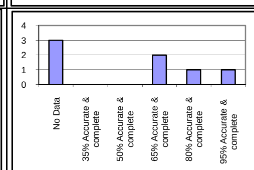


50 and 67. Cost history data. (eg. Full cost history of maintenance and operation activities together with depreciation and capital use charges where applicable.)

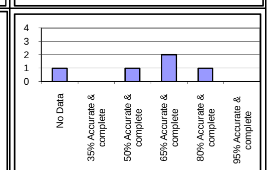
Decision Makers:



Maintenance:

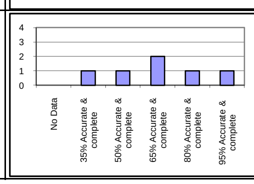


Traffic:

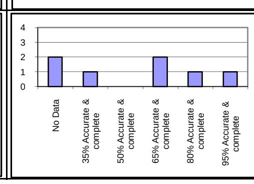


51. Data for costing of options. (eg. Cost summary for standard construction and rehabilitation techniques, maintenance and operational activities and options.)

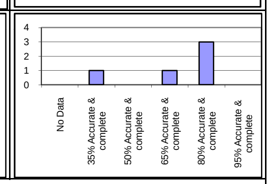
Decision Makers:



Maintenance:



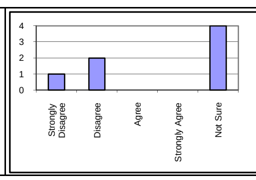
Traffic:



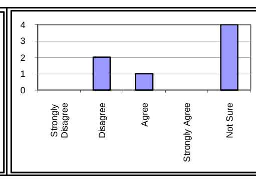
TRADE OFF ANALYSIS AND PROJECT SELECTION

92. Capital versus operations tradeoffs are explicitly considered in seeking to improve traffic movement.

Decision Makers:



Maintenance:

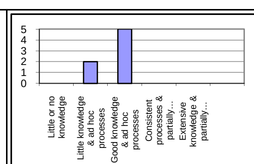


Manuals and Documents

OPERATIONS

18. Processes for developing and maintaining operation manuals. (eg. Are new assets automatically included and how often are they reviewed? How should operators update the manuals when procedures change?)

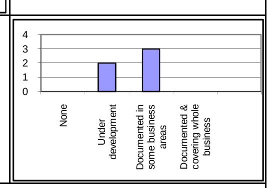
Maintenance:



Labels: Little or no knowledge; Little knowledge & ad hoc processes; Good knowledge & ad hoc processes; Consistent processes & partially documented; Extensive knowledge & partially documented; Fully documented & externally audited

20. Quality of the actual Operating Manuals and Standards. (eg. What form should do they take and does the manuals cover all assets?)

Traffic:



Labels: None; Under development; Documented in some business areas; Documented & covering whole business; Documented & fully implemented across whole business

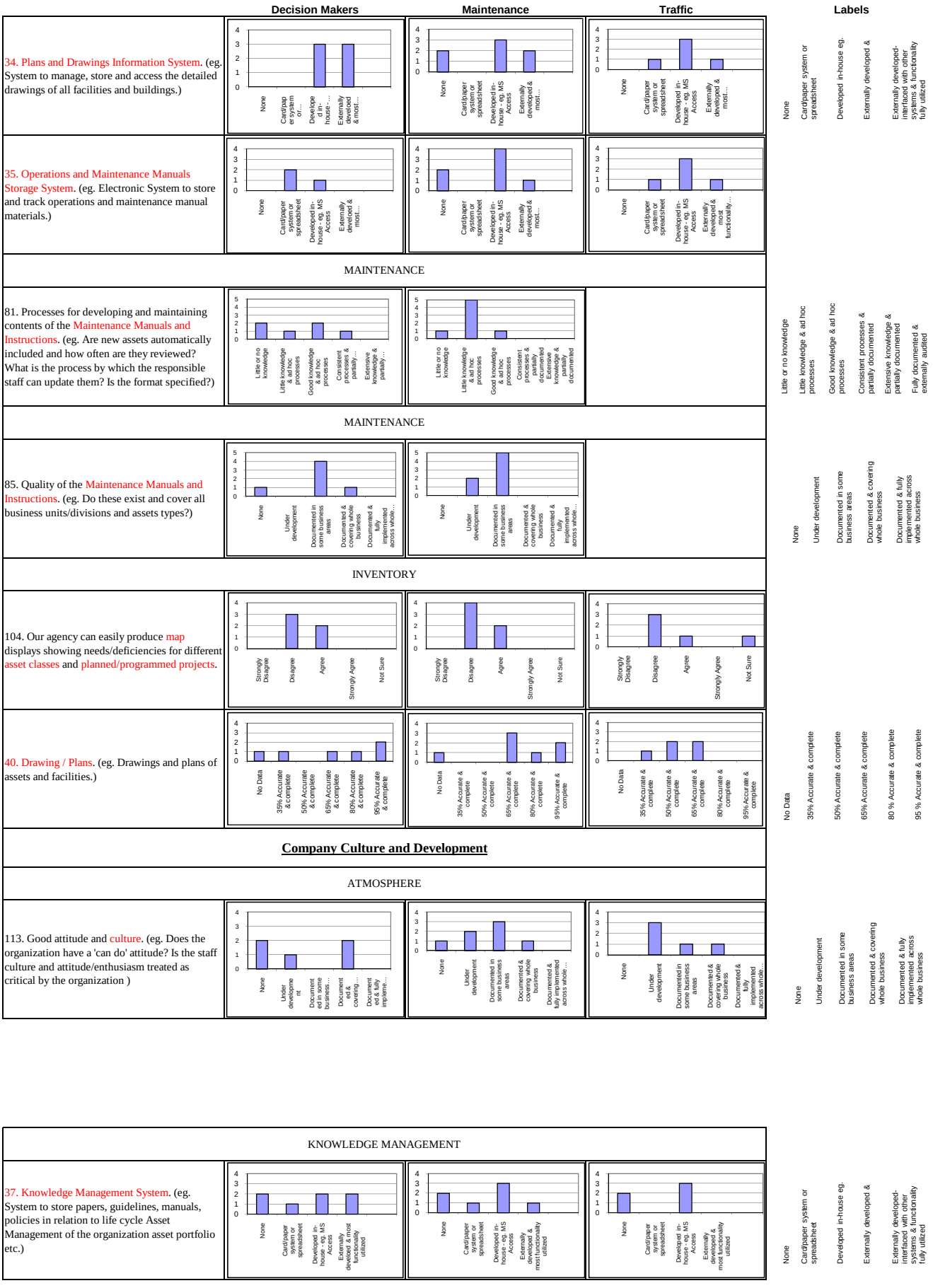
SYSTEMS

	Observation	Needs
25. Job Resource Management System. (eg. System to create and track work orders covering labor, plant, specialist tools and materials.)	The majority of decision makers and maintenance think job resource management system is externally developed. Maintenance personnel think the system is developed in-house or externally.	• Ensure capabilities of systems are known. • Document and disseminate information about the system.

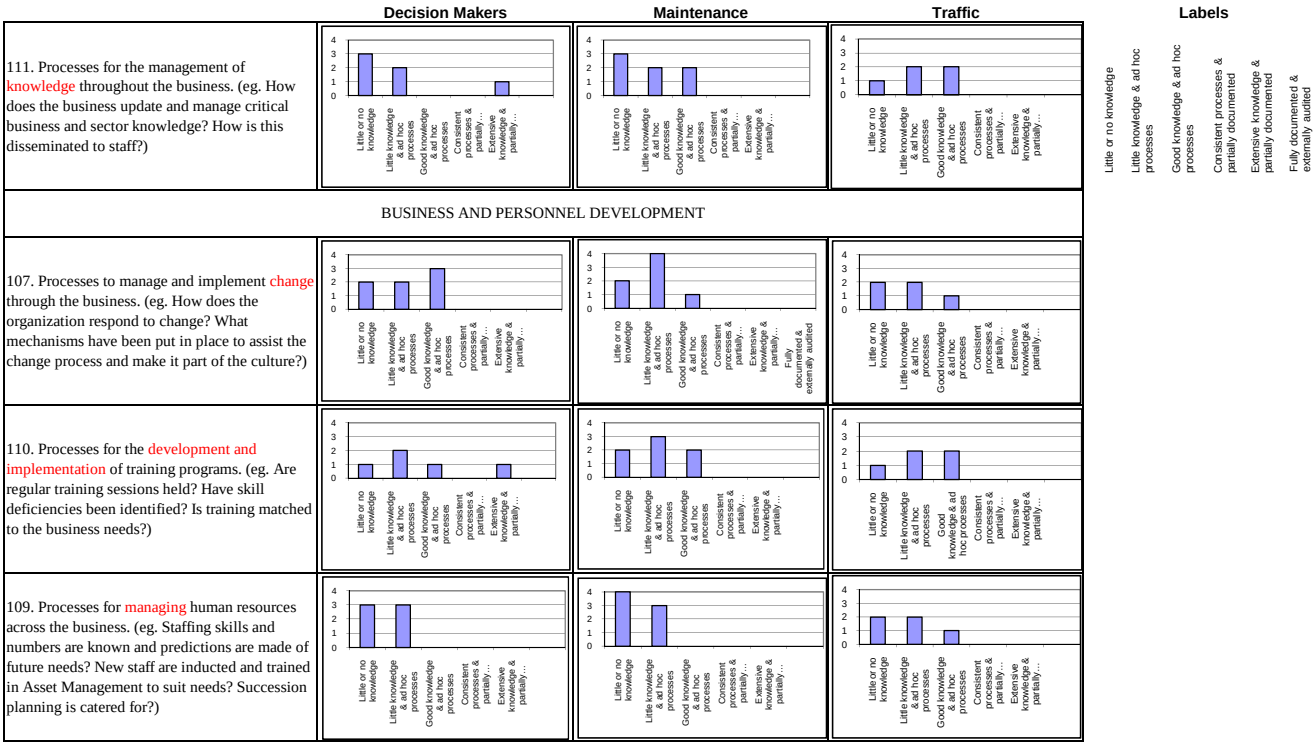
48. Operations Data. (eg. Operations history and data on failure consequences management.)	The evaluations of traffic personnel for the accuracy of operation data are diverse (35-95% accuracy).	• Document and disseminate information regarding operations data including: - Define accuracy. - Investigate what causes inaccuracy. - Determine required level of accuracy.
49 and 66. Works and / or resource management data. (eg. The data related to the resource elements of work order history including labor, plant and materials work performed, in both capital and recurrent activities.)	The majority of decision makers and traffic personnel think works and/or resource management data are 65% accurate or more. The evaluations of maintenance personnel are divided into 50% accurate and 80% accurate.	• Continue to improve data accuracy. • Document and disseminate information about the data.
50 and 67. Cost history data. (eg. Full cost history of maintenance and operation activities together with depreciation and capital use charges where applicable.)	Decision makers think historical cost data are less accurate, while traffic personnel think accurate. The majority of maintenance personnel think historical cost data are 65% accurate or more, although the minority think the data are not available.	• Document and disseminate cost history data including: - Define accuracy - Investigate inaccuracy - Determine required level of accuracy
51. Data for costing of options. (eg. Cost summary for standard construction and rehabilitation techniques, maintenance and operational activities and options.)	The majority of all groups think data for costing of options are relatively accurate.	• Document and disseminate cost history data including: - Define accuracy - Investigate inaccuracy - Determine required level of accuracy

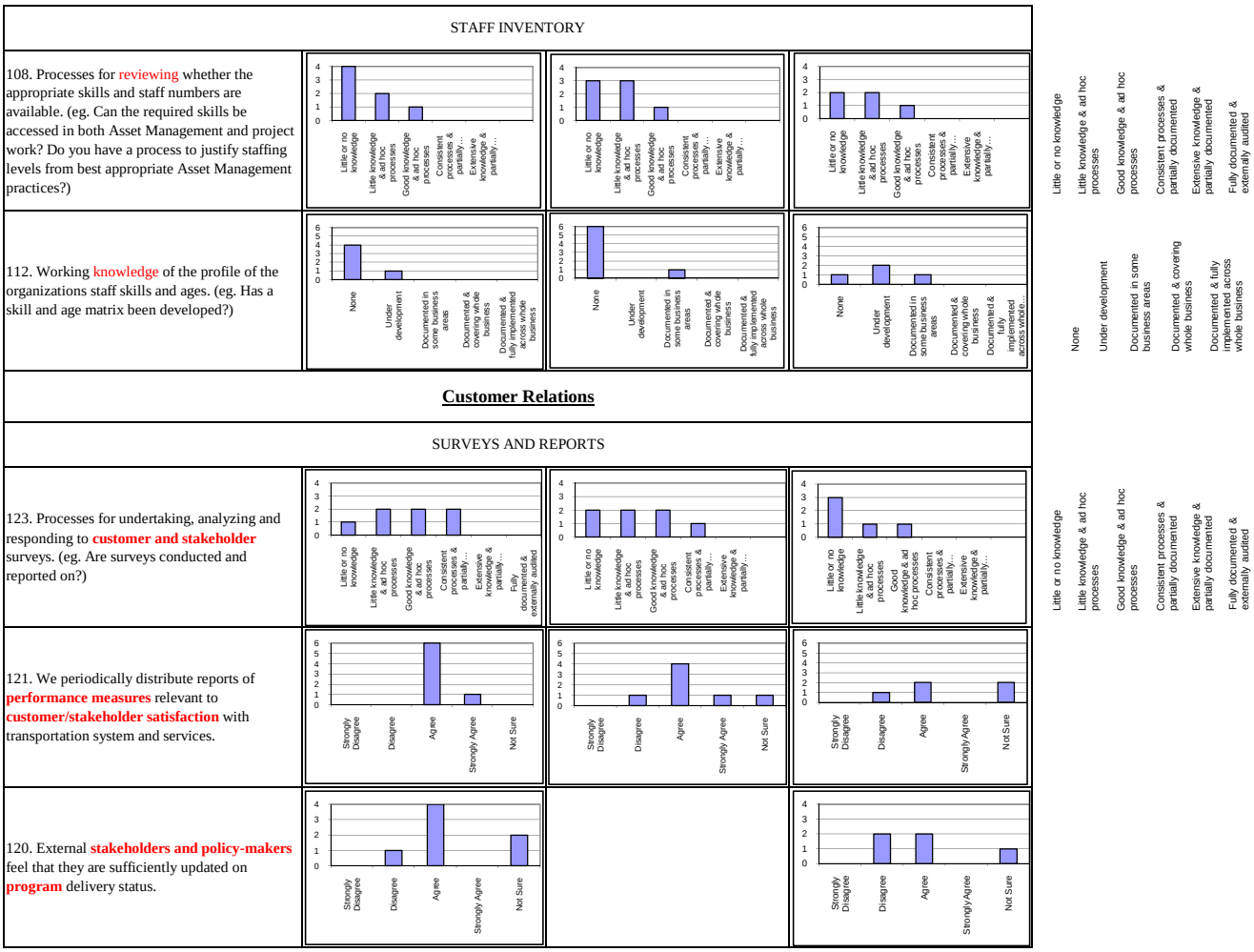
92. Capital versus operations tradeoffs are explicitly considered in seeking to improve traffic movement.	The majority of decision makers and maintenance personnel are not sure whether capital versus operations tradeoffs are explicitly considered in seeking to improve traffic movement. Secondary, there are many who disagree the tradeoffs.	• Document and disseminate information about capital versus operations tradeoffs.

18. Processes for developing and maintaining operation manuals. (eg. Are new assets automatically included and how often are they reviewed? How should operators update the manuals when procedures change?)	The majority of maintenance personnel have good knowledge about processes for developing and maintaining operation manuals.	• Document and disseminate the processes.
20. Quality of the actual Operating Manuals and Standards. (eg. What form should do they take and does the manuals cover all assets?)	The majority of traffic personnel think operating manuals and standards are documented in some business.	• Document and disseminate operating manuals and standards.


Decision Makers
Maintenance
Traffic
Labels
34. Plans and Drawings Information System. (eg. System to manage, store and access the detailed drawings of all facilities and buildings.)
35. Operations and Maintenance Manuals Storage System. (eg. Electronic System to store and track operations and maintenance manual materials.)
MAINTENANCE
81. Processes for developing and maintaining contents of the Maintenance Manuals and Instructions. (eg. Are new assets automatically included and how often are they reviewed? What is the process by which the responsible staff can update them? Is the format specified?)
MAINTENANCE
85. Quality of the Maintenance Manuals and Instructions. (eg. Do these exist and cover all business units/divisions and assets types?)
INVENTORY
104. Our agency can easily produce map displays showing needs/deficiencies for different asset classes and planned/programmed projects.
40. Drawing / Plans. (eg. Drawings and plans of assets and facilities.)
Company Culture and Development
ATMOSPHERE
113. Good attitude and culture. (eg. Does the organization have a 'can do' attitude? Is the staff culture and attitude/enthusiasm treated as critical by the organization)
KNOWLEDGE MANAGEMENT
37. Knowledge Management System. (eg. System to store papers, guidelines, manuals, policies in relation to life cycle Asset Management of the organization asset portfolio etc.)

	Observation	Needs
34. Plans and Drawings Information System. (eg. System to manage, store and access the detailed drawings of all facilities and buildings.)	All groups think plans and drawings information system is developed in house and externally developed.	• Document and disseminate information of capabilities.
35. Operations and Maintenance Manuals Storage System. (eg. Electronic System to store and track operations and maintenance manual materials.)	All groups address different formats of operations and maintenance manuals storage system. Some maintenance personnel think there is no storage system.	• Document and disseminate information about operations and maintenance manuals storage system.
81. Processes for developing and maintaining contents of the Maintenance Manuals and Instructions. (eg. Are new assets automatically included and how often are they reviewed? What is the process by which the responsible staff can update them? Is the format specified?)	The half of decision makers think they have good knowledge about processes for developing and maintaining contents of maintenance manuals and instructions and the rest of them think they have little knowledge about the processes. Most maintenance personnel think they have little knowledge.	• Document and disseminate the process.
85. Quality of the Maintenance Manuals and Instructions. (eg. Do these exist and cover all business units/divisions and assets types?)	The majority of decision makers and maintenance personnel think maintenance manuals and instructions are documented in some business.	• Document and disseminate maintenance manuals and instructions.
104. Our agency can easily produce map displays showing needs/deficiencies for different asset classes and planned/programmed projects.	The majority of all groups think DelDOT cannot easily produce map display showing needs/deficiencies for assets and projects.	• Identify areas needing improvement.
40. Drawing / Plans. (eg. Drawings and plans of assets and facilities.)	The majority of decision makers and maintenance personnel think drawing and plans are 65% accurate or more. On the other hand, the majority of traffic personnel think they are about 50% accurate (range: 35-65%).	• Document and disseminate cost history data including: - Define accuracy - Investigate inaccuracy - Determine required level of accuracy
113. Good attitude and culture. (eg. Does the organization have a 'can do' attitude? Is the staff culture and attitude/enthusiasm treated as critical by the organization)	Operational levels (i.e., maintenance and traffic) have good attitude and culture, while decision makers feel that they are not enough.	• Identify opportunities for team building. • Develop strategy.
37. Knowledge Management System. (eg. System to store papers, guidelines, manuals, policies in relation to life cycle Asset Management of the organization asset portfolio etc.)	Decision makers and maintenance personnel have the same trend on knowledge management system. Traffic personnel has different trend. Some personnel across three groups mention no knowledge management system exists.	• Document systems and processes. • Disseminate relevant and appropriate information.


Decision Makers
Maintenance
Traffic
Labels
111. Processes for the management of knowledge throughout the business. (eg. How does the business update and manage critical business and sector knowledge? How is this disseminated to staff?)
BUSINESS AND PERSONNEL DEVELOPMENT
107. Processes to manage and implement change through the business. (eg. How does the organization respond to change? What mechanisms have been put in place to assist the change process and make it part of the culture?)
110. Processes for the development and implementation of training programs. (eg. Are regular training sessions held? Have skill deficiencies been identified? Is training matched to the business needs?)
109. Processes for managing human resources across the business. (eg. Staffing skills and numbers are known and predictions are made of future needs? New staff are inducted and trained in Asset Management to suit needs? Succession planning is catered for?)
Little or no knowledge
Little knowledge & ad hoc processes
Good knowledge & ad hoc processes
Consistent processes & partially documented
Extensive knowledge & partially documented
Fully documented & externally audited

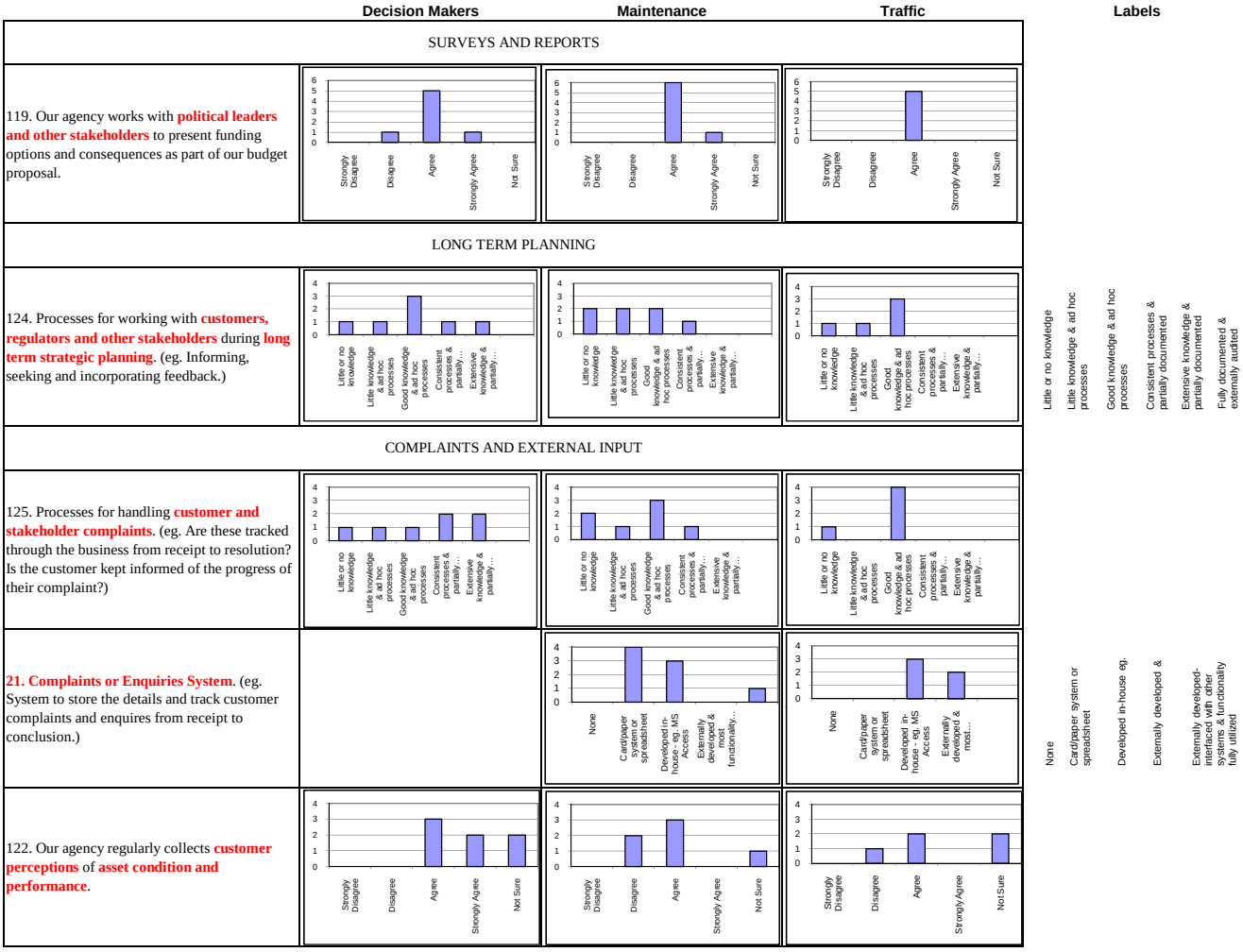

STAFF INVENTORY
108. Processes for reviewing whether the appropriate skills and staff numbers are available. (eg. Can the required skills be accessed in both Asset Management and project work? Do you have a process to justify staffing levels from best appropriate Asset Management practices?)
112. Working knowledge of the profile of the organizations staff skills and ages. (eg. Has a skill and age matrix been developed?)
None
Under development
Documented in some business areas
Documented & covering whole business
Documented & fully implemented across whole business
Customer Relations
SURVEYS AND REPORTS
123. Processes for undertaking, analyzing and responding to customer and stakeholder surveys. (eg. Are surveys conducted and reported on?)
121. We periodically distribute reports of performance measures relevant to customer/stakeholder satisfaction with transportation system and services.
120. External stakeholders and policy-makers feel that they are sufficiently updated on program delivery status.
Strongly Disagree
Disagree
Agree
Strongly Agree
Not Sure

	Observation	Needs
111. Processes for the management of knowledge throughout the business. (eg. How does the business update and manage critical business and sector knowledge? How is this disseminated to staff?)	The majority of all groups do not know the processes for knowledge management very well.	• Document and disseminate the processes.

107. Processes to manage and implement change through the business. (eg. How does the organization respond to change? What mechanisms have been put in place to assist the change process and make it part of the culture?)	The majority of all groups do not know processes to manage and implement change.	• Document and disseminate the processes.
110. Processes for the development and implementation of training programs. (eg. Are regular training sessions held? Have skill deficiencies been identified? Is training matched to the business needs?)	The majority of all groups do not know processes for development and implementation of training programs.	• Document and disseminate the processes.
109. Processes for managing human resources across the business. (eg. Staffing skills and numbers are known and predictions are made of future needs? New staff are inducted and trained in Asset Management to suit needs? Succession planning is catered for?)	The majority of all groups do not know processes for managing human resources.	• Document and disseminate the processes.

108. Processes for reviewing whether the appropriate skills and staff numbers are available. (eg. Can the required skills be accessed in both Asset Management and project work? Do you have a process to justify staffing levels from best appropriate Asset Management practices?)	The majority of all groups do not know the processes for reviewing staff ability and availability.	• Document and disseminate the processes.
112. Working knowledge of the profile of the organizations staff skills and ages. (eg. Has a skill and age matrix been developed?)	Most decision makers and maintenance personnel don't have staff inventory. Traffic group has inventory.	• Develop profile. • Develop succession plan.

123. Processes for undertaking, analyzing and responding to **customer and stakeholder** surveys. (eg. Are surveys conducted and reported on?)	Traffic personnel have little knowledge about process for analyzing customer and stakeholder surveys. Decision makers and maintenance personnel are even.	• Document and disseminate the processes.
121. We periodically distribute reports of **performance measures** relevant to **customer/stakeholder satisfaction** with transportation system and services.	The majority of all groups know periodical performance reports of transportation system and services.	• Document and disseminate distribution of reports.
120. External **stakeholders and policy-makers** feel that they are sufficiently updated on **program** delivery status.	Decision makers feel program delivery is sufficient more than traffic personnel.	• Document and disseminate program delivery and stakeholders' satisfaction with the delivery.


Decision Makers
Maintenance
Traffic
Labels
SURVEYS AND REPORTS
119. Our agency works with political leaders and other stakeholders to present funding options and consequences as part of our budget proposal.
Strongly Disagree
Disagree
Agree
Strongly Agree
Not Sure
LONG TERM PLANNING
124. Processes for working with customers, regulators and other stakeholders during long term strategic planning. (eg. Informing, seeking and incorporating feedback.)
Little or no knowledge
Little knowledge & ad hoc processes
Good knowledge & ad hoc processes
Consistent processes & partially...
Extensive knowledge & partially...
Little or no knowledge
Little knowledge & ad hoc processes
Good knowledge & ad hoc processes
Consistent processes & partially...
Extensive knowledge & partially...
Little or no knowledge
Little knowledge & ad hoc processes
Good knowledge & ad hoc processes
Consistent processes & partially...
Extensive knowledge & partially...
Little or no knowledge
Little knowledge & ad hoc processes
Good knowledge & ad hoc processes
Consistent processes & partially documented
Extensive knowledge & partially documented
Fully documented & externally audited
COMPLAINTS AND EXTERNAL INPUT
125. Processes for handling customer and stakeholder complaints. (eg. Are these tracked through the business from receipt to resolution? Is the customer kept informed of the progress of their complaint?)
Little or no knowledge
Little knowledge & ad hoc processes
Good knowledge & ad hoc processes
Consistent processes & partially...
Extensive knowledge & partially...
Little or no knowledge
Little knowledge & ad hoc processes
Good knowledge & ad hoc processes
Consistent processes & partially...
Extensive knowledge & partially...
Little or no knowledge
Little knowledge & ad hoc processes
Good knowledge & ad hoc processes
Consistent processes & partially...
Extensive knowledge & partially...
21. Complaints or Enquiries System. (eg. System to store the details and track customer complaints and enquires from receipt to conclusion.)
None
Card/paper system or spreadsheet
Developed in-house - eg. MS Access
Externally developed & most functionality...
None
Card/paper system or spreadsheet
Developed in-house - eg. MS Access
Externally developed & most...
None
Card/paper system or spreadsheet
Developed in-house eg.
Externally developed &
Externally developed-interfaced with other systems & functionality fully utilized
122. Our agency regularly collects customer perceptions of asset condition and performance.
Strongly Disagree
Disagree
Agree
Strongly Agree
Not Sure
Strongly Disagree
Disagree
Agree
Strongly Agree
Not Sure
Strongly Disagree
Disagree
Agree
Strongly Agree
Not Sure
POLICIES
118. Our agency regularly communicates to customers and other stakeholders our accomplishments in meeting policy objectives.
Strongly Disagree
Disagree
Agree
Strongly Agree
Not Sure
Strongly Disagree
Disagree
Agree
Strongly Agree
Not Sure
Strongly Disagree
Disagree
Agree
Strongly Agree
Not Sure
117. Our customers contribute to the process that formulates policy goals and objectives.
Strongly Disagree
Disagree
Agree
Strongly Agree
Not Sure
Strongly Disagree
Disagree
Agree
Strongly Agree
Not Sure
Strongly Disagree
Disagree
Agree
Strongly Agree
Not Sure
116. Policy guidance considers customer perceptions and expectations.
Strongly Disagree
Disagree
Agree
Strongly Agree
Not Sure
Strongly Disagree
Disagree
Agree
Strongly Agree
Not Sure
Strongly Disagree
Disagree
Agree
Strongly Agree
Not Sure

	Observation	Needs
119. Our agency works with **political leaders and other stakeholders** to present funding options and consequences as part of our budget proposal.	personnel in all groups think agency works with stakeholders to present funding options as part of budget proposal.	
124. Processes for working with **customers, regulators and other stakeholders** during **long term strategic planning**. (eg. Informing, seeking and incorporating feedback.)	Decision makers and traffic personnel have relatively enough knowledge about processes for working with stakeholders in strategic planning. Maintenance personnel need the knowledge.	• Document and disseminate the processes.
125. Processes for handling **customer and stakeholder complaints**. (eg. Are these tracked through the business from receipt to resolution? Is the customer kept informed of the progress of their complaint?)	The majority of all groups know processes and frequency for handling customer and stakeholder complaints.	• Document and disseminate the processes.
21. Complaints or Enquiries System. (eg. System to store the details and track customer complaints and enquires from receipt to conclusion.)	Maintenance and traffic groups have different systems.	• Document and disseminate information about complaints or enquiries system.
122. Our agency regularly collects **customer perceptions** of **asset condition and performance**.	The majority of all groups know processes and frequency for handling customer and stakeholder complaints. However, 20-40% personnel don't know the frequency.	• Document and disseminate information about customer survey.
118. Our agency regularly communicates to **customers and other stakeholders** our accomplishments in meeting **policy** objectives.	Most in all groups positively agree on regular communication to customers and stakeholders regarding accomplishments in policy objectives.	• Continue to communicate accomplishments.
117. Our **customers** contribute to the process that formulates **policy goals and objectives**.	Most in all groups positively agree on customers' contribution to the process formulating policy goals and objectives.	• Continue public involvement efforts.
116. Policy guidance considers **customer perceptions and expectations**.	Most in all groups positively agree on involvement of customer perceptions and expectations in policy guidance.	• Continue public involvement efforts.