U.S. Department of Transportation
Federal Highway Administration

Summary Report:
Peer Workshop on Inventory & Asset Management of Other Asset Classes

July 2008

Monterey, California

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Workshop Participants

First Name	Last Name	Title	Agency
Coco	Briseno	Chief, Division of Transportation System Information	California DOT
Mike	Bridges	Undersecretary, Management & Finance	Louisiana DOT
Theresa	Romell	Senior Funding Analyst	Metropolitan Transportation Commission
Matthew	DeMarco	Geotechnical Group Lead	FHWA - Central Lands Highway Division
Bridges	Michael	Undersecretary	Louisiana Department of Transportation and Development
Neil	Pedersen	Administrator	Maryland SHA
Jeff	Smith	Deputy Director Office of Planning & Prelim. Eng.	Maryland SHA
David	Wresinski	Division Administrator, Project Planning	Michigan DOT
Leonard	Evans	Administrator, Systems Analysis Planning	Ohio DOT
Cathy	Nelson	Chief Engineer	Oregon DOT
Ahmad	Jaber	Systems Planning & Programming Director	Utah DOT
Mel	Adams	Director of Systems Planning & Policy	Vermont AOT
Ron	McCready	Program Director - Policy & Planning *(Observer)*	AASHTO
Steve	Gaj	Asset Management Team Leader *(Observer)*	FHWA
Butch	Wlaschin	Director, Office of Asset Management *(Observer)*	FHWA
Robert	Ritter	Planning Capacity Building Team Leader *(Observer)*	FHWA
Peter	Plumeau	Facilitator/Manager	Resource Systems Group
Stephen	Lawe	Facilitator	Resource Systems Group

1. Background and Introduction

"Transportation Asset Management" (TAM) is a systematic, strategic and complete approach to maintain, upgrade, and operate physical infrastructure assets in a cost-effective way. State DOTs and other agencies have a long history of inventorying and managing transportation assets, particularly roadway pavements and highway bridges. In recent years, however, many in the transportation industry have recognized a need to expand asset management beyond the "edge of the pavement" to encompass transportation infrastructure assets such as culverts, lighting, signals and markings. In December 2007, the National Academies of Science (NAS) published *NCHRP Synthesis 371: Managing Selected Transportation Assets: Signals, Lighting, Signs, Pavement Markings, Culverts, and Sidewalks*,[1] which reviewed and summarized existing literature and research pertaining to expanding asset classes. It also highlighted a variety of issues associated with inventorying and managing these classes of assets.

In light of the desire to expand TAM, as well as the complexity associated with this expansion, the FHWA Office of Asset Management and AASHTO Subcommittee on Asset Management proposed to convene a national Peer Workshop to discuss state of the practice and identify professional and technical capacity-building needs.

FHWA and AASHTO convened the Peer Workshop over the course of two consecutive days (July 14 and 15, 2008) as part of the AASHTO Subcommittee on Asset Management meeting. A total of ten officials, representing state DOTs, one MPO and the Federal Lands Office, participated in the Workshop. A consulting team from Resource Systems Group, Inc. (RSG) managed, facilitated and documented the event. This report summarizes the results of the workshop, including key themes, participant presentations and discussions and recommendations for further action and research.

2. Key Workshop Themes

Four principal themes emerged from the workshop. These are summarized as follows:

- ***Build on Asset Management Activities Already Underway*** **-** It is important that efforts to address management of assets "beyond the pavement" build on efforts already underway in various states and not reinvent these efforts. For example, a clearinghouse for information on TAM data collection and management "best practices" would be very useful to many states. It was also agreed that asset management initiatives should be clearly related to performance measures and reporting requirements and not be undertaken in the absence of a clear mission.

- ***Employ a Risk Management Approach to Asset Management*** **–** Because of the multitude of transportation asset classes to be inventoried and managed, it is important that we focus on the most critical system elements. In a resource-constrained environment, DOTs and others need to understand the relative risks, costs and benefits associated with the various asset classes. Part of this involves educating policy-makers

[1] http://www.trb.org/news/blurb_detail.asp?id=8496.

and the public on the benefits of asset management and supporting decisions that move us beyond the "worst first" approach.

- ***Understand the Basis for Asset Class Definitions –*** The variety of potential asset classes that could be subject to inventorying and management means that criteria are needed to help organize data collection and decision-making. For example, an agency's own business plan criteria, court decisions and/or legislatively-mandated asset classes may provide an organizing framework. DOTs and others also need to be aware of "emerging" asset classes, such as ITS infrastructure and non-infrastructure equipment, and define these classes appropriately.

- ***Needs Assessments Require a Technical Basis –*** Asset management can be a valuable tool for helping identify and prioritize transportation investment needs. However, it is important that the identification of asset classes, asset inventories and asset management approaches be founded on a rational and objective process. To ensure credibility and usefulness, DOTs and others undertaking asset management need to ensure their processes employ sound and defensible data and methodologies. Sharing of "best practices" information and technical guidance from national sources would be helpful in this regard.

3. Participant Presentations on Current Practices & Issues

Each workshop participant discussed current TAM practices in his/her agency as well as significant issues or challenges they face related to TAM for assets outside the traditional realm of pavement and bridges. The following section provides a high-level summary of each participant's comments.

3.1 Jeff Smith, Maryland State Highway Administration

The Maryland State Highway Administration (SHA), a modal agency of the Maryland Department of Transportation, manages over 400 bridges, 2600 traffic signals, 2000 overhead sign structures and 20,500 lighting structures. SHA initiated its asset management process by establishing an inventory of assets and asset types. SHA has a business plan with over 400 asset measurement metrics. One of the difficulties SHA has faced in maintaining an asset management program is that the legal or historical responsibility for maintenance of a specific facility (e.g., signage, streetlight, etc.) may not be clearly documented or understood, leading to misunderstandings between the state and local or county governments.

Maryland SHA prepares business plans that help to prioritize assets. There are hopes to fully integrate the use of web-based GIS for asset management. Moreover, managing many assets does not necessarily provide greater detail about each asset. The SHA believes that the best asset management approach is a combination of inventory, condition collection rating and deterioration models.

From an administrator perspective, the asset management approach is helping to create a technical basis for decision-making. For example, prior to the focus on asset data collection, program managers would often vie for funding based on available, sometimes ad-hoc, data

efforts and/or anecdotal information. Political support can also be increased using asset management techniques because elected officials may be more likely to support a rational, objective process based on data rather than politically-influenced decision-making.

Legal issues have also provided motivation for the management and inventorying of assets. For example, threat of legal action has led to the development of sidewalk inventories in an effort to avoid Americans with Disabilities Act (ADA) lawsuits.

3.2. Coco Briseno, Chief, Division of Transportation System Information, Caltrans

Caltrans is a large state DOT with functions and responsibilities divided between a variety of units. The department has a strategic plan that includes strategies, goals and system-wide performance measures. Many measures are reported on a quarterly basis. Caltrans also conducts customer surveys to gather feedback in support of the asset management process.

Caltrans collects TAM data on culverts, slopes, barriers, roadsides, telecommunications, landscaping improvements and maintenance needs. Due to the decentralized nature of the department, however, Caltrans is maintaining a vast number of databases with overlapping data. As part of its long-term strategic plan, Caltrans is seeking to consolidate and more efficiently manage these databases and orient them to support a performance-based planning and investment process. At the same time, Caltrans is now working to conduct a more detailed asset inventory of its entire state-owned roadway/highway network.

Caltrans has developed a list of its "top three" assets that are "beyond the pavement:" storm drainage; sidewalks; and curb and gutters. Caltrans' prioritization of these asset types was a by-product of its realization that many Caltrans districts around the state were each using different methods to inventory, manage and track the assets. Caltrans therefore decided at the central office level that a unified approach to management of these asset types across all districts was required.

3.3 Theresa Romell, Senior Funding Analyst, Metropolitan Transportation Commission (MTC), Oakland, CA

The MTC is the metropolitan planning organization (MPO) for the greater San Francisco-Oakland Bay Area. Within the MTC planning region, there are 40,000 lane miles of roadway, most of which are in urban areas. MTC has been collecting data on pavements within the region for the last 20 years, and bridges for the last eight. Efforts to collect data on other transportation assets, however, have only recently begun. To date, MTC has collected inventory and estimated life-cycle and replacement cost information on a variety of non-pavement street and road assets and public-transit assets. Both the non-pavement and transit-related asset data were collected via a survey of all Bay Area local jurisdictions and transit operators. However, the accuracy of the data that was collected for the asset categories varies significantly across jurisdictions and agencies.

In order to estimate the maintenance needs associated with maintaining our existing transportation system for the MTC Regional Transportation Plan (RTP), the agency contracted with a consultant to develop a methodology using the data gathered from

jurisdictions on their non-pavement inventory, life-cycle and replacement costs. In the absence of condition data, the consultant developed a prediction model to estimate the cost to adequately maintain the existing non-pavement assets in the region over the next 25 years. Based on the consultant's regression analysis of the asset situation, MTC found that 80% of the TAM needs within the 15 identified non-road/bridge asset classes are comprised of the three general areas: storm drains, curb cuts and gutters, and sidewalks.

MTC is in the early stages of implementing a non-pavement street and road module of its StreetSaver Pavement Management System software. The first release of the non-pavement module will be limited to sidewalks, curbs & gutters and storm drainage, although the MTC has identified 15 non-road/bridge assets on which they intend to collect data in the future. Based on the MTC's survey data, these three asset classes represent about 80% of the total non-pavement maintenance and replacement costs. The software module will include, among various data fields, an inventory of basic data related to the non-pavement assets, a simplistic condition assessment for non-pavement assets, the ability to identify when and what work is needed, the estimated cost to complete the work for non-pavement assets and the ability to update and manage the database and produce custom reports as needed.

3.4 Matt Demarco, Geotechnical Group Lead, FHWA – Central Federal Lands Highway Division

The Central Federal Lands Highway Division (FLH) of FHWA provides roadway design-thru-construction services across a 14 state region for a variety of Federal Land Management Agencies (FLMA's), including the National Park Service (NPS), U.S. Forest Service (USFS), U.S. Fish and Wildlife Service (FWS), Bureau of Indian Affairs (BIA), and the Department of Defense (DOD). In addition to roadway construction projects, and associated training and technology deployment products, FLH also provides asset management support services pertaining to roadway and bridge inventories and condition assessments. Most recently, FLH has partnered with the NPS to develop new inventory and condition assessment programs for both earth retaining structures (ERS) and traffic barriers.

The National Park Service (NPS) is responsible for the management and maintenance of nearly 5,500 miles of paved roads and parkways across more than 250 park properties nationwide. Given the wide range of geographic settings and public usage comprising the NPS network of roads, defining the backlog of roadway equipment[2] needs, in terms of location, quantity, condition and failure consequence, is a major challenge to the parks program.

Currently, park roadways and bridges are assessed within two inventory programs co-developed with the NPS and managed by FLH – the Road Inventory Program (RIP) and Bridge Inventory Program (BIP). Both inventory programs provide asset data to the NPS Facility Management Software System (FMSS), the data hub for park asset documentation, management and planning efforts. Condition assessments for roadway and bridge structures (and soon other assets) are expressed as deferred maintenance costs, which are then divided by current year replacement costs to arrive at a "Facility Condition Index" (FCI). To ensure that its capital asset investments are made as efficiently as possible, the

[2]The NPS refers to roadway features - including bridges, retaining walls, culverts and traffic barriers –as "equipment" in its asset management terminology.

NPS is incorporating FCI analysis into the prioritization process by comparing the existing FCI of a facility against the proposed FCI after the construction investment. Coupling this condition prioritization practice with an "Asset Priority Index" (API), which measures the facility's importance to the mission of the park (emphasizing cultural aspects of key park assets), capital asset investments are made more efficiently – focusing maintenance and construction priorities on value, rather than solely on cost.

Beginning in 2005, the NPS Park Facility Management Division commissioned FLH to develop an earth retaining structure inventory and condition assessment program similar in scope to the on-going RIP and BIP inventories. With retaining structure inventories currently well underway, the newly developed NPS Wall Inventory Program (WIP) is supported by both NPS WASO and FLH division office personnel. Both organizations are equally responsible for the continual development and management of the WIP program; the NPS is primarily responsible for integration of WIP wall data within the FMSS asset management system, while FLH has taken the lead for delivery of all field inventories. The program mission is to define and quantify wall assets associated with park roadways in terms of their location, geometry, construction attributes, condition, failure consequence, cultural concerns, apparent design criteria and cost of structure maintenance, repair or replacement. In addition to providing asset information to FMSS, wall data are also provided to RIP to update equipment assets associated with the parent roadway asset. Bridge, culvert and traffic barrier data are also provided to FMSS and RIP via other inventory programs.

Similar to RIP, it is the intent of the WIP to periodically reassess retaining wall resources at programmed parks (35 major parks currently in the program) to ensure timely, accurate information is available to support NPS asset management initiatives. Although life-cycle cost analyses are not currently being conducted for other asset categories within the NPS FMSS program, future wall data collection will strive to provide better information on structure life and performance levels. CFLHD is currently working with the NPS to finalize program details within a comprehensive procedures manual.

3.5 Michael Bridges, Undersecretary, Louisiana Department of Transportation and Development

The transportation budget in Louisiana is prioritized through a process in which funds are allocated with input from districts. Currently, LDTD does not employ life-cycle budgeting; rather, the agency relies on the expertise of Department district office personnel. Within Louisiana, there are many different databases, mainframes, and processes for data collection. LDTD is replacing its current financial system by building a statewide Enterprise Resource Planning (ERP) system that will integrate management, data, and project management to better support the TAM process. The state is also considering installing radio-frequency identification (RFID) transponders on signs and other assets to retrieve data.

An LOS model has been built by consultants and placed on the LDTD website. This model integrates customer expectations into the prioritization of assets. This allows for separate aspects of an asset to be compared. An analysis was subsequently performed to determine further resources needed to achieve improved levels of service. As part of the model development, LDTD undertook a visual preference study to help understand how the public

perceives and articulates desired LOS in different situations. The LDTD is planning to use a new privately-provided asset management software application that is similar to the Pontis software. The ideal is to move toward a more comprehensive prioritization system that takes the asset management process beyond the highway system to include other assets, such as signs and guardrails.

3.6 David Wresinski, Division Administrator, Project Planning, Michigan DOT

For many assets, MDOT has implemented some form of asset management to monitor conditions and to develop budgets that promote asset preservation. The agency's Strategic Plan contains strategic objectives related to asset management. These strategies are aimed at providing training on asset management principals and applications and to continue to use asset management to improve outcomes and efficiencies. MDOT uses several models to develop investment programs, including Cash Flow Model, Road Quality Forecasting System, and Bridge Condition Forecasting System. MDOT also has a Safety Program that uses the "time of return" method in the selection of projects.

MDOT's asset management process is managed by several TAM teams within the agency under the general guidance of the Department's Asset Management Council. A multi-agency team that includes MDOT and the Michigan Center for Geographic Information manages the MDOT asset management database, which contains projects, phase information and asset data. The agency uses templates to monitor major assets such as bridges and pavements, with data collected on distress index, remaining service life and international roughness index. MDOT also maintains inventory data on a wide variety of items, including traffic signals, traffic signs, culverts, guardrails, national inventory rail crossings, state-owned rail, freeway crossovers, ADA sidewalk ramps, endangered species habitat, wetland mitigation banking, public use airports, carpool lots, rest areas/roadside parks and snowmobile crossings. Each MDOT regional office is provided an annual budget for system preservation and is allowed to allocate the money for projects as appropriate for that region.

3.7 Leonard Evans, Administrator, Systems Analysis Planning, Ohio DOT

Ohio's transportation asset management system began with the development of a comprehensive measurement process for determining lane miles in the 1950s. Since then, a Base Transportation Referencing System (BTRS) has been developed as a standard with the ability to locate agency transportation data to roads within 1/100 mile. The DOT interfaces with a GIS system that provides the latitude/longitude position of where the data is located. Using the BTRS, transportation data can be mapped or integrated from several of the various DOT management systems. For example, the DOT Maintenance Division, which historically used a log-mile referencing system, is now able to directly collect data using a GPS-enabled touchpad computer to identify where problems exist along roadways.

The DOT has achieved statewide coordination of GIS efforts and imagery (with resolutions from twelve to six inches) and shared the BTRS standard with external agencies. These GIS efforts have also assisted local agencies in creating a location-based response system for 911 emergencies.

Recently, the DOT has begun expanding its efforts to inventory its assets. For example, the DOT has begun to include non-pavement/bridge structures, such as Mechanically Stabilized Earth (MSE), retaining and noise walls in inventories and inspections. Investments have been based on condition assessments, such as the M2S condition assessment Each quarter, assets such as lights are sampled to determine if they need to be replaced. A statewide performance index normalizes this analysis across regions. If significant variations across regions in the various indices are noted, the DOT will reallocate funds to provide additional resources to deficient locations.

It was noted that the Ohio DOT foresees the state's asset management system improving over time as the state works toward a more comprehensive asset inventory process. A long term goal is to perform life-cycle cost analyses. Presently, beyond pavement and bridge assets, the DOT evaluates costs only for individual projects.

3.8 Cathy Nelson, Chief Engineer, Oregon DOT

Oregon has a regionally-based, decentralized asset management process for bridges and pavements. The state manages about 7,000 miles—20% of all roads, which carries 70% of total statewide traffic. While the Oregon DOT (ODOT) plays a major role in transportation system maintenance, its role can be considerably less substantial in the planning process, depending on which part of the state is involved.

ODOT recently undertook a pilot program within one if its regional offices to identify gaps in available data. Lessons learned from the program revealed that large amounts of data were already available with differing levels of readiness and that it was not essential to know every detail about each asset. The pilot program allowed challenges to be identified and assets to be prioritized.

ODOT employs an overall data management structure that includes assigning units within the Department as "owners" of various data sets and assessing and tracking the readiness of various asset classes for evaluation in the context of data availability and quality. This management structure helps ODOT prioritize asset classes and establish and track data needs in an orderly and strategic manner.

ODOT maintains a statewide inventory of data collected for traffic barriers, signs, bicycle facilities and sidewalks (on the state system). ODOT is also developing, but has not yet completed an inventory of retaining walls and culverts. In addition, ODOT has implemented improvements to automated data collection that is facilitating the availability of right of way data.

ODOT has been working on integrating data across the state because there are multiple systems that collect different information that are managed by numerous regions. Data is now being used to communicate with management about the level of resources that should be dedicated to certain programs. The DOT is trying to convince state, regional, and local management that asset management is an ongoing investment rather than a short-term initiative.

ODOT strives to accurately and consistently collect data and to use the data for improved planning. Data-driven recommendations are provided to steering committees and decision makers to improve the decision making process.

3.9 Mel Adams, Director of Systems Planning and Policy, Vermont AOT

Vermont is a small state with under 700,000 people, yet there are 3,000 miles of roads, 3,000 bridges, and 4,000 culverts to maintain. Overall, the management of roads within the state is fairly centralized within the Vermont Agency of Transportation (VTrans), which employs 1,300 people. The state recently began a "Road to Affordability" campaign with a focus on maintenance and preservation of assets rather than capacity expansion.

VTrans uses digital terrain maps (DTM) and Pontis for collecting data on roads and structures; data have been collected on these assets for 30 years. The University of Vermont's Center for Geographic Information also helps provide data collection technology for VTrans. Although there is adequate data collection for roads and bridges, the state has only recently begun to collect data on rail structures and other assets, and most of these data are not yet sufficient for use in asset management. Further, VTrans conducts economic analyses for only pavement and bridge asset classes at this time. VTrans would like to further develop its prioritization process. Once a priority system is in place, it will be easier to sustain.

In Vermont, the selection of asset classes for management focus has been generally driven by the existing transportation program structure. While VTrans has 12 main asset categories, it has focused on only six of these to date, including culverts, signs, signals, park & ride facilities and aviation related items at state-owned airports. In recent years, VTrans has placed particular focus on culverts because many are beginning to fail and there is concern about culverts' resiliency as weather extremes become more frequent. When originally installed, there was typically little knowledge of most culverts' life-cycles. Thus, VTrans closely examines certain critical large culverts, determines treatment options, and prioritizes them to avoid a catastrophic failure. However, a regular schedule for updating culvert inventory and condition information statewide has not been established.

4. Discussion of Challenges and Opportunities

Peter Plumeau facilitated a general discussion of asset management issues around three broad categories: process, data and results.

4.1 Asset Management Process

Because of its complexity, the TAM process works best when approached from a systems perspective. As asset management evolves to consider more "beyond the pavement" asset classes, it will become more complex. This growing complexity underscores the need to continue researching and improving approaches to and applications of TAM. For example, developing and disseminating methods and tools that provide the means to more effectively predict life-cycles and associated costs will only improve the TAM process. In many state DOTs and some MPOs, efforts are underway to move toward a performance-based planning approach to TAM. Further, in some DOTs, the TAM process is being integrated with the transportation planning process at the planning unit level. Although challenging, particularly in state DOTs that are highly decentralized, the need to improve agency and

system performance and cost-effectiveness requires developing approaches that allow for TAM across asset classes.

In the TAM process, developing and using appropriate deterioration models is essential to accurately predict the lifespan and maintenance/replacement needs for various assets. Overall, there is limited information on how long certain assets will last. For other types of assets, such as retaining walls, there are multiple layers of complexity – not only are these assets more technically difficult to assess, the data collected through typical assessments do not fit easily into existing TAM database structures.

Among the challenges to having successful and beneficial TAM processes is the need to increase the use of TAM as a future-oriented decision-making tool (proactive). TAM can be a powerful tool for understanding the actions and resources required over time to effectively preserve and maintain infrastructure assets. For example, a bridge failure should not be the trigger for preservation or modernization action; rather, effective use of TAM should enable a clear understanding of how and when assets are going to fail, and this applies to all assets, not just pavements and bridges. Part of the challenge in making TAM part of the basic transportation investment decision-making process is learning how to effectively communicate to policy-makers the benefits of using TAM and moving away from the "worst first" approach to maintenance and preservation.

Participants identified potential asset management process improvements. For example, it was suggested that transportation agencies and organizations convene committees of asset owners to help guide the TAM process, establish prioritization criteria, etc. Federal support needs to come in the form of research (risk analysis), guidance, and capacity building. In addition, FHWA, NCHRP or others could facilitate creation of a "template" that uses the current "laundry list" of assets and aligns them with specific possible investment decisions. Asset managers also could benefit from learning about utilities, as little is know about this aspect of TAM. Some participants also suggested that USDOT or others convene Webinars on facilitating local involvement in the process and on sharing the results of the peer exchange.

4.2 Asset Data Collection

Data collection techniques used in the TAM process need to be reviewed and updated, particularly concerning assets "beyond the pavement." Some DOTs are attempting to determine which data need to be migrated to newer systems and how to perform needed data integration. States are also trying to examine the many different systems and applications that currently exist for TAM data collection. Some states have developed data warehouse systems, allowing the submission and use of data. Other states have many separate databases that need to be synchronized in order to develop comprehensive asset inventories and analyses.

Manual data collection can present problems, such as variations among the different techniques used by people collecting data. Efficiency can also be an issue; for example, driving on roads to collect data may not be cost-effective with high fuel prices. Some agencies use college students to manually gather data about assets, which is an inexpensive but possibly unreliable method. Some participants wanted to know more about the technique of collecting geo-located data.

Participants generally agreed that it would be useful to have information on "best practices" in data management and on options for migrating data to new, state-of-the-art systems that some DOTs are now using. In addition, if there were some agreed upon data structure (and even types of criteria to collect) for TAM, then systems could be constructed to manage the data and methods or models could be built that would be transferable. Participants also recognized that when collecting information on assets, it is important to know when "we hit the point of diminishing returns."

4.3 Asset Management Results

The classification of different assets presents many challenges for agencies. DOTs may represent results differently, agencies and organizations within a state may categorize results in diverse ways and the variations among assets create complications.

Currently, there is significant variability in how states classify assets and represent TAM results. Because state agencies and organizations have varying structures and techniques, a standardized template or format would be difficult to achieve. Even within states that have one main agency, a common language is not always utilized to manage assets. Some participants felt that it may not be necessary to have total consistency across states as long as there are consistencies within individual state TAM processes.

Within states and even within individual agencies, there are differences in how asset management results are used and interpreted. One challenge is that DOTs today have a broader mobility focus rather than being focused solely on highways. Another challenge is that within the planning process, the asset management approach may change as goals change. Communication within and across agencies is also important, especially with communicating complex issues to the public. The issue is both technical (data governance, data dictionary, etc) and "cultural" because agencies need to be able to communicate clearly. Another important issue is lack of resources. Because there are less funding and revenues, money allocation becomes tighter. There is a concern that integrating and condensing the management of assets may cause regions to loose funding.

There are also many differences between asset classes. One example is "costs." Factors to consider for costs are materials, labor, and which issues the costs will cover. A seemingly simple measure, such as cost, can have great variability—complicating the data and results. The variations within each asset and between assets complicate the standardization of the process. In addition, agencies need cost estimates to develop asset maintenance, rehabilitation, repair and replacement priorities.

Although there are challenges with unifying asset management techniques, participants believed that FHWA technical guidance would be helpful. Definitions need to become more unified as do the different ways that key terms can be used. For example, the different ways that cost can be used could better be defined. Similarly, there is a need for support in determining when a feature should be considered within a particular asset class. For example, when does a retaining wall containing a culvert inlet/outlet become a culvert headwall? An FHWA template would be useful for agencies, regardless of the variations amongst states. It would also be helpful for FHWA and AASHTO to define each of the items within TAM (traffic barrier, curb, etc.) to overcome discrepancies in definitions.

Participants also suggested that additional peer exchanges on communicating engineering and technical results to other departments, the public, and decision-makers would be helpful and beneficial for TAM practitioners.

5. Recommendations for Action and Additional Research

Based on the discussions during the peer workshop, participants identified several recommendations for further work by the AASHTO Asset Management Subcommittee and the FHWA. The following summarizes these recommendations:

- Expand NCHRP Synthesis 371 - *Managing Selected Transportation Assets: Signals, Lighting, Signs, Pavement Markings, Culverts, and Sidewalks* - to:
  - Move toward consistency within the TAM process and definitions (within each TAM process)
  - Match data types with the decisions TAM should enable (what types of data need to be collected)
  - Enhance options for dissemination/knowledge-sharing: FHWA guidelines, webinars

- Establish a hierarchy of assets for establishing inspection protocols (inventory, condition, etc.)
  - Develop methodologies for determining the life-cycles of different assets
  - Incorporate utilities into the TAM process, possibly via SHRP 2

- Facilitate more participation by localities in TAM activities
  - The MPO role?
  - Can this be facilitated through LTAP and/or APWA initiatives?

- Identify effective and workable approaches to organizing for TAM across asset classes
  - Systems interdependencies (e.g., lighting)
  - Are we ready for Performance-based Decision-making?
  - Can we plan at a system level?
  - Collaborate with AASHTO Maintenance Committee

- Identify best practices in TAM data collection, integration and management methods
  - Geo-referencing
  - Where is point of diminishing returns?

- Develop methods for more effective communication on TAM with decision-makers

- Identify and apply risk analysis techniques for TAM

- Develop better asset management practices for non-infrastructure equipment

- Develop a methodology for conducting benefit-cost assessments for determining asset classes

- Develop a framework for prioritizing and making decisions across various asset classes

- Facilitate continuous information-sharing on asset class categories used by agencies across the nation (but NOT one-size-fits-all)

- Develop methods and guidance for quantifying the costs of TAM

- Develop a guide to assets:
  - Inventory, condition, performance
  - Strategic vs. non-strategic

APPENDICES

A. WORKSHOP AGENDA

B. SELECTED WORKSHOP PRESENTATIONS

Appendix A
Workshop Agenda

PEER WORKSHOP ON INVENTORY & ASSET MANAGEMENT OF OTHER ASSET CLASSES

CONVENED BY THE AASHTO SUBCOMMITTEE ON ASSET MANAGEMENT AND STANDING COMMITTEE ON PLANNING (SCOP)

MONDAY, JULY 14 & TUESDAY, JULY 15, 2008
1-5 PM PDT (EACH DAY)
MARRIOTT HOTEL, MONTEREY, CA

AGENDA

DAY 1 – MONDAY, JULY 14

1:00-1:30	Welcome, Introductions, Purpose & Goals	Neil Pedersen, Chair Butch Wlaschin, FHWA Robert Ritter, FHWA Peter Plumeau, RSG, Facilitator
1:30-3:00	Presentations on Current Practices & Related Issues by Participants (~15 minutes each) and Q&A	Participants (Q&A managed by Plumeau)
3:00-3:15	Break	
3:15-4:45	Presentations by Participants continued	Participants (Q&A managed by Plumeau)
4:45-5:00	Day 1 Summary and Preview of Day 2	Peter Plumeau, RSG
5:00	Adjourn	

DAY 2 – TUESDAY, JULY 15

1:00-1:15	Recap of Day 1 and Objectives for Day 2	Peter Plumeau, RSG
1:15– 3:00	Facilitated Discussion – Issues, Options and Opportunities (articulate different asset classes)	Facilitated by Plumeau
3:00-3:15	Break	
3:15-4:00	Facilitated Discussion continued	Facilitated by Plumeau
4:00-4:45	Workshop Synthesis – Themes, Issues, Recommendations for AASHTO & FHWA	Facilitated by Plumeau
4:45-5:00	Concluding Remarks & Adjournment	Chairpersons
5:00	Adjourn	

Appendix B
Selected Workshop Presentations