IDENTIFICATION OF OPERATIONS ASSETS

FHWA-HOP-05-056

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16. Abstract

This investigation will provide an informational foundation for operations asset management. Identifying the operations assets will establish a base line from which analytical capabilities; and data, information, and performance measure needs can be identified. The information will also help characterize aspects of operations asset management. The results of this investigation will help draw the lines between operations and other different asset areas and facilitate discussion on those assets that straddle the lines between the areas. The resulting report will not be the final word or a definitive list but an initial identification of what may constitute the range and breadth of operations asset. As work proceeds on Transportation Asset Management, the results of this work will provide some of the information necessary to develop a sound and robust Transportations Asset Management framework.

The investigation begins with a generic organizational framework that is first developed to be used to categorize operations assets. It takes into account current and future organizational functions that will be needed to support 21st century transportation operations. It includes a generic transportation operations section organizational chart with section and unit titles, and short descriptions that identify each unit's responsibilities.

Using the generic operations unit organizational framework as a backdrop, then operations assets are identified. These are based on investigations of current operations organizations, transportation and others, to assist in the identification of transportation operations assets. Current and envisioned operations functions, programs, and activities are accounted to facilitate operations assets identification. An alphabetized list of operations assets is then created.

Using the alphabetized list of assets completed, the operations assets are categorized as primarily physical, system, or personnel, and if applicable breakdown assets into physical, system, and personnel components.

Finally, a final chart is created that identifies operations assets by class and unit designation.

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INTRODUCTION

This investigation provides an informational foundation for operations asset management. Identifying the operations assets will establish a base line from which analytical capabilities; and data, information, and performance measure needs can be identified. The information will also help characterize aspects of operations asset management. The results of this investigation will help draw the lines between operations and other different asset areas and facilitate discussion on those assets that straddle the lines between the areas. This resulting report is not the final word or a definitive list, but an initial identification of what may constitute the range and breadth of operations asset. As work proceeds on Transportation Asset Management, the results of this work will provide some of the information necessary to develop a sound and robust Transportations Asset Management framework.

This report summarizes the development of the investigation according to the four tasks involved. A summary of each task activities and the outputs generated are detailed in the following sections.

TASK 1

This initial task is intended to develop a generic organizational framework that can be used to categorize operations assets. The framework is based on a study of current operations units to identify possible characteristics and organizational sub-unit designations, and consideration for the support of 21st century transportation operations.

Prior to studying the current activities of the various public agency operations units, it is important to have an accepted understanding of what *operations* is. While there is not generally a clear, professionally-recognized definition, one dictionary-based definition below is taken from *Encarta:*

Operations **-** controlling of organized activities: the supervising, monitoring, and coordinating of the activities of a military or civilian organization or a complex machine. (Encarta definition)

Considering the application of *transportation operations*, the previous definition is revised accordingly as follows:

Transportation Operations - controlling of organized activities: the supervising, monitoring, and coordination of activities of a transportation network.

In 1999, as the profession was gaining awareness of *operations*, Dr. Christine M. Johnson said at the 69th ITE Annual Meeting: "…we have expanded our core mission, for the first time, to include a mission of operating the system – actively managing its performance – safely and efficiently....(and that) operating a system almost inherently means process – the integration of actions, systems, users, etc….".

So what activities are managing this integration of actions, systems, users, etc.? Which activities within transportation agencies are considered "Operations"? It is noted that Transportation Operations has characteristics that are performance-oriented for the customer, consider human

factors as opposed to straight functional requirements, affects safety and mobility, and is continuous on a 24/7 basis. This varies from capacity expansion activities that are mainly function-based.

Review of Pavement and Bridge Asset Management Systems

Asset management has been slowly increasing in stature within the transportation community as a way to manage transportation assets. In its current state, asset management has consisted primarily of the management of infrastructure assets, specifically pavements and bridges. Pavement and bridge management systems represent the first level of asset management. Each of these systems assists asset owners in evaluating specific assets, identifying deficiencies, and helping prioritize improvements.

Pavement Management Systems (PMS) have been around since the early 1960's, tracing their early history back to the AASHO Road Tests of the late 50's and early 60's. Over time, all states have instituted some sort of PMS and assigned the maintenance of such a system to various branches of their DOT. The most common units within a DOT to maintain PMS include those associated with materials, design, construction and maintenance. The states that have put PMS under their materials units tend to have a more research-oriented outlook on pavement management. Other DOT's may be more oriented toward future repair and rehabilitation needs within the state.

Bridge Management Systems (BMS) is a much newer system used by the State DOT's. BMS has only been around for the last 20 years or so, with many of the states deploying BM as a result of initiatives occurring as a result of the ISTEA legislation during the 1990's. Due to expertise required for the system, it is generally managed by the structures or bridge units within the State DOTs.

Review of Current Operations Units

An outreach to several state and local transportation agencies that are somewhat more advanced in the deployment of 21st century technologies was performed for this review, in addition to literature research. While transportation is a multi-modal issue, and the operations focus is becoming more multi-modal, this study basically focuses on "Roadway-Based Operations", while recognizing there are multi-modal considerations in the process. The agencies that were reviewed include the following:

City of Anaheim, California
City of Portland, Oregon
City of Tallahassee, Florida
Salt Lake City, Utah
Harris County, Texas
Los Angeles County, California
Montgomery County, Maryland
Port Authority of New York and New Jersey
Arizona Department of Transportation
California Department of Transportation
Illinois Department of Transportation
Nebraska Department of Roads
Virginia Department of Transportation
Washington State Department of Transportation
Wisconsin Department of Transportation
Illinois State Toll Highway Authority
Metropolitan Government of Nashville and Davidson County, Tennessee

Local agencies usually place Roadway-Based Operations units in a public works department, while others are situated in traffic engineering departments, transportation departments, engineering departments, or others. Roadway-Based Operations units can be found in various designated functional units in State agencies, including: operations, engineering, traffic engineering, maintenance, and others, often spread across multiple units mostly in regional district organizations rather than the headquarters.

Proposed Generic Organizational Framework

A list of operations activities that may be performed by an agency unit was developed based on the research, then put into an organizational framework. It is believed no single agency has all of the units identified below. In many cases, actual agency units may perform more than one of the unit functions noted below. Considerable interaction and coordination is generally required across the units. Figure 1 below represents a generic organizational framework that will support the identification and categorization of roadway-based operations assets. The framework is followed by brief descriptions and explanations of the categorization breakdown by generic operational section and unit.

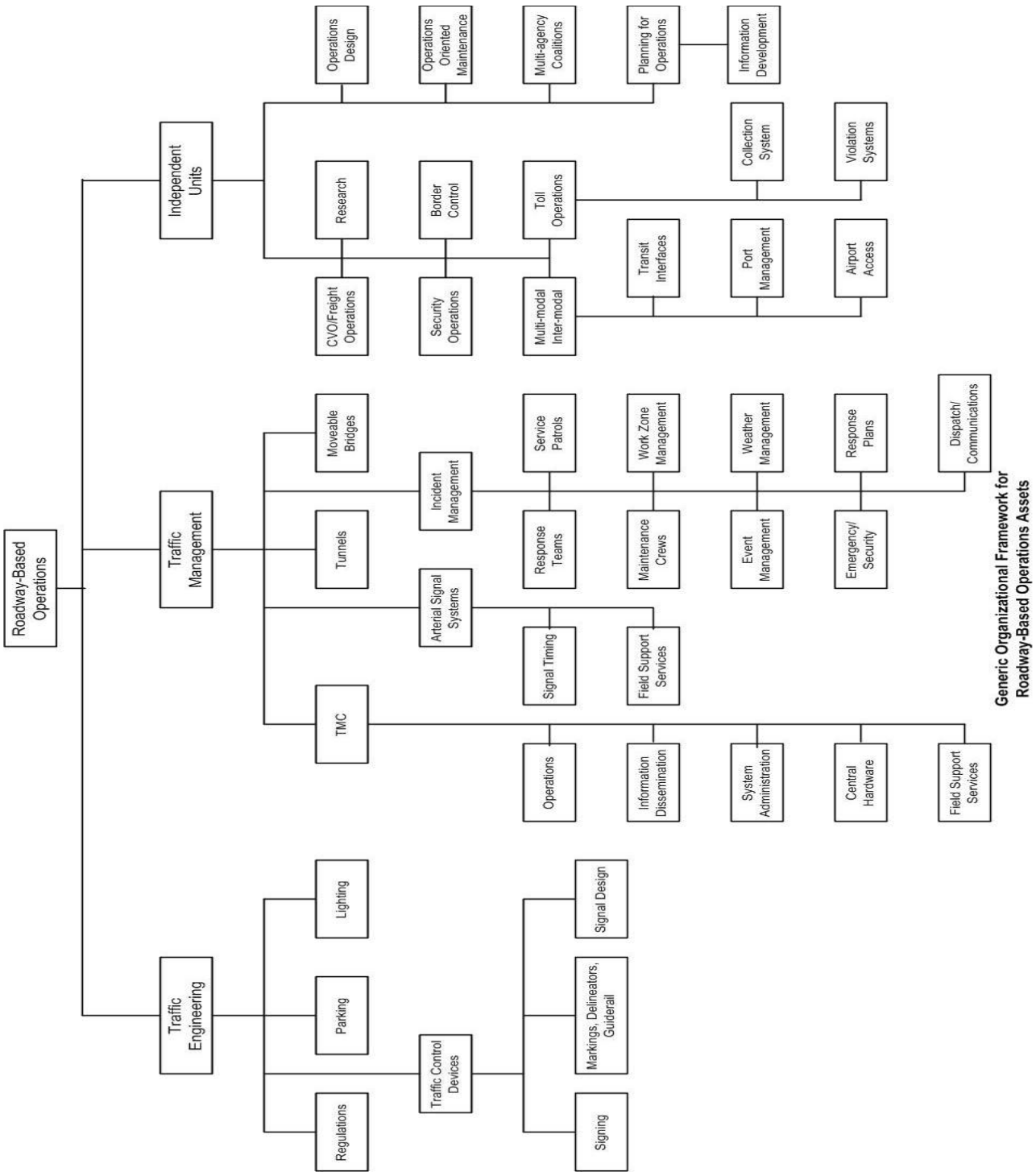

Roadway-Based Operations
Traffic Management
Independent Units
Traffic Engineering
Operations Design
Operations Oriented Maintenance
Multi-agency Coalitions
Planning for Operations
Information Development
Research
Border Control
Toll Operations
Collection System
Violation Systems
CVO/Freight Operations
Security Operations
Multi-modal Inter-modal
Transit Interfaces
Port Management
Airport Access
Moveable Bridges
Tunnels
Arterial Signal Systems
TMC
Incident Management
Service Patrols
Work Zone Management
Weather Management
Response Plans
Dispatch/ Communications
Response Teams
Maintenance Crews
Event Management
Emergency/ Security
Signal Timing
Field Support Services
Operations
Information Dissemination
System Administration
Central Hardware
Field Support Services
Lighting
Parking
Regulations
Traffic Control Devices
Signal Design
Markings, Delineators, Guiderail
Signing
Generic Organizational Framework for Roadway-Based Operations Assets

Figure 1

Traffic Engineering - Associated with the planning, monitoring, geometric design and traffic operations of roads, streets, motorways, their networks, and their relationships with other modes of transportation for the safe, efficient and convenient movement of persons and goods (definition from ITE). This section is fairly traditional with a long history of experience within transportation agencies and the industry. Decisions may require extensive analysis before deploying changes to the transportation network.

Regulations – This unit helps develop new and revised traffic laws and ordinances - i.e. speed limits, no passing zones, and prohibitions of specific movements.

Use of Traffic Control Devices – This unit is responsible for the applications of traffic control devices, following the guidelines of the MUTCD. It may include sub-units for each class of traffic control applications:

- Signing – Addressed the addition, deletion, modification and replacement of signing. Include responsibilities for design, location and operations to maintain uniformity. Sign manufacturing, installation and maintenance are placed in the Operations Maintenance unit. Note that many agencies' sign inventories may be part of a maintenance management system.

- Pavement Markings/Channelization/Guiderail – Addresses all devices, except signs, that are applied upon or attached to the pavement or mounted at the side of the roadway to guide traffic or warn of an obstruction. Similar responsibilities as above.

- Signal Design – Addresses any power-operated traffic control device by which traffic is alternately directed to stop and permitted to proceed. Responsibilities include: warrants analysis, design of all equipment, and operational phasing diagrams. Signal timings are placed in a sub-unit under Arterial Signal Systems in the Traffic Management Section, due to its real-time nature. Signal installation and maintenance is placed under Operations Maintenance.

Parking – This unit addresses the provision and operation of parking, both on street, off-street. Responsibilities may include: zoning studies, access considerations, design, and for some agencies operations (i.e. meters, lots).

Lighting – This unit addresses highway lighting to satisfy the needs of drivers and pedestrians. Responsibilities include: warrants analysis, design of light source luminaire and placement, maintaining uniformity over a system. Lighting is usually implemented as part of a capital project, but can be modified in an operations process. Lighting maintenance is placed under Operations Maintenance.

Traffic Management – Is **"**the utilization of personnel (traffic operations and enforcement), materials, and equipment along freeways, city streets, and rural highways to achieve safe and efficient movement of people, services and goods" (ITE Traffic Engineering Handbook). This

section is more instantaneous and dynamic than Traffic Engineering, as it addresses the various types of congestion-causing incidents. Decisions are frequently made in "real-time".

Traffic Management Centers (TMC) – This unit addresses all the functions directly related to the activities that take place in a TMC. Because of the varied skills required, it may be divided into several sub-units, identified below:

- Operations – Addresses real-time monitoring and control of the Advanced Traffic Management System (ATMS) that is housed is the TMC. Its responsibilities include information gathering or collecting from the ATMS and information sharing with other stakeholders (i.e. incident information to emergency responders).

- Information Dissemination – Addresses the processing of data and video for traveler information purposes, and the dissemination of information to media, customers and other partnering agencies, i.e. '511' and other traveler information systems. These functions are usually contracted to Information Service Providers (ISP).

- System Administration – Addresses management of integrated software-based systems and system configuration management plans.

- Central Hardware – Addresses operations and maintenance of all central hardware housed in TMC facility/building, including communications interfaces.

- Field Support Services – Addresses maintenance and support of field elements that are connected to the TMC which provide data gathering and traffic control functions (may be placed in a Maintenance section or division). Examples are system surveillance detectors, CCTV cameras, dynamic message signs, and associated power and communications.

Arterial Signal Systems – This unit addresses signalized intersection controllers interconnected to a central computerized system. The real-time operations of these systems is generally addressed in the TMC, however, other significant efforts are required for the operations of these systems. There are two sub-units identified which support this function:

- Signal Timing – Addresses the timing plans and parameters that are used for the operations of signalized intersections. Information to generate timing plans and parameters may come from internal system data collection functions, other system data collection functions, manual data collection functions (e.g. turning movement counts) and other units (e.g. geometric information, planning studies).

- Field Support Technicians – Addresses the maintenance needs for traffic signals and signal systems. This is very specialized work required within the intersection signal controller cabinets.

Incident Management – This unit addresses all activities related to incident management outside of the TMC. The diverse range of activities is represented by the following sub-units:

- Dispatch/Communications – Addresses dispatching and communications to field personnel, including operations of radio equipment and Automatic Vehicle Location/Computer Aided-Dispatch systems. This unit and function may be co-located with the TMC Operations or Operations Oriented Maintenance units.

- Incident Response Team – Addresses the on-scene response activities, including DOT personnel, Police, Fire, Emergency Medical Services, Towing, Hazmat, and other responders.

- Service Patrols – Addresses personnel who operate mobile service patrol vehicles that provide motorist assistance and may provide support at crash scenes or other incident sites.

- Maintenance Crews – Addresses response from the DOT that may provide traffic control and clean-up support functions for incidents. Personnel, vehicles, equipment and communications from this unit may be used in response to weather incidents like snow/ice removal and flood control.

- Work Zone Management – Addresses contracting procedures, construction phasing, lane closure permitting, traffic control, and awareness campaigns related to workzones for long-term capital construction, short-term maintenance, and moving operations. This sub-unit may be found in other sections.

- Planned Event Management Coordination – Addressed the advanced planning and coordination related to special events that impact traffic operations.

- Weather Management – Addresses adverse weather-related events and responses using weather warning forecasts and road-weather information systems. Personnel, equipment and communications may come from a variety of units to perform related support duties, including maintenance crews.

- Emergency/Security – Addresses emergency coordination efforts for emergency and national security events (i.e. earthquakes, evacuations, threats of terrorism).

- Strategic Response Plans – Addresses the preparation of traffic response plans to be used during possible incidents, including: mitigation measures, alternate/diversion routing, evacuations, etc. This sub-unit may overlap some of the others.

Moveable Bridges – This unit specifically addresses the operations of moveable bridges.

Tunnels – This unit specifically addresses the operations of tunnels.

Independent Units may include the following:

Toll Payment Collection – This unit addresses the operations of toll collection facilities. Although common with toll highway agencies, some state and local agencies have such facilities, and more are emerging through the implementation of managed lane facilities. It is also noted that many agencies consider Toll Payment and Processing as a separate entity on par with, or more important than, Traffic Engineering or Operations Planning.

- Manual Collection/Electronic Payment - Addresses the manual/electronic operations of the toll collection process.

- Violation Enforcement – Addresses the violation enforcement element of the toll collection process.

Planning for Operations – This separate unit may be placed in a planning section that plans for capital and operational projects. Responsibilities include: architectures, long range plans, systems planning process, modeling/analysis, concepts of operations, performance measurements/evaluations.

- Transportation Information Management – This unit consists of the providers of transportation information, though traditionally have not been inclusive of ITS information. The information inventories are usually geographically referenced, and linear-based. It is most commonly found in Planning sections due to the need for information in performing planning analysis.

Operations Project Management – This separate unit may be found in a capital design/construction or project management section that addresses capital and operational projects. Responsibilities include: system requirements, design plans, specifications, procurements, inspections, as-builts, and acceptance tests.

Operations Oriented Maintenance – This separate unit is usually placed in a Maintenance section, but impacts operations by providing maintenance support for operational assets. Examples include maintenance of: sign fabrication, removal, replacement, installation; signal hardware installation and maintenance (may not include cabinet equipment); pavement markings installation and maintenance; and roadway lighting.

Research – This separate unit may be found in various parts of an organization. Responsibilities include those supporting operations based activities.

CVO/Freight Management – This separate unit is usually found in planning sections or on its own. Responsibilities include: CVISN; safety monitoring; credentialing; enforcement; emissions testing (DMV activities); supply chain management (i.e. FIRST program in New York).

Border control – This section is not common to all state and local transportation agencies, but certainly impacts operations. Responsibilities may include international visitors and goods, or other inspection services (i.e. California and Arizona agriculture departments).

Security Activities – This section addressed security functions that have more recently emerged in level of importance.

Multi-modal/Inter-modal Operations – This section addresses multi-modal and inter-modal activities that can impact roadway operations. These units may fall outside the jurisdiction of a DOT, but require inter-agency coordination. Possible sub-units include:

- Port management – Addresses shipping and rail connections. This is usually under the responsibility of a port authority. Ferries are an example operation for passenger travel.

- Transit stations/centers – Addresses connections and interactions of roadway operations with transit bus or rail. This requires coordination usually with a transit agency.

- Airport surface transportation – Addresses the access from the roadway network to the airport. This requires coordination usually with a separate authority.

Regional/Multi-agency Coalitions – Though usually not a specific unit within an agency, this is a growing activity due to the emergence of integrated ITS systems, information sharing and coordination of activities, incident management, signal systems (i.e. TRANSCOM, Gary-Chicago-Milwaukee Corridor).

TASK 2

This task develops an alphabetized list of transportation operations assets, presented in a table (Table 1), following a description of assets associated with the Organizational Framework presented in Task #1 (as shown in Figure 1). Each asset identified in the text is underlined with an ID number matching its location in the table for reference purposes.

Roadway-Based Operations Units

There are some assets that are common across all the sections/units identified in the organizational framework: inventories – location/characteristics/condition (for equipment(45), vehicle fleet(47), systems(46)), personnel(64-84) (quantity, expertise), budgets/funding(17), and strategic plans(119). Some of these assets are detailed further under the respective sections/units.

Traffic Engineering – An overview of the personnel, equipment and systems resources found in Traffic Engineering units is provided first, followed by the more specialized resources for the units within this section.

Traffic Engineering units have a broad range of personnel of various, sometimes unique, titles found throughout the agencies investigated for this project. Positions range from senior management to junior level support, including engineers, planners, technicians and administrative/clerical support. Engineers(70) can very in background, with the most common including Traffic, Transportation, Civil and Electrical. Planners(79) are professionals with focus on planning and policy perspectives. Technicians basically consist of office-based(75), IT support(73), and field-maintenance staff(71). Administrative staff(64) is mostly clerical, but can have other unique titles that support the units. Planners are not too common in these units.

Vehicles(150) are very common equipment resources for all units, due to the need for field data collection and analysis. Some vehicles may be specially equipped for these functions.

System resources include files and records of the various information required to support the units. Computer workstations(26) are very common, and may include specialized software(115) to support the units' specialized work.

> ***Regulations*** – System information includes records(91) or files of regulations and associated investigations for various regulations; such as speed limits, no passing zones, turn prohibitions, one-way streets, on-street parking. Specialized equipment in the vehicles may include speed and distance measuring devices(117).
>
> ***Use of Traffic Control Devices*** – Assets can include a variety of traffic control devices(137-139), mostly consisting of signs, pavement markings and signals.
>
> - Signing – Assets include: signs(98), sign fabrication shop(96), signing materials(113), storage facilities(118), and sign management systems(97).

- Pavement Markings/Channelization/Guiderail – Assets include: striping materials(120), delineators(28), and barrier wall – portable sections(15).

- Signal Design – Assets include an equipment inventory: poles(107), mast arms(106), signal heads(103), signal indications(104), mast arm signs(105) (including internally illuminated street name signs(44)), detectors(29), cabling/wiring(18), cabinets(27), controllers(101), signal preemption/priority equipment(108), power service(89) and communications(22-23). Another asset is an intersection inventory which identifies signal subsystems(109) (groups of interconnected and coordinated intersections) and the physical location of signal equipment (design plans/as-builts(102), traffic counts(141) and traffic studies(143)).

Parking – Agencies with responsibilities for operations of parking facilities include some additional special resources: parking operations systems(61), payment collection and revenue systems(63), and meters(62). Additional personnel resources may include: enforcement(77) and attendants(76).

Lighting – Additional equipment for this unit includes: luminaires(51), lighting control systems(50), cabling/wiring(18), and power services(89). Other resources are design plans/as-builts(102) and bucket/lift trucks(16) (may be shared with Maintenance units).

Traffic Management – The units under this section may include those noted under Traffic Engineering; personnel (Engineers(70), Planners(79), Technicians(75,71), and Administrative staff(64)), vehicles(150), and computer workstations(26) with specialized software(115). In addition are some more specialized personnel that are identified in the subsequent units.

Traffic Management Centers (TMC) – Traffic Management Centers(121) vary greatly in size and content amongst operating agencies, and may include: building facilities, operator consoles, wall displays with monitors, conference rooms, technician rooms, media centers, radio equipment, computer-aided dispatch, and communications interfaces.

- Operations – Assets include: ATMS computer hardware and software(8,9), offline traffic model/software(142), operating parameters/plans(11), graphical user interface(10), Operators(82), and the following portable and permanent field devices with respective support structures – vehicle detectors(29), dynamic message signs(31), CCTV cameras(20), road weather information systems(94), ramp control devices/meters(90), lane control signals/signs(49), dynamic speed control signs(32), highway advisory radio(38), call boxes(19), moveable barrier walls(54), flashing beacons(37), communications(22-23) and power services(89).

- Information Dissemination – Assets include: ATIS computer hardware and software(3-4), and interagency information exchange networks(43). These systems can disseminate over a variety of media, some of which may be

owned by an agency ('511'(155), websites(7), kiosks(5), radio stations(6)), as well as others (television, PDA's, in-vehicle signing and navigation).

- System Administration – Assets include: network software(126) and System Administrators(81).

- Central Hardware – Assets include: central system hardware(122) and computer system technicians(67).

- Field Support Services – Assets include: Field Technicians(71), maintenance equipment(52) (power tools, hand tools, ladders, shovels, and brooms), electronic and communications testing equipment(33), system fault reports(129) and work orders/activities/history(153).

Arterial Signal Systems – These assets may be a part of a TMC and ATMS system and include similar components.

- Signal Timing – Assets include: signal controllers(101), signal subsystems(109), controller firmware(100), communications(22-23), central computer hardware(99), computer workstations(26), computer system technicians(67), signal system software(111), signal timing operating parameters/plans(112), and graphical user interface(110).

- Field Support Services – Assets similar to those for TMC Field Support Services.

Incident Management – These assets are closely coordinated and integrated with TMCs.

- Dispatch/Communications – Assets include: dispatchers(68), two-way radios(149), cell phones(21), pagers(60), AVL equipment(14), computer-aided dispatch systems(25), and consoles(30).

- Incident Response Team – Assets include: incident response team members(72), incident response team vehicles(42), traffic control equipment(140) for site management and diversion routes.

- Service Patrols – Assets include: service patrol vehicles(95), service patrol personnel(80), vehicle repair equipment(151) and first aid equipment(36) in each vehicle.

- Maintenance Crews – Assets include: maintenance staff(74) and maintenance resources(53) (both shared with Maintenance units).

- Work Zone Management – Assets include: traffic control equipment(140) and barrier wall – portable sections(15) in advance and through the work

zone, work zone plans(154), speed measuring/display equipment(117), and assorted portable ATMS equipment(as listed under TMC Operations).

- Planned Event Management Coordination – Assets include: planned event coordinators(78) (may be shared with other agencies), planned event information(85), and planned event response plans(86).

- Weather Management – Assets include: road weather information systems(94), weather forecast systems(152), automated anti-icing systems(13), ice removal materials(39), and snow plow trucks(114) (shared with Maintenance units).

- Emergency/Security – Assets include: response plan(34) information and evacuation routes(35) for various emergency/security scenarios.

- Strategic Response Plans – Assets include: response plan(41) information and incident diversion routes(40) for various incident scenarios.

Moveable Bridges – This unit manages moveable bridges with each including the following assets: local control facility(55), operating systems(56), security systems(57), bridge operators(66), and maintenance staff(74).

Tunnels – This unit manages tunnels with each including the following assets: local control facility(146), operating systems(147), security systems(148), tunnel operators(84), enforcement(83) (shared with enforcement agency), and maintenance staff(74).

Independent Units – These units share information, services and facilities with Operations. Detailed information not included, but each is included in the table of Operational Assets.

Toll Payment Collection

- Manual Collection(134)
- Electronic Payment(133)
- Violation Enforcement(135)
- Customer Service(132)

Planning for Operations

- Archived Transportation Information Management(2)

Operations Project Management

Operations Oriented Maintenance

Research

- Evaluations(92)
- Study Results(93)

CVO/Freight Management

- Oversize/overweight permits(59)
- Tracking of hazardous materials(136)
- Inspection/weigh stations(145)

Border control

Security Activities

Multi-modal/Inter-modal Operations – Interfaces with:

- Port management(88)
- Transfer stations/centers (transit)(144)
- Airport surface transportation(1)

Regional/Multi-agency Coalitions

- Information exchange networks(43)

TABLE 1 - OPERATIONAL ASSETS IN ALPHABETICAL ORDER (Page 1 of 5)

1. airport surface transportation information
2. archived transportation information management
3. ATIS computer hardware
4. ATIS computer software
5. ATIS kiosks
6. ATIS radio stations – high powered
7. ATIS websites
8. ATMS computer hardware
9. ATMS computer software
10. ATMS graphical user interface
11. ATMS operating parameters/plans
12. ATMS surveillance detectors
13. automated anti-icing systems
14. AVL equipment for operations vehicle fleet
15. barrier wall – portable sections
16. bucket/lift trucks
17. budget/funding
18. cabling/wiring
19. call boxes
20. CCTV cameras
21. cell phones for staff
22. communications – wireless
23. communications – wireline
24. communications testing equipment
25. computer-aided dispatch
26. computer workstations
27. controller cabinets
28. delineators
29. detectors
30. dispatch consoles
31. dynamic message signs
32. dynamic speed control signs
33. electronic testing equipment
34. emergency/security event response plans
35. evacuation routes
36. first aid equipment

TABLE 1 - OPERATIONAL ASSETS IN ALPHABETICAL ORDER (Page 2 of 5)

37. flashing beacons
38. highway advisory radio – low powered
39. ice removal materials
40. incident management diversion routes
41. incident management response plans
42. incident response team vehicles
43. information exchange networks
44. internally illuminate street name signs
45. inventories – equipment
46. inventories - systems
47. inventories – vehicle fleet
48. ITS architectures
49. lane control signals/signs
50. lighting control systems
51. luminaires
52. maintenance equipment
53. maintenance resources
54. moveable barrier walls
55. moveable bridge control facilities
56. moveable bridge operating systems
57. moveable bridge security systems
58. multi-agency information exchange networks
59. oversize/overweight permits
60. pagers for staff
61. parking operations systems
62. parking meters
63. parking payment collection/revenue
64. personnel – administrative staff
65. personnel – ATMS operators
66. personnel – bridge operators
67. personnel – computer system technicians
68. personnel – dispatchers
69. personnel - enforcement
70. personnel – engineers
71. personnel – field maintenance technicians

TABLE 1 - OPERATIONAL ASSETS IN ALPHABETICAL ORDER (Page 3 of 5)

72. personnel – incident response team members
73. personnel – IT support
74. personnel – maintenance staff
75. personnel – office-based technicians
76. personnel - parking attendants
77. personnel - parking enforcement
78. personnel – planned event coordinators
79. personnel – planners
80. personnel – service patrol staff
81. personnel – system administrators
82. personnel – TMC operators
83. personnel – tunnel enforcement
84. personnel – tunnel operators
85. planned event information
86. planned event response plans
87. portable speed radar measuring devices
88. port management information
89. power services
90. ramp control devices/meters
91. records
92. research – evaluations
93. research – study results
94. road weather information systems
95. service patrol vehicles
96. sign fabrication shop
97. sign management systems
98. signs
99. signal central compute hardware
100. signal controller firmware
101. signal controllers
102. signal design plans/as-builts
103. signal heads
104. signal indications
105. signal mast arm signs
106. signal mast arms

TABLE 1 - OPERATIONAL ASSETS IN ALPHABETICAL ORDER (Page 4 of 5)

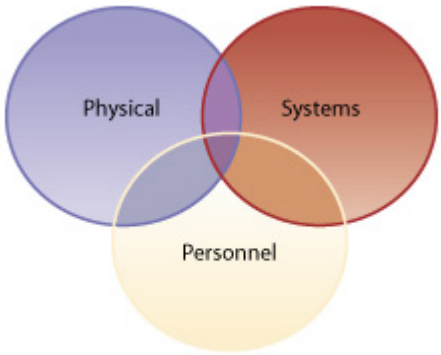
107. signal poles
108. signal preemption/priority equipment
109. signal subsystems
110. signal system graphical user interface
111. signal system software
112. signal timing operating parameters/plans
113. signing materials
114. snow plow trucks
115. specialized software
116. speed and distance measuring equipment
117. speed measuring/display equipment
118. storage facilities
119. strategic plans
120. striping materials
121. TMC building facilities
122. TMC central system hardware
123. TMC communications interfaces
124. TMC conference rooms
125. TMC media centers
126. TMC network software
127. TMC operator consoles
128. TMC radio equipment
129. TMC system fault reports
130. TMC technician rooms
131. TMC wall displays
132. toll – customer service
133. toll - electronic payment systems
134. toll - manual collection systems
135. toll – violation enforcement systems
136. tracking of hazardous materials
137. traffic control devices – others
138. traffic control devices – pavement markings
139. traffic control devices – signs
140. traffic control equipment
141. traffic counts
142. traffic models/software
143. traffic studies
144. transfer stations/centers information (transit)

TABLE 1 - OPERATIONAL ASSETS IN ALPHABETICAL ORDER (Page 5 of 5)

145. truck inspection/weigh stations
146. tunnel control facilities
147. tunnel operating systems
148. tunnel security systems
149. two-way radios
150. vehicles
151. vehicle repair equipment
152. weather forecast systems
153. work orders/activities/history
154. work zone plans
155. 511 telephone systems

TASK 3

This task uses the alphabetized list in Table 1, and classifies the asset as being primarily **physical, system, and personnel**. Some assets may be classified as physical, but may also have system and personnel components. Therefore, if applicable, the asset is broken down into components, and those components are classified in the same manner.



Operations Asset Components

Figure 2

The asset designation is based on the primary purpose or function of the asset. The classifications were made using the following assumptions, based on and modified from the FHWA sponsored report *Elements of a Comprehensive Signals Asset Management System*, by Cambridge Systematics, Inc., December 2004:

> Physical – The specific physical components that make up the asset or a system (e.g., dynamic message sign units, sign housing, sign support structure)
>
> System – The capabilities and configuration of hardware, software and communications infrastructure that connects and controls a system to provide management functionality
>
> Personnel – The staff resources available for operating and maintaining assets

The 'Personnel' classification was a most obvious designation, used for the assets that are personnel. The 'Physical' classification was designated on assets that are basically hardware or materials that do not have system functionality or software programming. Any asset component that is composed of software, contains programming, or enables system functionality is classified as 'System'. Computer hardware has been classified as 'Physical', even though it has electronic capabilities, as it cannot function in a system without software programming. The communications components are classified as 'System' if they consist of software or programming functionality.

Table 2 presents a list of the assets as identified in Table 1, with components listed below the asset if appropriate. Generally, the assets broken down are those which are systems.

TASK 4

This task finalizes the list of assets by adding the unit designation, presented in the far right column of Table 2. The designations are based upon the analysis performed in Task 2.

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ID#	Asset	Physical	System	Personnel	Organizational Unit
1	airport surface transportation information		X		Multi-modal/Inter-modal Airport Access
2	archived transportation information management				Planning for Operations
	computer server		X		
	database	X			
3	ATIS computer hardware	X			TMC Information Dissemination
4	ATIS computer software		X		TMC Information Dissemination
5	ATIS kiosks				TMC Information Dissemination
	computer hardware	X			
	kiosk support stand/shell	X			
	power source		X		
	communication interface		X		
	local operating software		X		
6	ATIS radio stations – high powered				TMC Information Dissemination
	antenna	X			
	tower	X			
	transmitter	X			
	transmission system		X		
	power source		X		
7	ATIS websites		X		TMC Information Dissemination
8	ATMS computer hardware	X			TMC Operations
9	ATMS computer software		X		TMC Operations
10	ATMS graphical user interface		X		TMC Operations
11	ATMS operating parameters/plans		X		TMC Operations
12	ATMS surveillance detectors				
	sensor device	X			
	data processor		X		
13	automated anti-icing systems				Incident Management Weather Management
	housing for tanks/pumps	X			
	storage tank	X			
	pump	X			

TABLE 2 - CLASSIFICATION OF OPERATIONAL ASSETS AND COMPONENTS WITH DESIGNATED UNIT

ID#	Asset	Physical	System	Personnel	Organizational Unit
	sprayers	X			
	control system		X		
	power source		X		
	communication interface		X		
	environmental sensors	X			
	warning signs	X			
14	AVL equipment for operations vehicle fleet				Incident Management Dispatch/Communications
	communications		X		
	on-board vehicle equipment	X			
	system software		X		
15	barrier wall – portable sections	X			Traffic Control Devices - Markings, Delineators, Guiderail; Incident Management Work Zone Management
16	bucket/lift trucks	X			Traffic Engineering - Lighting
17	budget/funding		X		Roadway-Based Operations (all units)
18	cabling/wiring	X			Traffic Control Devices - Signal Design; Traffic Engineering Lighting
19	call boxes				TMC Operations
	telephone	X			
	housing for telephone	X			
	pole mounting	X			
	sign	X			
	communication interface		X		
	power source		X		
	local operating software		X		
20	CCTV cameras				TMC Operations
	video camera unit	X			
	environmental housing	X			
	mounting device	X			
	control system		X		
	cabinet for control equipment	X			

TABLE 2 - CLASSIFICATION OF OPERATIONAL ASSETS AND COMPONENTS WITH DESIGNATED UNIT

ID#	Asset	Physical	System	Personnel	Organizational Unit
	communication interface		X		
	power source		X		
21	cell phones for staff	X			All units with field personnel
22	communications – wireless				Traffic Control Devices - Signal Design; TMC Operations; Arterial Signal Timing
	wireless transmission links		X		
	modems	X			
	switches	X			
	system software		X		
23	communications – wireline				Traffic Control Devices - Signal Design; TMC Operations; Arterial Signal Timing
	wireline transmission links	X			
	modems	X			
	switches	X			
	system software		X		
24	communications testing equipment	X			TMC Field Support Services; Arterial Signal Systems Field Support Services
25	computer-aided dispatch				Incident Management Dispatch/Communications
	CAD terminal	X			
	mobile data terminals in vehicles	X			
	system software		X		
	transmission system		X		
26	computer workstations				Roadway-Based Operations (all units)
	computer hardware	X			
	computer software		X		
27	controller cabinets	X			Traffic Control Devices - Signal Design
28	delineators	X			Traffic Control Devices - Markings, Delineators, Guiderail
29	detectors				Traffic Control Devices - Signal Design; TMC Operations
	vehicle sensor unit	X			
	data processing system		X		

TABLE 2 - CLASSIFICATION OF OPERATIONAL ASSETS AND COMPONENTS WITH DESIGNATED UNIT

ID#	Asset	Physical	System	Personnel	Organizational Unit
	lead-in cable	X			
	cabinet for processing equipment	X			
	power source		X		
	communication interface		X		
30	dispatch consoles				Incident Management Dispatch/Communications
	desktop environment	X			
	chair	X			
31	dynamic message signs				TMC Operations
	sign display units	X			
	environmental housing	X			
	mounting device	X			
	control system		X		
	cabinet for control equipment	X			
	communication interface		X		
	power source		X		
32	dynamic speed control signs				TMC Operations
	sign display units	X			
	environmental housing	X			
	mounting device	X			
	control system		X		
	cabinet for control equipment	X			
	communication interface		X		
	power source		X		
33	electronic testing equipment	X			TMC Field Technicians; Signal Technicians
34	emergency/security event response plans		X		Incident Management Emergency/Security
35	evacuation routes		X		Incident Management Emergency/Security
36	first aid equipment	X			Incident Management Response Teams and Service Patrols
37	flashing beacons				Traffic Control Devices; TMC Operations
	flashing beacon unit	X			

TABLE 2 - CLASSIFICATION OF OPERATIONAL ASSETS AND COMPONENTS WITH DESIGNATED UNIT

ID#	Asset	Physical	System	Personnel	Organizational Unit
	mounting device	X			
	power source		X		
	communication interface		X		
38	highway advisory radio – low powered				TMC Operations
	antenna	X			
	tower	X			
	transmitter	X			
	transmission system		X		
	power source		X		
39	ice removal materials	X			Incident Management Maintenance Crews and Weather Management
40	incident management diversion routes		X		Incident Management Response Plans
41	incident management response plans		X		Incident Management Response Plans
42	incident response team vehicles	X			Incident Management Response Teams
43	information exchange networks		X		TMC Information Dissemination; Regional/Multi-agency Coalitions
44	internally illuminate street name signs	X			Traffic Control Devices - Signal Design
45	inventories – equipment		X		Roadway-Based Operations (all units)
46	inventories - systems		X		Roadway-Based Operations (all units)
47	inventories – vehicle fleet		X		Roadway-Based Operations (all units)
48	ITS architectures		X		Traffic Management
49	lane control signals/signs	X	X		TMC Operations
50	lighting control systems		X		Traffic Engineering - Lighting
51	luminaires	X			Traffic Engineering - Lighting
52	maintenance equipment	X			TMC Field Support Services
53	maintenance resources	X			Incident Management Maintenance Crews
54	moveable barrier walls				TMC Operations
	moveable barrier wall networked links	X			
	barrier transfer system		X		
55	moveable bridge control facilities				Traffic Management - Moveable Bridges
	operator housing	X			

TABLE 2 - CLASSIFICATION OF OPERATIONAL ASSETS AND COMPONENTS WITH DESIGNATED UNIT

ID#	Asset	Physical	System	Personnel	Organizational Unit
	control system		X		
56	moveable bridge operating systems				Traffic Management - Moveable Bridges
	electrical drive systems		X		
	mechanical drive systems		X		
57	moveable bridge security systems	X	X		Traffic Management - Moveable Bridges
58	multi-agency information exchange networks		X		Multi-agency Coalitions
59	oversize/overweight permits		X		CVO/Freight Management
60	pagers for staff	X	X		Roadway-Based Operations (all units)
61	parking operations systems				Traffic Engineering - Parking
	control gates	X	X		
	vehicle detection system	X	X		
	database for price structure and availability		X		
	operating system		X		
	parking status displays	X	X		
62	parking meters				Traffic Engineering - Parking
	meter units	X			
	processing system		X		
63	parking payment collection/revenue				Traffic Engineering - Parking
	violation enforcement system	X	X		
	payment collection system	X	X		
	communications to financial clearinghouse		X		
64	personnel – administrative staff			X	Roadway-Based Operations (all units)
65	personnel – ATMS operators			X	TMC Operations
66	personnel – bridge operators			X	Traffic Management Moveable Bridges
67	personnel – computer system technicians			X	TMC Central Hardware
68	personnel – dispatchers			X	Dispatch/Communications
69	personnel - enforcement			X	TMC Operations
70	personnel – engineers			X	Roadway-Based Operations (all units)
71	personnel – field maintenance technicians			X	TMC Field Technicians; Signal Technicians
72	personnel – incident response team members			X	Incident Management Response Teams

TABLE 2 - CLASSIFICATION OF OPERATIONAL ASSETS AND COMPONENTS WITH DESIGNATED UNIT

ID#	Asset	Physical	System	Personnel	Organizational Unit
73	personnel – IT support			X	Roadway-Based Operations (all units)
74	personnel – maintenance staff			X	Incident Management Maintenance Crews; Operations Oriented Maintenance
75	personnel – office-based technicians			X	Roadway-Based Operations (all units)
76	personnel - parking attendants			X	Traffic Engineering - Parking
77	personnel - parking enforcement			X	Traffic Engineering - Parking
78	personnel – planned event coordinators			X	Incident Management Event Management
79	personnel – planners			X	Roadway-Based Operations (all units)
80	personnel – service patrol staff			X	Incident Management Service Patrols
81	personnel – system administrators			X	TMC System Administration
82	personnel – TMC operators			X	TMC Operations
83	personnel – tunnel enforcement			X	Traffic Management Tunnels
84	personnel – tunnel operators			X	Traffic Management Tunnels
85	planned event information		X		Incident Management Event Management
86	planned event response plans		X		Incident Management Event Management
87	portable speed radar measuring devices	X			Traffic Engineering - Regulations
88	port management information		X		Multi-modal/Inter-modal Port Management
89	power services	X	X		Traffic Control Devices - Signal Design; Traffic Engineering - Lighting; TMC Operations
90	ramp control devices/meters				TMC Operations
	signal units	X			
	support structures	X			
	control system		X		
	cabinet for control equipment	X			
	communication interface		X		
	power source		X		
91	records		X		Traffic Engineering - Regulations
92	research – evaluations		X		Research
93	research – study results		X		Research
94	road weather information systems				TMC Operations; Incident Management Weather Management

TABLE 2 - CLASSIFICATION OF OPERATIONAL ASSETS AND COMPONENTS WITH DESIGNATED UNIT

ID#	Asset	Physical	System	Personnel	Organizational Unit
	various weather sensor units	X			
	support structures	X			
	control system		X		
	cabinet for control equipment	X			
	communication interface		X		
	power source		X		
95	service patrol vehicles	X			Incident Management Service Patrols
96	sign fabrication shop				Traffic Control Devices - Signing
	sign production equipment	X	X		
	sign design software		X		
97	sign management systems		X		Traffic Control Devices - Signing
98	signs	X			Traffic Control Devices - Signing
99	signal central compute hardware	X			Arterial Signal Timing
100	signal controller firmware		X		Arterial Signal Timing
101	signal controllers	X			Traffic Control Devices - Signal Design; Arterial Signal Timing
102	signal design plans/as-builts		X		Traffic Control Devices - Signal Design; Traffic Engineering - Lighting
103	signal heads	X			Traffic Control Devices - Signal Design
104	signal indications	X			Traffic Control Devices - Signal Design
105	signal mast arm signs	X			Traffic Control Devices - Signal Design
106	signal mast arms	X			Traffic Control Devices - Signal Design
107	signal poles	X			Traffic Control Devices - Signal Design
108	signal preemption/priority equipment				Traffic Control Devices - Signal Design
	vehicle detector	X			
	signal controller interface unit	X			
	system software		X		
109	signal subsystems		X		Traffic Control Devices - Signal Design; Arterial Signal Timing
110	signal system graphical user interface		X		Arterial Signal Timing
111	signal system software		X		Arterial Signal Timing

TABLE 2 - CLASSIFICATION OF OPERATIONAL ASSETS AND COMPONENTS WITH DESIGNATED UNIT

ID#	Asset	Physical	System	Personnel	Organizational Unit
112	signal timing operating parameters/plans		X		Arterial Signal Timing
113	signing materials				Traffic Control Devices - Signing
	aluminum panels	X			
	retro-reflective sheeting	X			
	color inks (various)	X			
114	snow plow trucks	X			Incident Management Weather Management
115	specialized software		X		Roadway-Based Operations (all units)
116	speed and distance measuring equipment	X	X		Traffic Engineering - Regulations; Incident Management Work Zone Management
117	speed measuring/display equipment	X	X		Traffic Engineering - Regulations; Incident Management Work Zone Management
118	storage facilities	X			Traffic Control Devices - Signing
119	strategic plans		X		Roadway-Based Operations (all units)
120	striping materials				Traffic Control Devices - Markings, Delineators, Guiderail
	striping materials	X			
	striping machines	X			
	removal equipment	X			
121	TMC building facilities				Traffic Management Centers
	building infrastructure	X			
	HVAC system	X	X		
	lighting	X	X		
	power/UPS	X	X		
122	TMC central system hardware	X			TMC Central Hardware
123	TMC communications interfaces	X			TMC Operations
124	TMC conference rooms	X	X		Traffic Management Centers
125	TMC media centers	X	X		Traffic Management Centers
126	TMC network software		X		TMC System Administration
127	TMC operator consoles				Traffic Management Centers
	desktop environment	X			
	chair	X			

TABLE 2 - CLASSIFICATION OF OPERATIONAL ASSETS AND COMPONENTS WITH DESIGNATED UNIT

ID#	Asset	Physical	System	Personnel	Organizational Unit
	workstation		X		
128	TMC radio equipment	X	X		TMC Operations
129	TMC system fault reports		X		TMC Field Support Services
130	TMC technician rooms	X			Traffic Management Centers
131	TMC wall displays	X	X		Traffic Management Centers
132	toll – customer service				Toll Payment Collection
	account management systems		X		
	service staff/phone operators			X	
133	toll - electronic payment systems	X	X		Toll Payment Collection
	control gates	X	X		
	vehicle detection system	X	X		
	database for price structure		X		
	operating system		X		
	toll lane status displays	X	X		
	payment collection system	X	X		
	communications to financial clearinghouse		X		
134	toll - manual collection systems	X	X		Toll Payment Collection
	control gates	X	X		
	vehicle detection system	X	X		
	database for price structure		X		
	operating system		X		
	toll lane status displays	X	X		
	payment collection system	X	X		
	communications to financial clearinghouse		X		
135	toll – violation enforcement systems	X	X		Toll Payment Collection
136	tracking of hazardous materials		X		CVO/Freight Management
137	traffic control devices – others	X			Traffic Engineering - Traffic Control Devices
138	traffic control devices – pavement markings	X			Traffic Engineering - Traffic Control Devices
139	traffic control devices – signs	X			Traffic Engineering - Traffic Control Devices

TABLE 2 - CLASSIFICATION OF OPERATIONAL ASSETS AND COMPONENTS WITH DESIGNATED UNIT

ID#	Asset	Physical	System	Personnel	Organizational Unit
140	traffic control equipment	X			Incident Management Response Teams and Work Zone Management
141	traffic counts		X		Traffic Control Devices - Signal Design
142	traffic models/software		X		TMC Operations
143	traffic studies		X		Traffic Control Devices - Signal Design
144	transit stations/centers information		X		Multi-modal/Inter-modal Transit Interfaces
145	truck inspection/weigh stations	X	X		CVO/Freight Management
146	tunnel control facilities	X			Traffic Management - Tunnels
	operator housing	X			
	control system		X		
147	tunnel operating systems		X		Traffic Management - Tunnels
	air control management systems		X		
	electrical drive systems		X		
	mechanical drive systems		X		
148	tunnel security systems	X	X		Traffic Management - Tunnels
149	two-way radios				Incident Management Dispatch/Communications
	base radio stations	X	X		
	portable units	X	X		
150	vehicles	X			Roadway-Based Operations (all units)
151	vehicle repair equipment	X			Incident Management Service Patrols
152	weather forecast systems		X		Incident Management Weather Management
153	work orders/activities/history		X		TMC Field Support Services
154	work zone plans		X		Incident Management Work Zone Management
155	511 telephone systems				TMC Information Dissemination
	telco interfaces		X		
	system software		X		
	system hardware	X			

TABLE 2 - CLASSIFICATION OF OPERATIONAL ASSETS AND COMPONENTS WITH DESIGNATED UNIT