Module 15: Emerging Evacuation Standards of Communication/ Incident Management (ISO 19083)

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1. Module Description

The module describes the elements of the ISO 19083-1 standard which:

- Defines the framework for Emergency Evacuation and Disaster Response and Recovery (EEDRR) as it relates to transportation and the use of Intelligent Transportation System technologies.
- Establishes the criteria under which Transit should support evacuations and disaster response and recovery.
- Identifies the types of agencies and organizations involved in a regionally supported evacuation and disaster.
- Defines the roles and responsibilities Transit entities should provide in planning, preparing for, and conducting evacuations and disaster response and recovery efforts in support of regional authorities.
- Provides a concept of operation for Transit disaster support that is the guiding document for Transit Services Operators who wish to develop an EEDRR Decision Support Systems.

2. Introduction/Purpose

The purpose of the module is to provide a guide to develop a Decision Support System that will be used by Transit to identify routes and manage equipment and personnel used to evacuate people out of harm's way. The Decision Support System will also provide transportation support for all response and recovery efforts from major disasters such as hurricanes, tsunamis, or catastrophic accidents. This standard recommends Transit to serve as the primary mobility agent for all transportation-related actions before, during and after a disaster. This represents a paradigm shift from past response and recovery efforts such as Hurricane Katrina, which typically see transportation-related activities commanded by emergency managers who may rely on traffic managers and transit to provide the services. While the emergency manager remains the responsible individual for any disaster, the role of coordinating of transportation between Traffic Management, Emergency Services and Transit should be assigned to a Transit professional. The reasoning for this shift of responsibility is that Transit has the most experience and the resources to move large numbers of people efficiently and in a timely manner, which is paramount before, during, and after a disaster.

3. Samples/Examples

The ISO 19803 family of standards recommends the creation of a cloud-based Emergency Evacuation and Disaster Response and Recovery (EEDRR) Decision Support System to assist, coordinate, and direct all transportation services including those used by emergency management, traffic management and Transit[1]. The cloud-based solution allows different services — such as servers, storage and applications

[1] ISO uses the term "public transport" instead of transit. The reader should consider the terms equivalent for the purpose of this module. Public Transport is abbreviated as PT in the ISO document.

— to be delivered to Transit computers and devices through the Internet, thus providing access to the EEDRR even when access to the physical area is not possible because of the disaster. The major actors involved in coordinating transportation services related to a disaster and the systems required for communicating the associated information are shown in Figure 1.

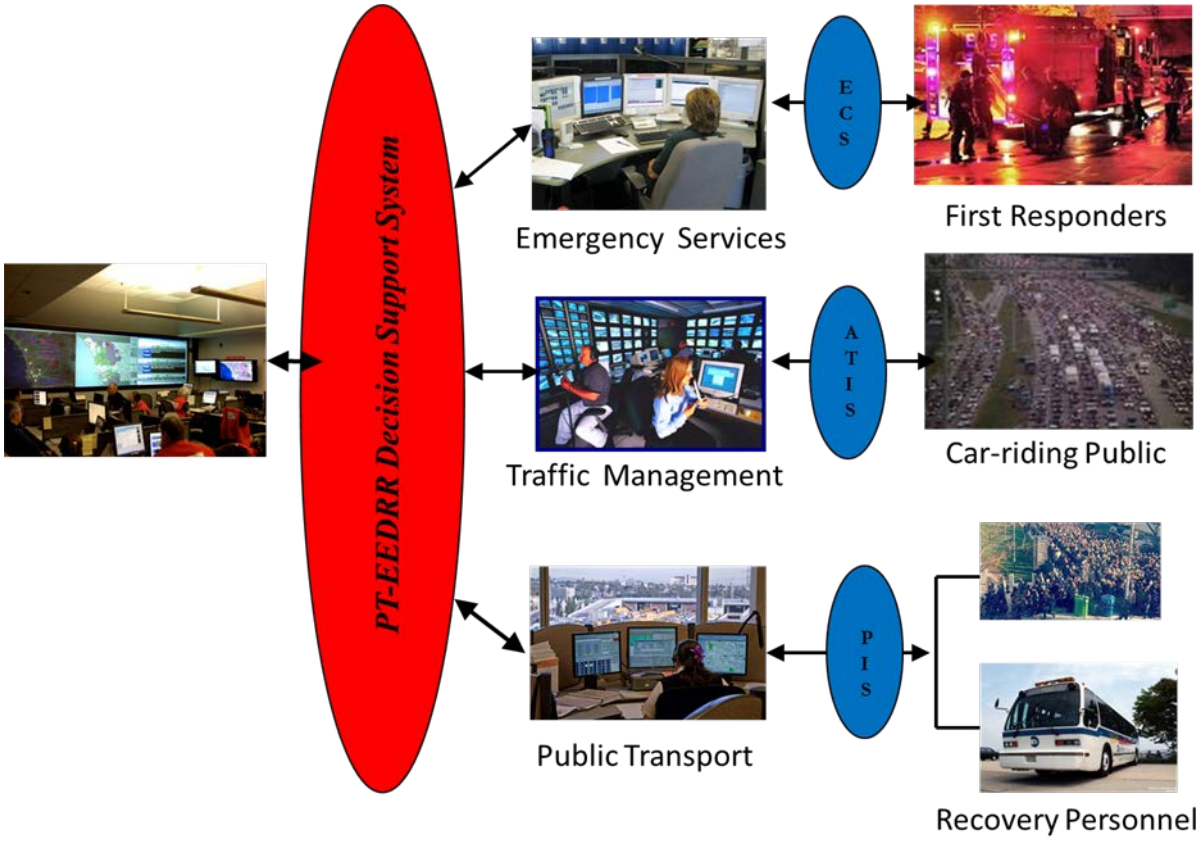

Figure 1— Coordinated Transportation Services for Disasters

Figure 2 depicts the system architecture of the Cloud-enabled Decision Support System. The system consists of three main layers. The Cloud infrastructure layer provides the base platform and environment for the decision support system. The Knowledge Layer provides the following:

- traffic models used for route development;
- algorithms for situational analysis, vulnerability analysis, damage and risk analysis;
- accreditation of thematic maps derived from satellite or ground-based early warning, detecting, monitoring, and mitigation systems and;
- exercise knowledge required to devise emergency evacuation response and recovery strategies by processing the data available from various sources.

The System Interface acquires the data from various gateways including the Internet, transit infrastructure, traffic management infrastructure, emergency services infrastructure, and social

networks to include assets such as roadside equipment units, emergency responder communication, and transit computer aided dispatch.

Cloud computing involves deploying groups of remote servers and software networks that allow centralized data storage and online access to computer services or resources. Cloud computing can be defined as web applications and server services that users pay for in order to access, rather than software or hardware that the users buy and install onsite themselves. This is an important feature for the Decision Support System architecture as it focuses on maximizing the effectiveness of the shared resources thus allowing users to access a wide variety of applications, services, and hardware, which they might not be able to access otherwise. Additionally, it moves these resources offsite from where in all likelihood there will not be electricity, Internet and mobile communication services available. Cloud computing, based on virtualization, takes a very different approach to disaster recovery. With virtualization, the entire server, including the operating system, applications, patches and data is encapsulated into a single software bundle or virtual server. This entire virtual server can be copied or backed up to an offsite data center and spun up on a virtual host in a matter of minutes. The virtual host would be operating outside the disaster area and not impacted by network and power outages inflicted by the disaster.

The PT-EEDRR-DSS System Interfaces are used to communicates with various user interfaces and communication gateways including the ITS vehicle to infrastructure (V2I) and infrastructure to vehicle (I2V). The interface gathers, validates and propagates data, information, and emergency response operations. Data is validated by collecting it from trusted sources such as traffic management and emergency management networks. Data collected from social networks must be scrutinized as it is not always possible to know whether social media users are who they claim to be or whether the information they share is accurate. Although false messages that are broadcast widely are often rapidly corrected by other users, it is often difficult to separate real signals of a transportation crisis or a material need from background noise and opportunistic scams. Emergency management utilizes the power of social networks to instantly broadcast and amplify emergency warnings to the public. Incorporating these sources ensures data validation as much as possible.

The Knowledge Layer uses this data and information to develop models/simulations of evacuation, responses, and recovery route. The system interface layer is responsible for validating the data and information it receives. It also provides the communication link for command and control information released by the Knowledge Layer.

The Knowledge layer consists of various mathematical models, algorithms and simulations, both stochastic and deterministic. These models accept traffic and Transit-related data received from various ITS sensors. The modelling and analysis software uses the previously validated data for a particular activity based on the urgency of the situation. In some cases such as when reviewing the outcome of an exercise, it is necessary and/or affordable to employ microscopic traffic models this is due to the demands on higher accuracy and greater flexibility on the available time for decision, optimization and analysis. A higher authority in the emergency management chain of command accredits the results of the microscopic modelling by reviewing the data and testing the results. In other cases, microscopic simulations may not be possible, due to the real-time nature of operations such as a response to major disaster such as a chemical plant fire or earthquake. In these cases, the use of macroscopic modelling is required. A no warning disaster usually limits the availability of real-time data as many communication sources are damaged due to the disaster, and compounding the problem the time period in which the

system has to act will be short. Macroscopic models require relatively small computational time and resources. Which models to invoke in a particular situation is an area for automatic model selection algorithm. Additionally, enhancing distributed algorithms to invoke the most precise models for real-time critical situation is an important feature to incorporate in a cloud infrastructure as it provides *virtualization and flexibility by moving it outside the area affected by the disaster*. This is possible considering the capability of Cloud technology.

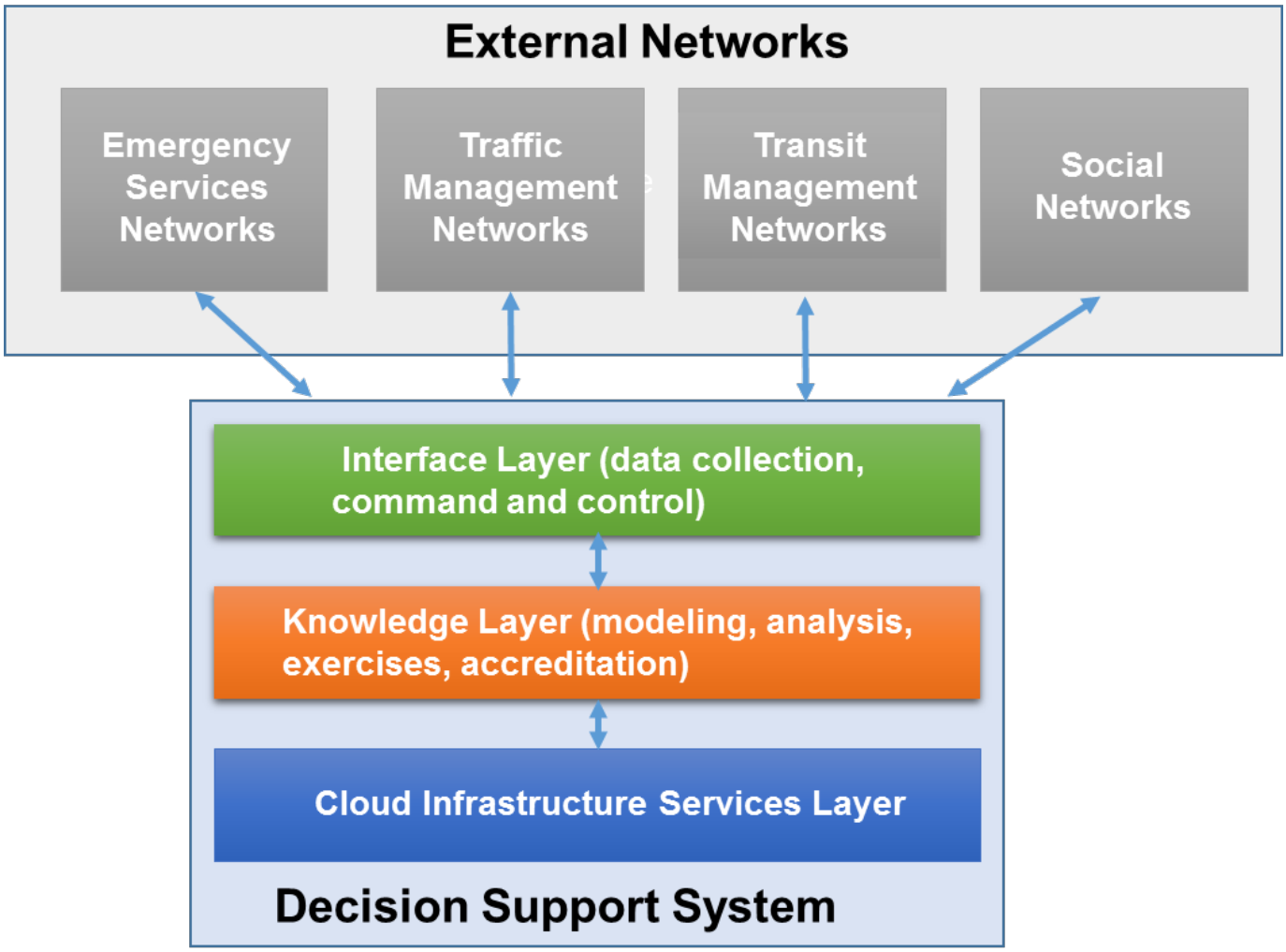

Figure 2 — Cloud-enabled PT-EEDRR-DSS Architecture

ISO 19083-1 provides a Concept of Operations template that describes the use of a Decision Support System for Emergency Evacuation and Disaster Response and Recovery (PT-EEDRR-DSS). It is non-technical and bridges the gap between the needs of the decision support system and the specific technical requirements as viewed by the stakeholders. Transit managers may use the Concept of Operations template to:

a) Obtain stakeholder agreement on:

1) How the system operates,

2) Who is responsible for specific functions, and

3) What lines of communication exist between Public Transport, Emergency Management, Traffic Management and the public?

b) Define the concept for the Decision Support System and justify that it is superior to the other alternatives.

c) Define the environment in which the Decision Support System will operate.

d) Derive high-level user requirements for the Decision Support System.

e) Provide criteria for validation of the completed Decision Support System.

The template is found in the ISO 19083-1 document and should be used to develop a custom Concept of Operation for the region.

4. References to Other Standards

Resource / Provider	Cost and Access Method	Website
ISO TR 19083-1 Public transport — Emergency evacuation and disaster response and recovery — Part 1: Framework and concept of operation ISO	**Cost**: $50.00+ **Access**: Download from ISO website	www.iso.org
ISO 19083-2 Public transport — Emergency evacuation and disaster response and recovery — Part 2: Information	**Cost**: $50.00+ **Access**: Download ISO website	www.iso.org

Resource / Provider	Cost and Access Method	Website
Flow ISO		

5. Case Studies and Other Material

1. TRANSIT OPERATIONS DECISION SUPPORT SYSTEM (TODSS) CORE REQUIREMENTS PROTOTYPE DEVELOPMENT CASE STUDY AND LESSONS LEARNED February 2010 Report No. FTA-IL-26-7009-2009.2- This report presents the results of a research effort undertaken by the Pace Suburban Bus; Booz Allen Hamilton; and Public Transit Solutions, Continental, with sponsorship and funding from the United States Department of Transportation (USDOT) Federal Transit Administration (FTA) and Research and Innovative Technology Administration (RITA) Intelligent Transportation Systems Joint Program Office (ITS JPO). At the end of the operational test period, Pace and all those involved with the prototype development effort were convinced that the TODSS core requirements had the desired effect of improving dispatcher efficiency. The results showed that the core requirements were valid and that the prototype TODSS based on the core requirements was accepted by dispatchers and improved their job performance.

2. Technical_Memorandum_TODSS_Core_Requirements_Evaluation_and_Update_Recommendations_Final_Report_v4_(final)_(508) Emergency Communications for Evacuation (EVAC) in New Orleans Impact Assessment Report— May 8, 2015 FHWA-JPO-15-204- This document constitutes the Impact Assessment Report for Emergency Communications for Evacuation (EVAC) in New Orleans. Response, Emergency Staging and Communications, Uniform Management, and Evacuation (R.E.S.C.U.M.E.) is a bundle of applications that targets the improvement of traffic safety and mobility during crashes and other emergencies that affect the highway network. A key R.E.S.C.U.M.E. focus is on traffic incident management and responder safety. Another is emergency communications for evacuation. The R.E.S.C.U.M.E. bundle includes the following three applications:

    1. Incident Scene Pre-Arrival Staging Guidance for Emergency Responders (RESP-STG)

    2. Incident Scene Work Zone Alerts for Drivers and Workers (INC-ZONE)

    3. Emergency Communications for Evacuation (EVAC).

    Areas of interest within the EVAC application include information on traffic and road conditions, location of available lodging, and location of fuel, food, water, cash machines, and other

necessities for evacuees using their own mode of transportation and those for whom transportation services were provided. The EVAC application bundle employs mobile communications technologies. This document assesses the potential impacts of EVAC through simulation that uses a model of the Greater New Orleans region.

http://ntl.bts.gov/lib/55000/55000/55045/R_E_S_C_U_M_E__EVAC_IAReport_FINAL_FHWA-JPO-15-204.pdf

Disaster Response Roles and Responsibilities

Phase	Transit Responsibilities
Advance Planning Activities	• Coordinate with regional agencies • Execute agreements including collective bargaining units when required. • Establish guidelines for Transit response including call back (drivers, dispatchers) during emergency. • Establish communications protocols with internal personnel and external organizations (EOC). • Maintain and verify lists of population groups • Inventory and plan to coordinate (and share) transit resources in the region. • Personnel training • Identify and designate evacuation/response routes. • Establish uniform communications channels to notify public of services in support of emergency response. • Obtain database of shelters including facilities for special needs, pet shelters, and other resources.
Incident Notification Activities	• Brief Supervisors, Dispatchers, and other key personnel on the need to implement emergency response. • Develop evacuation/response routes, time estimates, and resource assignments for the emergency response. • Identify staging areas for Transit resources including those areas where vehicles will be stored. • Identify and contact special needs clients to determine if van service is required for evacuation. • Establish communication link with the EOC and Traffic Management Center (TMC).

	• Communicate to the EOC the routes, time estimates, resource assignments, and special needs client ride list. • Communicate about available transit services to the public via websites, social media, and PT passenger information system.
Activation and Notification Activities	• Recall and deploy agency response personnel as needed. • Make all vehicles available to support transportation service response necessary, including special needs populations. • Roll out Transit resources in an orderly and timely manner. • Move vehicles and other resources to storage areas outside the impact area. • Coordinate with lead emergency management agency through command and control center. • Maintain expenditure records to facilitate reimbursement.
Response Operations Activities	• Conduct response according to emergency plans. • Monitor and adapt to changing conditions the resources required to stage response. • Coordinate with EOC through command control center. • Maintain expenditure records to facilitate reimbursement.
Re-Entry Activities	• Brief Supervisors, Dispatchers, and other key personnel on the re-entry plan. • Develop re-entry routes, time estimates, and resource assignments. • Identify reentry staging areas for PT resources. • Contact special needs clients to determine if van service is required for evacuation. • Establish communication link with the EOC and Traffic Management Center (TMC). • Communicate to the EOC the re-entry routes, time estimates, resource assignments, and special needs client ride list. • Communicate to the public PT re-entry services via websites, social media, and PT passenger information system. • Recall and deploy agency personnel as needed. • Make all vehicles available to support mobilization of evacuees necessary, including special needs evacuees. • Roll out Transit resources in an orderly and timely manner. • Return vehicles and other resources from storage areas to facilities inside impact area. • Maintain expenditure records to facilitate reimbursement. • Maintain re-entry logs and records.
Debrief and Assessment Activities	• Discuss/evaluate overall performance in relation to the agency's execution of the tasks described in the emergency response plan. • Discuss/evaluate overall performance in relation to the emergency response plan's ability to address the issues that were apparent during the actual emergency evacuation. • Prepare a post-evacuation document detailing the agency's

	evacuation operations and experiences as well as lessons learned and modify plans as necessary. • Present expenditure records to facilitate reimbursement. • Present records of agency's evacuation activities.

Recovery Phase Roles and Responsibilities

Phase	Transit Responsibilities
Pre-disaster Preparedness Activities	• Establish clear leadership, coordination, and decision-making structures within the Transit organization and with other local and regional disaster recovery organizations. • Test and evaluate Disaster Transportation Service Recovery plans through seminars, workshops, and exercises. • Participate in local and regional disaster recovery planning and related activities. • Build partnerships with other local government agencies to form the basis for pre- and post-transportation services. • Integrate pre-disaster recovery planning (e.g. public information, mitigation planning) with other appropriate planning (e.g. capital improvement planning, disaster response). • Identify transportation service limitations in recovery capacity and the means to supplement this capacity. • Incorporate financial elements into recovery planning guidelines. • Develop an accessible transportation services public information campaign that addresses the concerns of the public based an array of possible scenarios. • Prepare pre-disaster memoranda of understanding (MOUs) transportation resources as a way to establish mutual aid for recovery. • Create a comprehensive disaster recovery plan for all essential equipment and facilities including vehicles, garages, offices, command and control systems, communications systems, passenger information systems, etc.
Short-term Recovery Activities	• Activate Transit Recovery Team to implement short-term recovery process. • Develop damage assessment of transportation services. • Identify staging areas for Transit recovery including those areas where vehicles will be stored. • Identify and contact transportation services mutual aid organizations. • Establish communication link with the EOC and Traffic

	Management Center (TMC). • Communicate to the EOC the short-term recovery plan. • Communicate about transit recovery services to the public via websites, social media, and local media.
Intermediary-term Recovery Activities	• Develop an intermediate recovery plan that: • Uses existing plans and footprint to reduce work required to restore service. • Takes a collaborative approach by engaging vendors in the recovery process and enhances the recovery team • Streamlines administration and accelerates the approval process • Assemble reimbursement records and submit to national financial aid bodies. • Activate mutual aid process to acquire equipment and facilities needed to begin service restoration.
Long-term Recovery Activities	• Evaluate and report to recovery partners what worked, what needs improvement, and what goals and objectives remain to be addressed in an effort to enhance and maintain the collaboration effort.

National ITS Architecture Emergency Management Service Packages

The National ITS Architecture version 7.1 includes ten (10) Service Packages that supports Emergency Management (EM) where a Service Package is defined as representing slices of the Physical Architecture that address specific services like surface street control. A service package collects together several different subsystems, equipment packages, terminators, and architecture flows that provide the desired service. The 10 consist of the following:

Service ID	**Service Name**	**Service Description** (from http://www.iteris.com/itsarch/html/mp/mpindex.htm, 2015)
EM01	Emergency Call-Taking and Dispatch	This service package provides basic public safety call-taking and dispatch services. It includes emergency vehicle equipment, equipment used to receive and route emergency calls, and wireless communications that enable safe and rapid deployment of appropriate resources to an emergency. Coordination between Emergency Management Subsystems supports emergency notification between agencies. Wide area wireless communications between the Emergency Management Subsystem and an Emergency Vehicle supports dispatch and provision of information to responding personnel.
EM02	Emergency Routing	This service package supports automated vehicle location and dynamic routing of emergency vehicles. Traffic information, road conditions, and suggested routing information are provided to enhance emergency vehicle routing. Special priority or other specific emergency traffic control strategies can be coordinated to improve the safety and time-efficiency of responding vehicle travel on the selected route(s). The Emergency Management Subsystem provides the routing for the emergency fleet based on real-time conditions and has the option of requesting a route from the Traffic Management subsystem. The Emergency Vehicle may also be equipped with dedicated short-range communications for local signal preemption and the transmission of alerts to surrounding vehicles. The service provides for information exchange between care facilities and both the Emergency Management Subsystem and emergency vehicles.
EM03	Mayday and Alarms Support	This service package allows the user (driver or non-driver) to initiate a request for emergency assistance and enables the Emergency Management Subsystem to locate the user, gather information about the incident, and determine the appropriate response. The request for assistance may be manually initiated or automated and linked to vehicle sensors. This service package also includes general surveillance capabilities that enable the Emergency Management Subsystem to remotely monitor public areas (e.g., rest stops, parking lots) to improve security in these areas. The Emergency Management Subsystem may be operated by the public sector or by a private sector telematics service provider.

EM04	Roadway Service Patrols	This service package supports roadway service patrol vehicles that monitor roads that aid motorists, offering rapid response to minor incidents (flat tire, accidents, out of gas) to minimize disruption to the traffic stream. If problems are detected, the roadway service patrol vehicles will provide assistance to the motorist (e.g., push a vehicle to the shoulder or median). The service package monitors service patrol vehicle locations and supports vehicle dispatch to identified incident locations. Incident information collected by the service patrol is shared with traffic, maintenance and construction, and traveler information systems.
EM05	Transportation Infrastructure Protection	This service package includes the monitoring of transportation infrastructure (e.g., bridges, tunnels and management centers) for potential threats using sensors and surveillance equipment and barrier and safeguard systems to control access, preclude an incident, and mitigate the impact of an incident if it occurs. Threats can result from acts of nature (e.g., hurricanes, earthquakes), terrorist attacks or other incidents causing damage to the infrastructure (e.g., stray barge hitting a bridge support). Infrastructure may be monitored with acoustic, environmental threat (such as nuclear, biological, chemical, and explosives), infrastructure condition and integrity, motion and object sensors and video and audio surveillance equipment. Data from such sensors and surveillance equipment may be processed in the field or sent to a center for processing. The data enables operators at the center to detect and verify threats. When a threat is detected, agencies are notified. Detected threats or advisories received from other agencies result in an increased level of system preparedness. In response to threats, barrier and safeguard systems may be activated by Traffic Management Subsystems to deter an incident, control access to an area or mitigate the impact of an incident. Barrier systems include gates, barriers and other automated and remotely controlled systems that manage entry to transportation infrastructure. Safeguard systems include blast shields, exhaust systems and other automated and remotely controlled systems that mitigate impact of an incident.
EM06	Wide-Area Alert	This service package uses ITS driver and traveler information systems to alert the public in emergency situations such as child abductions, severe weather events, civil emergencies, and other situations that pose a threat to life and property. The alert includes information and instructions for transportation system operators and the traveling public, improving public safety and enlisting the public's help in some scenarios. The ITS technologies will supplement and support other emergency and homeland security alert systems such as the Emergency Alert System (EAS). When an emergency situation is reported and verified and the terms and

		conditions for system activation are satisfied, a designated agency broadcasts emergency information to traffic agencies, transit agencies, information service providers, toll operators, and others that operate ITS systems. The ITS systems, in turn, provide the alert information to transportation system operators and the traveling public using ITS technologies such as dynamic message signs, highway advisory radios, in-vehicle displays, transit displays, 511 traveler information systems, and traveler information websites.
EM07	Early Warning System	This service package monitors and detects potential, looming, and actual disasters including natural disasters (hurricanes, earthquakes, floods, winter storms, tsunamis, etc.) and technological and man-made disasters (hazardous materials incidents, nuclear power plant accidents, and acts of terrorism including nuclear, chemical, biological, and radiological weapons attacks). The service package monitors alerting and advisory systems, ITS sensors and surveillance systems, field reports, and emergency call-taking systems to identify emergencies and notifies all responding agencies of detected emergencies.
EM08	Disaster Response and Recovery	This service package enhances the ability of the surface transportation system to respond to and recover from disasters. It addresses the most severe incidents that require an extraordinary response from outside the local community. All types of disasters are addressed including natural disasters (hurricanes, earthquakes, floods, winter storms, tsunamis, etc.) and technological and man-made disasters (hazardous materials incidents, nuclear power plant accidents, and national security emergencies such as nuclear, chemical, biological, and radiological weapons attacks). The service package supports coordination of emergency response plans, including general plans developed before a disaster as well as specific tactical plans with short time horizon that are developed as part of a disaster response. The service package provides enhanced access to the scene for response personnel and resources, provides better information about the transportation system in the vicinity of the disaster, and maintains situation awareness regarding the disaster itself. In addition, this service package tracks and coordinates the transportation resources - the transportation professionals, equipment, and materials - that constitute a portion of the disaster response. The service package identifies the key points of integration between transportation systems and the public safety, emergency management, public health, and other allied organizations that

		form the overall disaster response. In this service package, the Emergency Management subsystem represents the federal, regional, state, and local Emergency Operations Centers and the Incident Commands that are established to respond to the disaster. The interface between the Emergency Management Subsystem and the other center subsystems provides situation awareness and resource coordination among transportation and other allied response agencies. In its role, traffic management implements special traffic control strategies and detours and restrictions to effectively manage traffic in and around the disaster. Maintenance and construction provides damage assessment of road network facilities and manages service restoration. Transit management provides a similar assessment of status for transit facilities and modifies transit operations to meet the special demands of the disaster. As immediate public safety concerns are addressed and disaster response transitions into recovery, this service package supports transition back to normal transportation system operation, recovering resources, managing on-going transportation facility repair, supporting data collection and revised plan coordination, and other recovery activities. This service package builds on the basic traffic incident response service that is provided by ATMS08, the Traffic Incident Management service package. This service package addresses the additional complexities and coordination requirements that are associated with the most severe incidents that warrant an extraordinary response from outside the local jurisdictions and require special measures such as the activation of one or more emergency operations centers. Many users of the National ITS Architecture will want to consider both ATMS08 and this service package since every region is concerned with both day-to-day management of traffic-related incidents and occasional management of disasters that require extraordinary response. Disaster Response and Recovery is also supported by EM10, the "Disaster Traveler Information" service package that keeps the public informed during a disaster response. See that service package for more information.
EM09	Evacuation and Reentry Management	This service package supports evacuation of the general public from a disaster area and manages subsequent reentry to the disaster area. The service package addresses evacuations for all types of disasters, including disasters like hurricanes that are anticipated and occur slowly, allowing a well-planned orderly evacuation, as well as disasters like terrorist acts that occur rapidly, without warning, and allow little or no time for preparation or public warning.

		This service package supports coordination of evacuation plans among the federal, state, and local transportation, emergency, and law enforcement agencies that may be involved in a large-scale evacuation. All affected jurisdictions (e.g., states and counties) at the evacuation origin, evacuation destination, and along the evacuation route are informed of the plan. Information is shared with traffic management agencies to implement special traffic control strategies and to control evacuation traffic, including traffic on local streets and arterials as well as the major evacuation routes. Reversible lanes, shoulder use, closures, special signal control strategies, and other special strategies may be implemented to maximize capacity along the evacuation routes. Transit resources play an important role in an evacuation, removing many people from an evacuated area while making efficient use of limited capacity. Additional shared transit resources may be added and managed in evacuation scenarios. Resource requirements are forecast based on the evacuation plans, and the necessary resources are located, shared between agencies if necessary, and deployed at the right locations at the appropriate times. Evacuations are also supported by EM10, the "Disaster Traveler Information" service package, which keeps the public informed during evacuations. See that service package for more information.
EM10	Disaster Traveler Information	This service package uses ITS to provide disaster-related traveler information to the general public, including evacuation and reentry information and other information concerning the operation of the transportation system during a disaster. This service package collects information from multiple sources including traffic, transit, public safety, emergency management, shelter provider, and travel service provider organizations. The collected information is processed and the public is provided with real-time disaster and evacuation information using ITS traveler information systems. A disaster will stress the surface transportation system since it may damage transportation facilities at the same time that it places unique demands on these facilities to support public evacuation and provide access for emergency responders. Similarly, a disaster may interrupt or degrade the operation of many traveler information systems at the same time that safety-critical information must be provided to the traveling public. This service package keeps the public informed in these scenarios, using all available means to provide information about the disaster

		area including damage to the transportation system, detours and closures in effect, special traffic restrictions and allowances, special transit schedules, and real-time information on traffic conditions and transit system performance in and around the disaster. This service package also provides emergency information to assist the public with evacuations when necessary. Information on mandatory and voluntary evacuation zones, evacuation times, and instructions are provided. Available evacuation routes and destinations and current and anticipated travel conditions along those routes are provided so evacuees are prepared and know their destination and preferred evacuation route. Information on available transit services and traveler services (shelters, medical services, hotels, restaurants, gas stations, etc.) is also provided. In addition to general evacuation information, this service package provides specific evacuation trip planning information that is tailored for the evacuee based on origin, selected destination, and evacuee-specified evacuation requirements and route parameters. This service package augments the ATIS service packages that provide traveler information on a day-to-day basis for the surface transportation system. This service package provides focus on the special requirements for traveler information dissemination in disaster situations.

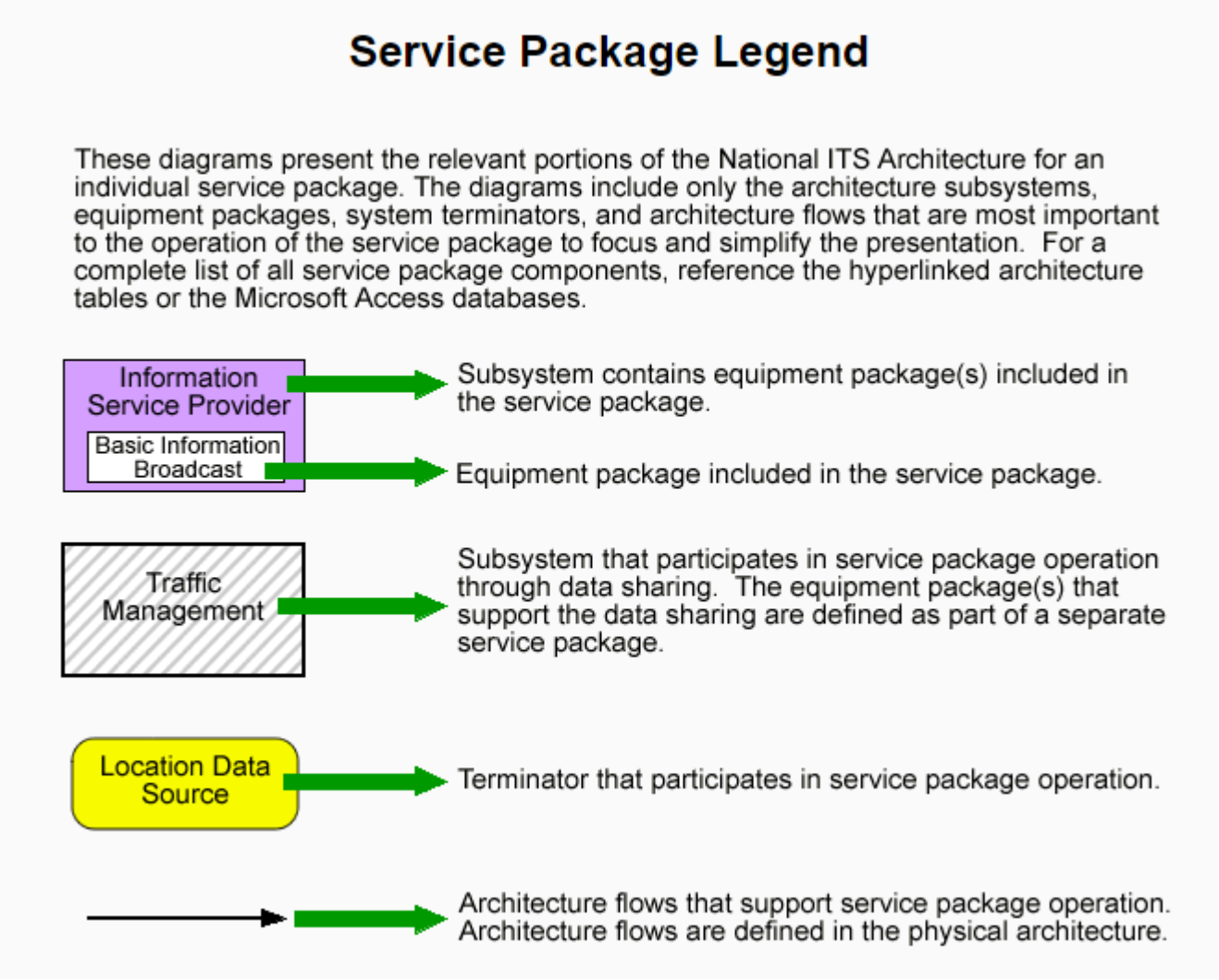

Figure 3 — Service Package Legend (source: http://www.iteris.com/itsarch/html/mp/mplegend.htm)

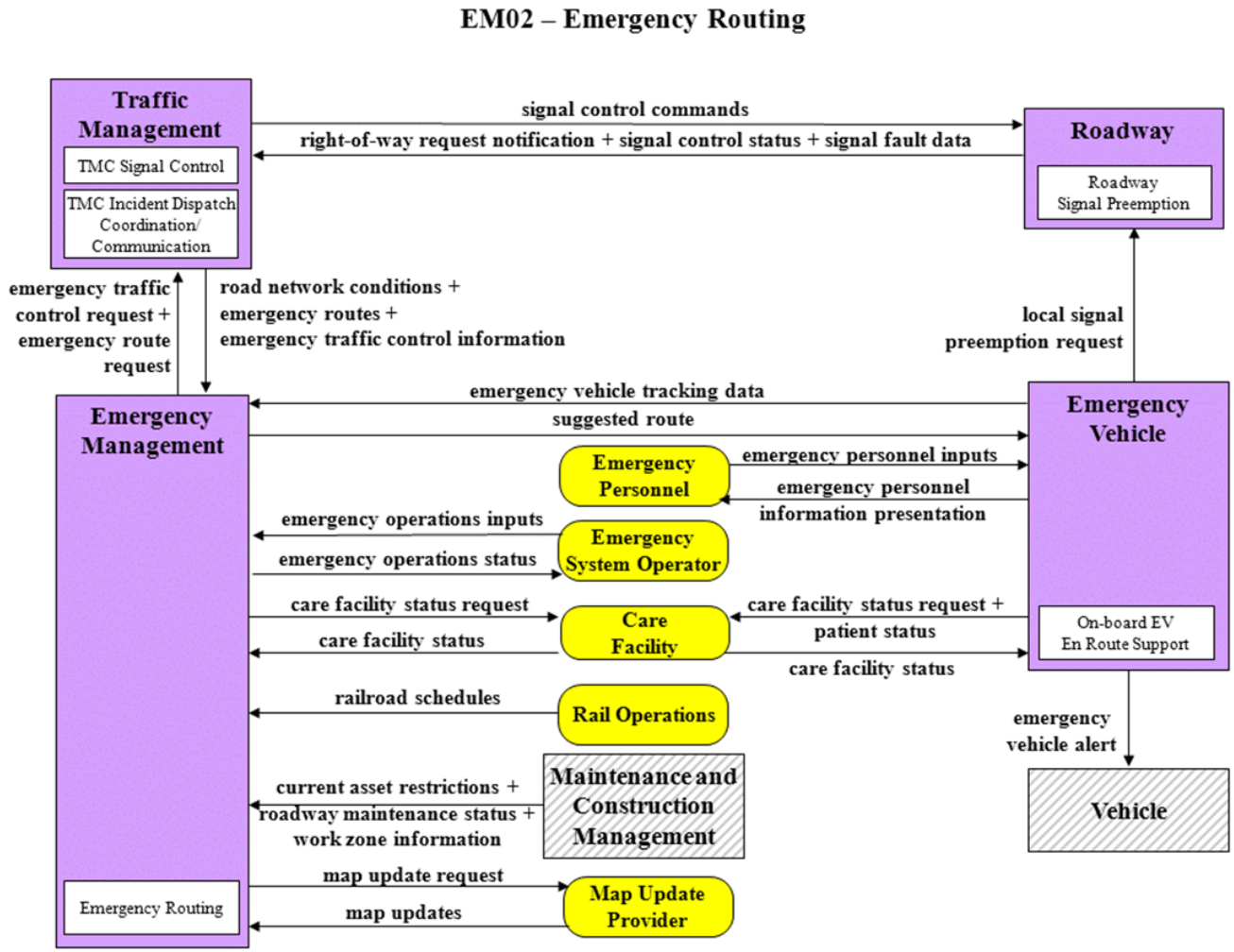

Figure 4 — EM02 Emergency Routing Service Package (source: http://www.iteris.com/itsarch/html/mp/mpem02.htm)

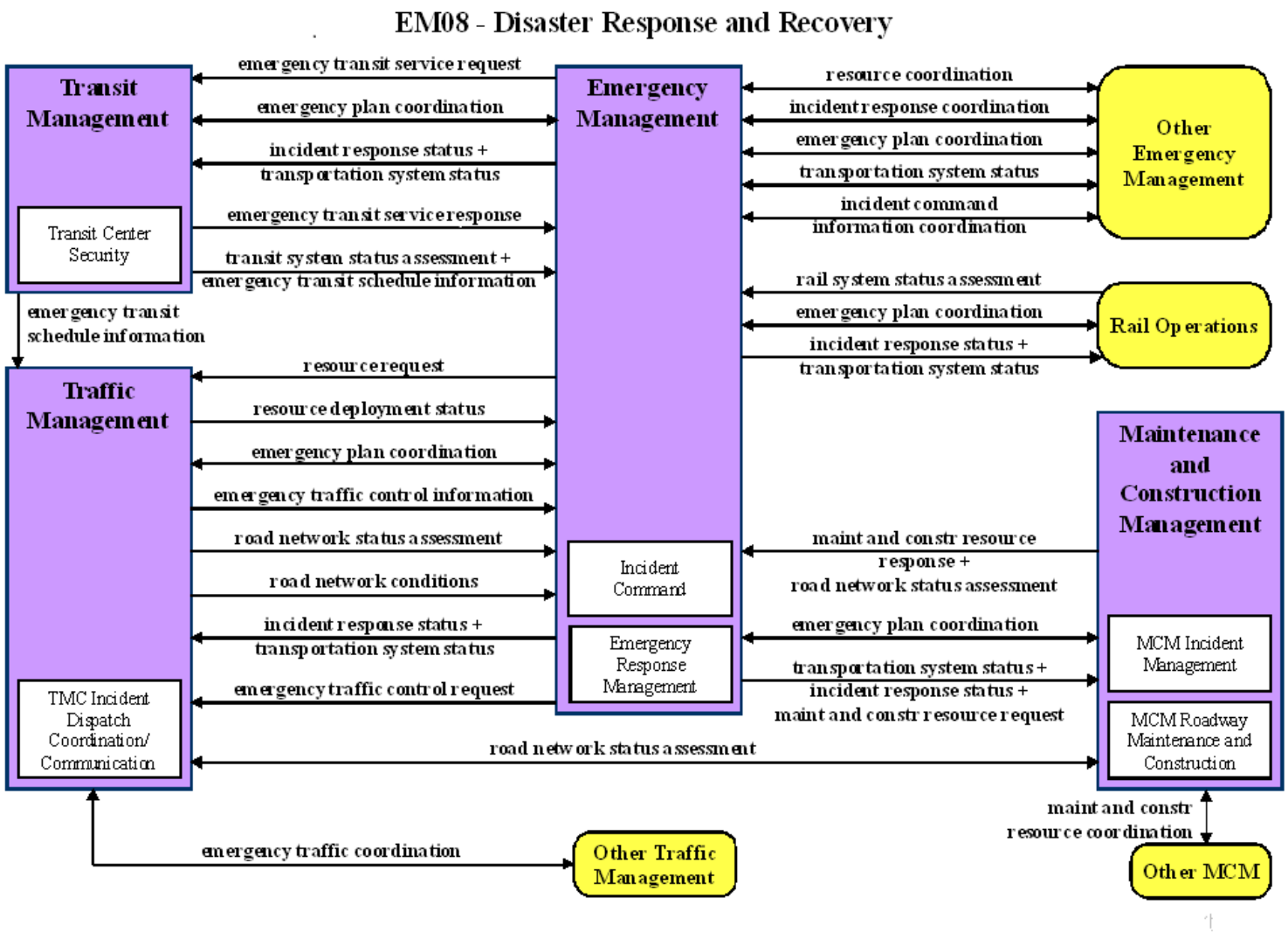

Figure 5 — EM08 Disaster Response and Recovery Service Package (source: http://www.iteris.com/itsarch/html/mp/mpem08.htm)

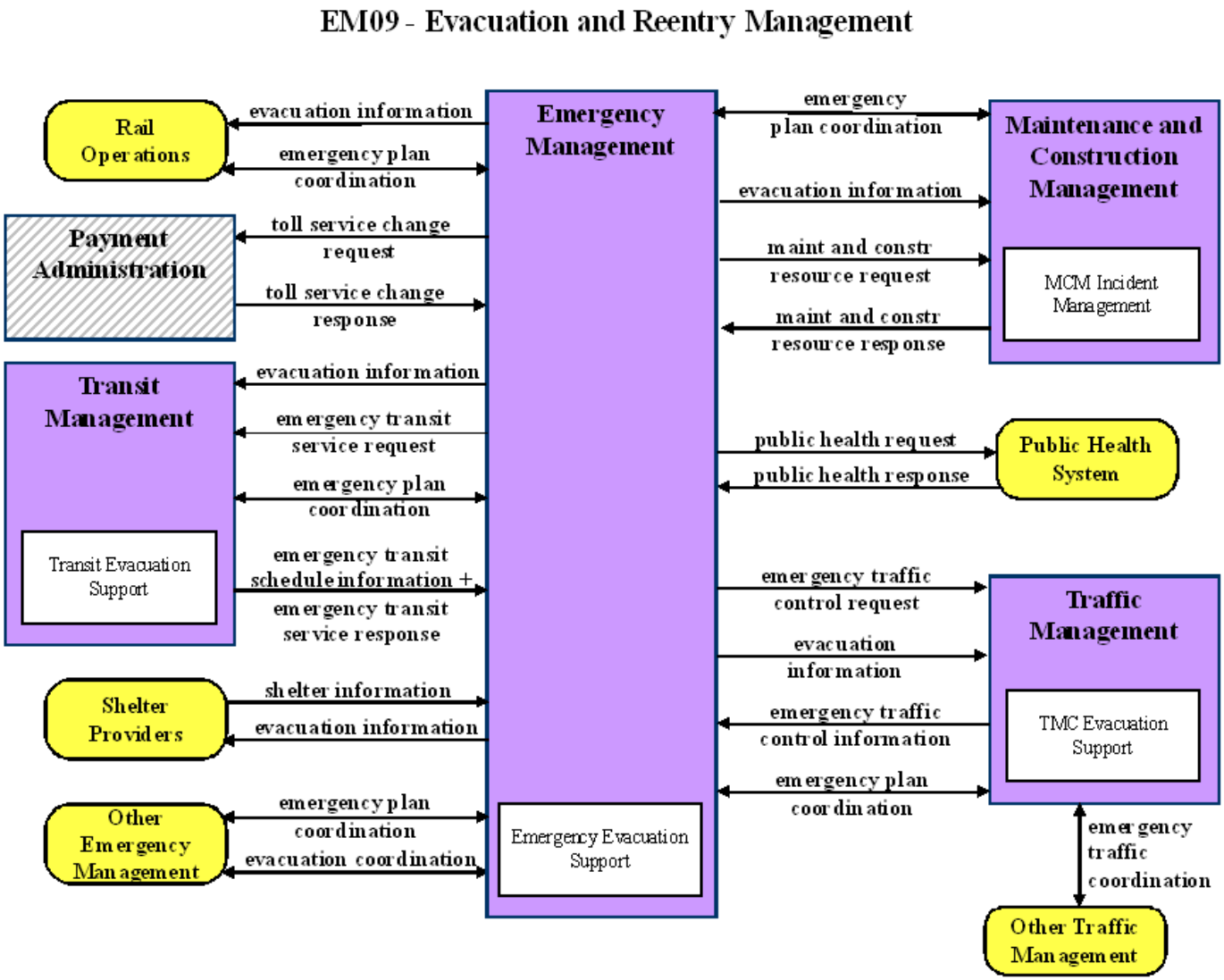

Figure 6 — EM09 Evacuation and Reentry Management Service Package (source: http://www.iteris.com/itsarch/html/mp/mpem09.htm)

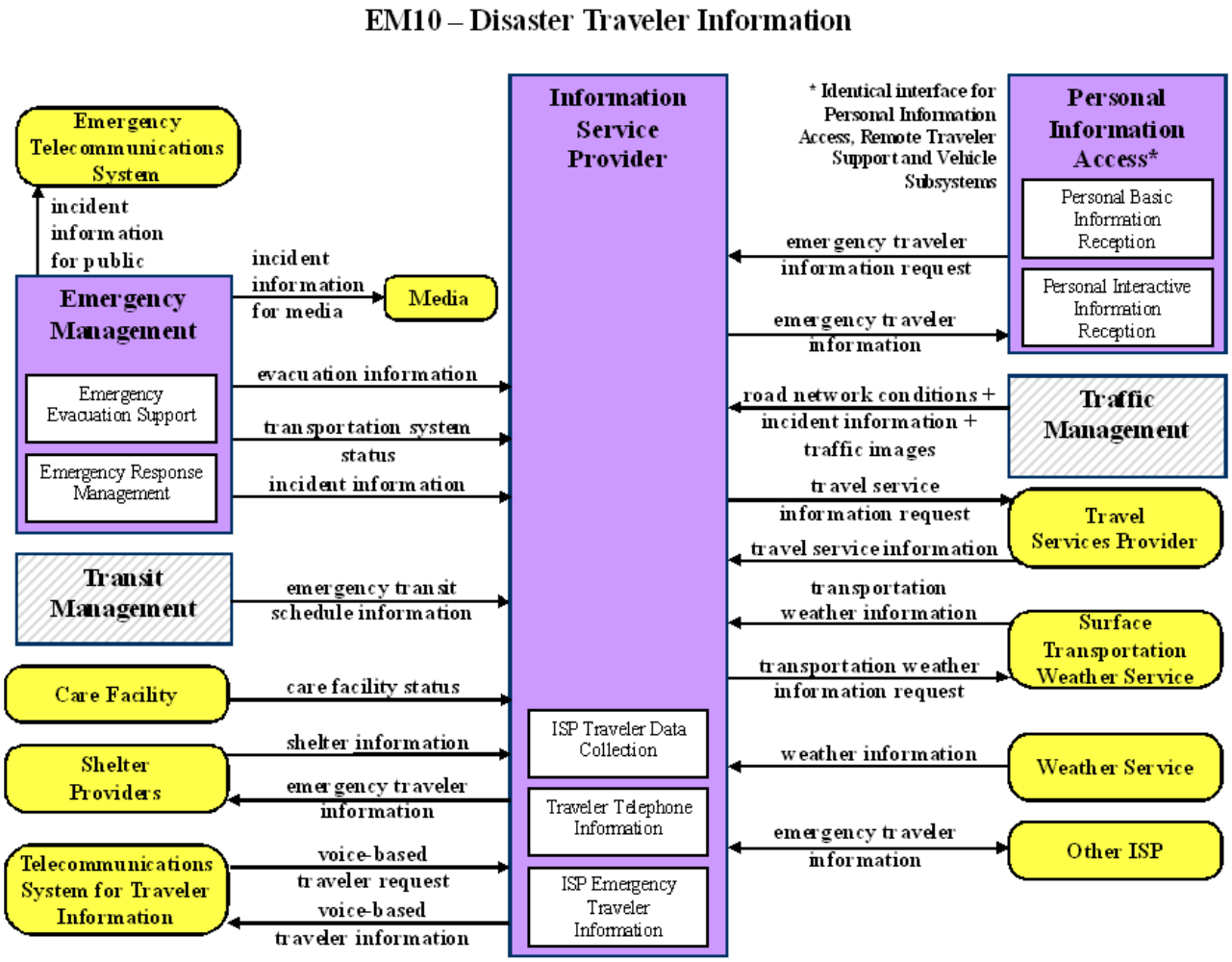

Figure 7 — EM10 Disaster Traveler Information Service Package (source: http://www.iteris.com/itsarch/html/mp/mpem10.htm)

Response Phase Roles and Objectives: Examples

(Source: ISO 19083 adopted from Pigora, Mary Ann. *TCRP Web-Only Document 60: Command-Level Decision Making for Transit Emergency Managers*. Transportation Research Board, Washington, DC, 2013 http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_w60.pdf)

Response Phase	Role	Objective
Activation	PT Emergency Manager	1.1 The PT Emergency Manager immediately gathers information to gain situation awareness of ITS related transportation.
Activation	PT Emergency Manager	1.2 The PT Emergency Manager activates and staffs the EOC.
Activation	PT Emergency Manager	1.3 The PT Emergency Manager schedules the Initial Transportation Action Plan meeting.
Activation	PT Emergency Manager	1.4 The PT Emergency Manager establishes communication between the PT EOC and other agencies.
Activation	PT Emergency Operations Coordinator	1.5 The PT Emergency Operations Coordinator coordinates with the PT Emergency Manager (TEM) to activate the EOC.
Activation	PT Emergency Planning Coordinator	1.6 The PT Emergency Planning Coordinator communicates and coordinates with the PT Emergency Manager in supporting the activation of the EOC.
Activation	PT Emergency Logistics Coordinator	1.7 The PT Emergency Logistics Coordinator coordinates with the PT Emergency Manager to activate the EOC.
Operations	PT Emergency Manager	2.1 The PT Emergency Manager maintains appropriate transportation related documentation during all phases of the response.
Operations	PT Emergency Manager	2.2 The PT Emergency Manager coordinates and communicates with EOC personnel.
Operations	PT Emergency Manager	2.3 The PT Emergency Manager responds and collaborates with external agencies in supporting transportation services for all emergency response efforts.
Operations	PT Emergency Manager	2.4 The PT Emergency Manager maintains consistent communication with the press and media outlets regarding transportation related actions.
Operations	PT Emergency Operations Coordinator	2.5 The PT Emergency Operations Coordinator maintains appropriate documentation throughout all response and recovery phases.
Operations	PT Emergency Operations Coordinator	2.6 The PT Emergency Operations Coordinator oversees Transit personnel performance of the Operations Section.

Response Phase	Role	Objective
Operations	PT Emergency Operations Coordinator	2.7 The PT Emergency Operations Coordinator supports coordination of Transit resource requests to the EOC.
Operations	PT Emergency Planning Coordinator	2.8 The PT Emergency Planning Coordinator maintains appropriate documentation throughout all response and recovery phases.
Operations	PT Emergency Planning Coordinator	2.9 The PT Emergency Planning Coordinator supports transportation planning for EOC's response.
Operations	PT Emergency Planning Coordinator	2.10 The PT Emergency Planning Coordinator identifies transportation resources and coordinates requests with the PT Emergency Operations and Logistics Coordinators.
Operations	PT Emergency Planning Coordinator	2.11 The PT Emergency Planning Coordinator provides PT EOC members with updated Transportation Action Plans.
Operations	PT Emergency Logistics Coordinator	2.12 The PT Emergency Logistics Coordinator maintains appropriate documentation throughout the emergency response and recovery.
Operations	PT Emergency Logistics Coordinator	2.13 The PT Emergency Logistics Coordinator oversees the performance of transportation logistics personnel.
Operations	PT Emergency Logistics Coordinator	2.14 The PT Emergency Logistics Coordinator maintains communication with PT coordinators regarding the status of transportation resources throughout the incident.
Demobilization	PT Emergency Manager	3.1 The PT Emergency Manager coordinates and supports transportation related actions during demobilization phase.
Demobilization	PT Emergency Operations Coordinator	3.2 The PT Emergency Operations Coordinator supports transportation operations actions during the demobilization phase.
Demobilization	PT Emergency Planning Coordinator	3.3 The PT Emergency Planning Coordinator coordinates with the PT Emergency Manager to support transportation planning during the demobilization activities.
Demobilization	PT Emergency Logistics Coordinator	3.4 The PT Emergency Logistics Coordinator supports transportation logistics during the demobilization.

Recovery Phase Roles and Objectives: Examples

(Source: ISO 19083 adopted from Pigora, Mary Ann. *TCRP Web-Only Document 60: Command-Level Decision Making for Transit Emergency Managers*. Transportation Research Board, Washington, DC, 2013)

Recovery Phase	Role	Objective
Assessment	PT Recovery Manager	4.1 PT Recovery Manager gathers information from ITS related transportation source to gain situation awareness of transportation infrastructure.
Assessment	PT Recovery Manager	4.2 PT Recovery Manager activates and staffs the PT Recovery Team.
Assessment	PT Recovery Manager	4.3 PT Emergency Manager schedules the Initial Transportation Recovery Action Plan meeting.
Assessment	PT Recovery Communications Coordinator	4.4 PT Recovery Communications Coordinator establishes communication between the Transportation Recovery Team and other disaster recovery teams.
Assessment	PT Recovery Project Coordinator	4.5 PT Recovery Project Coordinator activates the transportation recovery plan that streamlines transportation administration and accelerates the transportation project approval process.
Assessment	PT Recovery Project Coordinator	4.6 PT Recovery Project Coordinator establishes transportation related interagency/cross-jurisdictional coordination protocols.
Prioritization	PT Recovery Manager	5.1 PT Recovery Manager develops a disaster recovery plan for short-term transportation service restoration.
Prioritization	PT Recovery Communications Coordinator	5.2 PT Recovery Communications Coordinator coordinates and communicates the short-term transportation recovery plan with the EOC and communicates to the public the recovery services via websites, social media and local media.
Prioritization	PT Recovery Project Coordinator	5.3 PT Recovery Project Coordinator refines the short-term transportation recovery plan based on feedback from EOC and public.
Prioritization	PT Recovery Project Coordinator	5.4 PT Recovery Project Coordinator identifies staging areas for transportation equipment and contacts transportation service mutual aid organizations.
Mitigation	PT Recovery Manager	6.1 PT Recovery Manager authorizes the PT Recovery Project Coordinator to begin implementing the short-term transportation recovery plan.

Recovery Phase	Role	Objective
Mitigation	PT Recovery Communication Coordinator	6.2 PT Communications Coordinator maintains consistent communication with the press and media outlets and the public through social media.
Mitigation	PT Recovery Project Coordinator	6.3 PT Recovery Project Coordinator activates mutual aid process to acquire transportation equipment and facilities needed for transportation service restoration.
Mitigation	PT Recovery Project Coordinator	6.4 PT Recovery Project Coordinator begins service restoration by using existing plans and collaborating with vendors to get the work done.
Mitigation	PT Recovery Project Coordinator	6.5 PT Recovery Project Coordinator assembles reimbursement records and submit to national financial aid bodies.
Infrastructure Repair	PT Emergency Manager	7.1 PT Emergency Manager develops a set of long-term transportation recovery goals and objectives based on available resources and identify the roles and responsibilities of the Transit Long Term Recovery team.
Infrastructure Repair	PT Emergency Manager	7.2 PT Emergency Manager coordinates the long-term transportation recovery process by collaborating with other local, regional and national resources to leverage all available recovery resources.
Infrastructure Repair	PT Recovery Communications Coordinator	7.3 PT Recovery Communications Coordinator evaluates and reports to recovery partners what worked, what needs improvement, and what goals and objectives remain to be addressed in an effort to enhance and maintain the collaboration effort.

6. Glossary

To include additional **descriptions/acronyms** used primarily in the module.

Term	Definition
Actor	Entity that fulfils a role Note 1 to entry: The same definition can also be found in EN 302 665
Command-level decision making	Those decisions made by managers to manage and mitigate critical incidents
Command-level decision makers	are those managers within Transit tasked with making decisions during critical incidents
Command-level roles	are those management positions within Transit tasked with making decisions during critical incidents
Commercial vehicle	is any type of motor vehicle used for transporting goods or paid passengers
Computer Aided Dispatch /Automatic Vehicle Location systems	Central software used by dispatchers for operations management that periodically receives real-time updates on fleet vehicle locations
Data	Reinterpretable representation of information in a formalized manner suitable for communication, interpretation or processing.
Disaster	Situation where widespread human, material, economic or environmental losses have occurred which exceeded the ability of the affected organization, community or society to respond and recover using its own resources
Disaster planning	First phase of disaster management cycle consisting of prevention and preparedness
Disaster recovery	Recovery phase that starts after the immediate threat to human life has subsided with the immediate goal to bring the affected area back to normalcy as quickly as possible
Disaster response	Second phase of the disaster management cycle consisting of warning/evacuation, search and rescue, providing immediate assistance, assessing damage caused by the disaster, continuing assistance and the immediate restoration of infrastructure
Emergency Management Organization	The group of people that has its own functions with responsibilities, authorities and relationships to the overall approach preventing and managing emergencies that might occur
Emergency Operations Centre	is a central location from which local, regional or national governments can provide interagency coordination and executive decision making in support of disaster response and recovery

Term	Definition
	operations
Exercise	Process to train for, assess, practice, and improve performance in an organization
Hazardous material	A hazardous material is any item or agent (biological, chemical, radiological, and/or physical), which has the potential to cause harm to humans, animals, or the environment, either by itself or through interaction with other factors
Incident	Process to train for, assess, practice, and improve performance in an organization
Man-made disaster	A disastrous event caused directly and principally by one or more identifiable deliberate or negligent human actions
Private vehicle	A two- wheel or four-wheel vehicle that are not used to carry passengers for a fee
Public safety agency	Includes emergency management agencies, law enforcement agencies, fire departments, rescue squads, emergency medical services and other such entities whose purpose is to enhance the public welfare
Public Transport	A shared transport service which is available for use by the general public and includes city buses, trolleybuses, trams (or light rail) and passenger trains, rapid transit (metro/subways/undergrounds etc.) and ferries. In the U.S. term refers to **transit**.
Transit emergency management	The managerial function charged with creating the framework within which Transit reduce vulnerability to hazards and cope with disasters
Transit emergency services personnel	Persons within Transit responsible for transportation related mitigation activities in an evacuation or disaster including pre-disaster planning, response, and recovery
Transit emergency response team	Persons within Transit responsible for transportation related mitigation activities in an evacuation or disaster including pre-disaster response planning and disaster response
Transit recovery team	Persons within Transit responsible for transportation related mitigation activities in an evacuation or disaster including pre-disaster recovery planning disaster recovery
Transit emergency	Person who is responsible for the overall strategic command of the emergency response effort such as risk identification and mitigation
Transit emergency operations coordinator	Person who is responsible for managing the tactical functions such as coordination with field supervisors, assigning vehicles and drivers/operators to routes, monitoring traffic flow, etc.,
Transit emergency planning coordinator	Person who is responsible for the collection, evaluation, forecasting, dissemination, and use of the information about the emergency incident and status of resources
Transit Recovery Manager	Person who is responsible for the overall strategic plan of the recovery effort to include damage assessment and recovery

Term	Definition
	planning for short-term, intermediate, and long-term mitigation
Transit Recovery Communication Coordinator	Person who is responsible for informing outside organizations and the public of recovery plans and services
Transit Recovery Project Coordinator(s)	Person or persons who is/are responsible for managing mutual aid request and work associated with infrastructure repair
Transit emergency logistics coordinator	Person who is responsible for managing logistical support such as personnel, vehicles, equipment, and supplies
Transit operator	Private profit-driven entity that provides shared transport service which are available for use by the general public and includes city buses, trolleybuses, trams (or light rail), passenger trains, rapid transit (metro/subways/undergrounds etc.) and ferries
Transit service manager	Private profit-driven entity that provides shared transport service which are available for use by the general public and includes city buses, trolleybuses, trams (or light rail), passenger trains, rapid transit (metro/subways/undergrounds etc.) and ferries
Regional	Layer within the emergency management hierarchy that exists between national and local
Primary mobility agent	Lead person in transportation services in this case for emergency evacuation and disaster response and recovery
Shared-use vehicle	is a vehicle used by several different individuals throughout the day
Strategic command	Organization responsible for formulating the strategy for dealing with the incident
Tactical functions	Formulate from strategic plans the sets of actions dealing with the incident that are completed in the field
Traffic flow models	The use of computer modelling to simulate the of interactions between vehicles, drivers, pedestrians, cyclists, other travellers and infrastructure (including highways, signage, and traffic control devices), with the aim of understanding and developing an optimal road network with efficient movement of traffic and minimal traffic congestion problems
Use case	Sequence of actions that an actor (usually a person, but perhaps an external entity, such as another system) performs within a system to achieve a particular goal

7. References

Mass Evacuation Incident Index United States Department of Homeland Security/Federal Emergency Management Agency, June 2008.
https://www.fema.gov/pdf/emergency/nrf/nrf_massevacuationincidentannex.pdf

NCHRP Report 753: A Pre-Event Recovery Planning Guide for Transportation National Cooperative Highway Research Program, Transportation Research Board 2013
https://www.massport.com/media/266266/Report_A-Pre-Event-Recovery-Planning-Guide-for-Transportation-2013.pdf

Evacuation Transportation Management Task Five: Operational Concept United States Department of Transportation/ Federal Highway Administration, June 2006
http://ops.fhwa.dot.gov/publications/fhwahop08020/fhwahop08020.pdf

Information Sharing Guidebook for Transportation Management Centers, Emergency Operations Centers and Fusion Centers United States Department of Transportation/ Federal Highway Administration, June 2010
http://ops.fhwa.dot.gov/publications/fhwahop09003/tmc_eoc_guidebook.pdf

8. Study Questions

To include the quiz/poll questions and answer choices as presented in the PowerPoint slide to allow students to either follow along with the recording or refer to the quiz at a later date in the supplement.

1. Which of the following is a part of the ISO 19083 standard?
    a) Sheltering, aid, and security
    b) Railways, airports, and ports
    c) Evacuation, response and recovery
    d) Organizations, policies, and procedures

2. What paradigm change does the EEDRR propose for emergency evacuation and disaster response and recovery?
    a) Transit is primary mobility agent for all transportation related actions
    b) Transit supports emergency evacuations
    c) Transit does not participate in disaster recovery
    d) Emergency management relinquishes control of the Emergency Operations Center to Transit Emergency Manager

3. What is the purpose of developing a concept of operation for EEDRR?
    a) Find support for funding a system
    b) Resolve labor issues associated with operating a system
    c) Identify size of operational force needed for disasters
    d) Develop the scope of a decision support system

4. Which layer is NOT a layer in the EEDRR-DSS?
    a) Network Layer
    b) Interface Layer
    c) Knowledge Layer
    d) Cloud Infrastructure Services Layer

9. Icon Guide

The following icons are used throughout the module to visually indicate the corresponding learning concept listed out below, and/or to highlight a specific point in the training material.

1) **Background information:** General knowledge that is available elsewhere and is outside the module being presented. This will be used primarily in the beginning of slide set when reviewing information readers are expected to already know.

2) **Tools/Applications:** An industry-specific item a person would use to accomplish a specific task, and applying that tool to fit your need.

3) **Remember:** Used when referencing something already discussed in the module that is necessary to recount.

4) **Refer to Student Supplement:** Items or information that are further explained/detailed in the Student Supplement.

5) **Example:** Can be real-world (case study), hypothetical, a sample of a table, etc.

6) **Checklist:** Use to indicate a process that is being laid out sequentially.

10. Speaker Notes

These notes accompany the presentation slides.

Slide 2

We are in the early stages of the new age of information gathering. Just pull your mobile device from your pocket or purse and in an instant you can talk to anyone in the world or use it to access the limitless network of information on the Internet. This small plastic device with specialized circuit boards is really the culmination of a career path that I have followed and incorporates the technologies that are the subject of this ITS based standard for Emergency Evacuation and Disaster Response and Recovery.

Slide 3- Instructor's biography

Slide 4

As you can see by the four boxes on the screen, the course is organized into four learning objectives. These four learning objectives are meant to guide the viewer in developing a customized decision support system for transportation service for emergency evacuation and disaster response and recovery. You will be hearing that term throughout this web pilot and I am hopeful that by the end of this presentation you will understand the framework from which you will be able to develop disaster response and recovery. You will be hearing that term throughout this web pilot and I am hopeful that by the end of this presentation you will understand the framework from which you will be able to develop a set of system specifications. Learning objective 1 will define the framework for transportation services for disaster evacuation, response, and recovery. Learning objective 2 will cover how to develop the roles and responsibilities associated with these transportation services. Learning objective 3 focuses on how to develop a concept of operation for providing the transportation services. In learning objective 4 we apply these lessons to developing a Decision Support System for transit starting with the actors involved and identifying the information flow and characteristics of the EEDRR-DSS.

Slide 5

In Learning Objective 1 we will describe the boundaries of the EEDRR by looking at the needs, identifying the gaps, and proposing solutions through the use of ISO 19083 in developing a custom decision support system for managing transportation services before, during and after a disaster.

Slide 6

Let's begin by looking at the occurrences of disasters as this drives the need for the system.

Slides-7-10

Disasters impact transit in three major ways –

Equipment and facilities – destroys and degrades

Service – prevents and reduces ability to provide services to riders

And Ridership – most importantly, dependent transit riders (other travel is also impacted making people even more reliant on transit services.

Slide 10

We looked at the occurrences and impact disasters have on transportation and transit in particular. Let's next look at some of the organizations that are involved in developing transportation services when a disaster strikes. As an example TRB and APTA have prepared guidance on disaster preparedness. ISO has a technical committee dedicated to Societal Security and there are numerous emergency management organizations that exist as well state and regional organizations.

Slide 11

However, transit has been left out of most of the emergency management activities in ITS.

Yet, it is the expert in moving people in a crowded city, including estimating the resources, assigning resources and executing the services.

Transit has significant knowledge, through providing ADA paratransit and senior passes, to different demographic groups that are carless.

Few Emergency Evacuation Plans consider specific routes and schedules for transit services to pick up carless during an evacuation. They typically identify places for people to evacuate to.

There may be many public transit operations in the region. There will also be a need among transit agencies to coordinate their operations during an emergency.

Slide 12

Transit should provide transportation to the carless but as we will discuss throughout the presentation there are many roadblocks inadequate communications leading the list. This is not only communication to the riding public but also communication between the organizations that are responsible for providing these service. ITS can be used to improve the communications and standards can be used to "standardize" the response to a disaster.

Slide 13

ISO 19083 provides a guide for developing a Decision Support System that can be used to establish lines of communications to integrate transit as the mobility agent/ transportation provider in times of disaster. This is accomplished through a three-part standard where part one is used to develop a framework and concept of operation that will determine the architecture of the system. Part two provides guidance on developing the information flow. It is important to note this is information flow and not data flow. Part three will provide guidance on setting up exercises and defining use cases in support of ensuring the system is deemed fit for operation should a disaster strike. It will provide the feedback to ensure that your decision support system remains current and viable.

Slide 14

Just to reiterate ISO 19083 is a three-part standard and this webinar is focused on Part 1.

Slide 15

SLIDE PURPOSE: Identify where EEDRR Decision Support System fits within the framework of the existing ITS and EM worlds.

The focus of the standard is on the activities and content of the EEDRR DSS. (animations)

Slide 16

Explain how EEDRR standard fits into the overall Emergency Management landscape and what is outside the scope of the standard.

Slide 17

Explain how ISO 19083 proposes a *paradigm shift* from current practices where transit is considered first when an evacuation is necessary.

Explain how ISO 19083 uses terminology developed by ISO 22330 to ensure it is compliant with societal security where societal security is defined as "protection of society from, and response to, incidents, emergencies and disasters caused by intentional and unintentional human acts, natural hazards, and technical failures."

Slide 18

These points will be discussed in more detail in the next several slides.

Considerations:

1. The resources available to transit may be insufficient to deal with the needs created by a major disaster.
2. There may be more than one transit operator within the affected area and coordination among operators need to be addressed.
3. The majority of resources available for evacuation (such as school buses) may fall under the purview of non-transit entities.
4. To properly support EEDRR, there may need to be a designated person/agency appointed to coordinate and deploy the resources of multiple suppliers.

Slide 19

The first step to developing a concept of operations is to understand the planning assumptions and user needs. The "user" is associated with all the parties who use or benefit from the tool. The next

several slides will walk through how to identify needs and understand your planning assumptions as described by the standard.

So before we can identify needs, we need to understand who the stakeholders are who use the system.

Slide 20

Needs related to Stakeholders:

- Who are the stakeholders who need to be involved and with who do they need to share information?
- What types of information does each stakeholder need to make good decisions?
- Can that information be stored in preparation for a disaster?
- What information is needed to exchange (receive or send) during for evacuation, response and recovery?
- How is that information reviewed for to ensure its quality -- accuracy, timeliness, resolution and precision?
- What services (or tools) are available to support the planning, resource and supply chain management processes?

Slide 21

Continue defining the planning approach by addressing the 3 main problems:

- How many people are impacted (needs),
- What routes will be used to transport them (response times), and
- How many vehicles/operators do I have to do it with (resources)

These are typical questions that Transit operators need to solve on a daily basis.

- How many people? How long can they work? Are they trained to perform the work?
- How many buses are needed given the people who need to be served? When and how frequently should buses be dispatched?
- Which path will the buses go? How will the drivers know where to go? What are their expected running times?
- By whom and where will buses be serviced?

Slide 22

Define how to go about determining the demographics for the area impacted particularly the "carless" populations.

Slide 23

Modeling Software includes dynamic routing, evacuation time estimate (ETE), dynamic traffic assignment.

Dynamic routing is similar to "disruptive mobility" based routing algorithms – creation of routes with virtual bus stops disseminated through mobile apps or demand response algorithms used for on-demand carpooling.

ETE is a calculation of the time to evacuate the plume exposure pathway emergency planning zone (EPZ), which is an area with a radius of about 10 miles (16 km) around a nuclear power plant. The ETE is primarily used to inform protective action decision-making and may also be used to assist in development of traffic management plans to support an evacuation.

Slide 24

SLIDE PURPOSE: Define how to assign the resources.

Slide 25

Continue discussion on what other factors may impact the decisions.

Slide 26

- Shelters – transportation
- Response-recovery
- Sp. Needs populations including children

Slide 27-29 Question for Learning Objective 1

Slide 30

Explain that the objectives of LO#2 is to develop an understanding of the roles and responsibilities of transit in a disaster and the criteria by which transit is used in providing transportation services in a disaster.

Slide 31

There are stakeholders grouped by jurisdiction hierarchy. When a disaster is large enough, the National Government agencies support or manage the ground situation.

There are lots of other National organizations that help when different emergencies occur, for example the US Army Corp of Engineers helped during Hurricanes Katrina and Sandy.

Slide 32

There are overlapping stakeholders at each level of government. Emergency management services extend from local through national governments, similarly traffic management. They have their own organizations to coordinate their services from local to national.

Each stakeholder group has its own role and responsibility. Traffic Management agencies manage the roads and the car riding public. The standard identifies the role of transit to evacuate the carless public and to support recovery personnel transportation to the scene of the disaster.

Slide 33

Explain that roles and responsibilities change based on the phase of the disaster and that transportation services requirements also change based on the activities within the phase. Transit roles associated with each phase are described in the next few slides.

Slide 34

Provide examples of the transit roles within the activities in a phase. Additional roles for each phase are covered in the supplement.

Slide 35

Provide additional examples of transit roles in various activities within a phase.

Slide 36

Identify the need to include transit roles in the recovery phase. Again, long term recovery lessons learned should be incorporated into any pre-disaster planning and preparedness.

Slide 37

For example, picture a large earthquake or storm that devastates an area.

- After the fires are out and the rescues over the task of rebuilding begins.
- But debris is being removed and there are severe limitations on access to the few routes that are open or re-opened.

In collaboration with industry, government could decide which organizations and sites should get up and running first and which personnel are needed to accomplish this - including inspectors. Rather than have these individuals arrive in separate vehicles, transit should transport them as a group or at the very least be the official access fleet management agency to identify and control who gets access. This role may continue for months after the disaster and as the situation changes hourly or daily there needs to be a system/process such as is included in this proposal.

Slide 38

Answer the question why transit and why ITS. Use this diagram to explain how a regional ITS architecture process brings different stakeholders together to agree on how they will interact to support different services. Transit can contribute if they are sitting at the table. When multiple transit agencies are sitting at the table, they can coordinate their activities to address issues such as evacuation and response services.

There are 10 service packages that describe emergency management (see next slide for description of a service package).

Slide 39

Explain the use of transit in disasters for evacuation, response and recovery is different than typical emergency routing for accidents but requires much of the same data and information from Emergency Management Services and Traffic Management.

The regional ITS architecture process gathers key stakeholders when the architecture is being developed to discuss how the stakeholders will operate, exchange information, and share resources during the situation described by each service. In this case the service is emergency routing. This is the place to define roles and responsibilities, the specific content, format and frequency by which information is exchanged, shared resources and more.

The Supplement describes all the EM services as well as specific ones for Transit.

Slide 40

Show an example of the “reference” model for Emergency Routing for the National ITS Architecture. Regions will walk through the reference and tailor these to fit their region. Most regions only adopt some of the functions and interfaces shown in this diagram (see next page for an example).

This is a generic or reference diagram from the National ITS Architecture. A diagram from a region will have names of organizations in each box. Notice, that even in this national model of emergency routing, there is little provision for carless populations, and there is little to no transit presence included in the services.

Discuss how the DSS proposes that Transit replace Emergency Management in the diagram as the primary mobility agent for disasters.

Slide 41

Here is an example of a regional instance of EM #02. Solid lines represent existing communications pathways, while dotted lines (not included) represent planned pathways that should be funded to ensure that services that agencies need to provide are enabled.

A regional ITS architecture would include names for the “City/Town/County” and “Hospital”. Note that there is no transit included in this depiction, through transit agencies are called on when there are major issues with moving people. What would a routing request look like for evacuating people to shelters if transit was delegated with the responsibility? (See next slide.)

Slide 42

In this example, Transit suggests the route, the number of vehicles to the Traffic Management system, which in turn responds with the status of the roads.

Here is an example of a regional instance of EM #02. Solid lines represent existing communications pathways, while dotted lines (not included) represent planned pathways that should be funded to ensure that services that agencies need to provide are enabled.

Slide 43

Describe how transit is usually absent in current regional ITS architecture instances when it comes to transportation services for disasters hence the resulting loss of both equipment and potentially lives. Examples – Hurricane Sandy & Hurricane Katrina.

Slide 44

The decision support system (DSS) addresses the limited perspective on the role of transit. The purpose of the DSS is to make transit operations smarter during a disaster. However, any data driven tool should be developed using a Concept of Operations. Explain the purpose and characteristics of a ConOps.

Slide 45

Obtain stakeholder agreement on who is responsible for developing the ConOps.

Manage stakeholder collaboration and needs on -- How the system operates, who is responsible for specific functions, what lines of communication exist between Transit, Emergency Management, Traffic Management and the public.

Define the environment in which the Decision Support System will operate. Derive high-level user requirements for the Decision Support System. Provide criteria for validation of the completed Decision Support System.

Slide 46-48 Question and answers

Slide 49

Review the importance of developing a Concept of Operation and how it drives the specifications for the Decision Support System.

Describe how LO#3 focuses on the steps to follow in developing the Concept of Operation and how operational requirement translate into system specifications.

Slide 50-51

Describe how the first step is to develop a detailed outline for the ConOps and then begin the research to fill in the details. Walk through each of the sections that are listed. Emphasis that interest of time we will focus on User-Oriented Operational Approach.

Slide 52

Describe how it is important that consensus with all actors be reached with the operation approach. Remind participants that consensus may be reached through the regional ITS architecture approach or numerous other disaster planning and coordination meetings. Describe selecting the scope, command level roles, and goals through the meeting process.

Slide 53

A cognitive process is defined as a series of interdependent actions executed during multi-agency response to an emergency. These actions form an evolving response pattern aimed at resolving the crisis. Through these actions, it is possible to employ, maintain, and revise plans. These processes involve activities such as leveraging previously established relationships with other transportation authorities, establishing morale, and establishing internal communication and information flows that promote effective multi-agency (public and private) Transit response. As described below, there are three main cognitive processes, which include; Develop Situation Awareness, Synchronize Information and Resources, and Execute Actions and Decisions.

Slide 54

The actors or roles differ by phase.

The response phase includes Transit Emergency Manager, Operations, Planning and Logistics Coordinators. These correspond to the major activities that are conducted during disasters.

The recovery phase includes a Recovery manager and then communications and project coordinators. The communications coordinator communications with transit riders and the project coordinator manages the rebuilding effort.

Slide 55

Corresponding to the roles are the phase activities:

The response phase activities follow Activation, Operations andDemobilization.

And the Recovery phase activities correspond to Assessment, Prioritization, Mitigation, and Infrastructure repair.

Slide 56

Each role has different sets of objectives they cover for each phase of the response and recovery. These objectives are like general duties.

Slide 57

Each objective has a template that describes how the objective will be met. The role to whom the objective is assigned (see previous slide) is responsible for implementing the task. These operational templates are used as building blocks to describe the actions and order that they should be

accomplished; they should be linked together to provide the order, priority and reuse of functions that will be implemented in the DSS, the actions and resources that should be marshalled, and the coordination activities needed to meet the objective. The operational approach may vary for different organizations who coordinate with different players. The objectives and roles may be distributed across many transit agencies when there are multiple providers in a region, or they might be associated with a single operator.

This approach facilitates standardizing the functions for use as building block (reuse). Additionally, it provides scalability and a well-defined set of requirements.

Each parameter in the template is defined in the next slide.

Slide 58

These are the parameters included in the template. Review the parameters starting with task.

Slide 59

Objective corresponds to the **Phase-Role-Objective** table. There may be multiple tasks that fall under each objective. Definitions are in the previous slide. Not shown are: **Expected Actions** – step by step activities and **Enabling Requirements** – decision support requirements derived from objective

Slide 60

These are the Measurement Methods from the Template

ER – the enabling requirement from the previous parameter

CP – The cognitive process that is performed – Assessment, scheduling, implementation

DSS Strategy – functions that need to be performed in the DSS

Performance Measures – how to validate the strategies

Slide 61

Operational scenarios are used to validate the operational requirements for real world situations. Operational scenarios may be generic descriptions based on lessons learned from previous, similar events. These help build information that support updating the response and recovery plans, and table top and field exercises.

ISO 19083 includes 4 general scenarios everything from earthquakes to hurricanes. Developers will select scenarios that are important and viable to the location.

Slide 62

These templates become a formal way to document lessons learned and incorporate the information into planning scenarios for the next disaster.

Slide 63

We then use the templates to develop the support environment for the DSS.

Slide 64-Review

- We talked about the stakeholder and who needs to be involved. There may be more than one transit agency in your region, similarly traffic and emergency management centers. Each of them will have their own set of coordinated roles and responsibilities by phase and region.

- We begin to talk about the knowledge layer, these are the scenarios and the tools needed to build a knowledge layer.

- We identified where the DSS needed to reside, in a cloud infrastructure.

Slide 65

The final assessment of the Concept of Operations is to look at operational impacts to the organization.

Slides 66-68 Question and answer Learning Objective 3

Slide 69

LO#1 introduced ISO 19083 standard and the paradigm shift from emergency management to transit serving as primary mobility agent for disasters.

LO#2 focused on roles and responsibilities of transit in a disaster and the criteria by which transit provides transportation services in a disaster.

LO#3 provided the steps to follow in developing the Concept of Operation and how the operational requirement translate into system specifications.

In LO#4 we apply these lessons to developing a Decision Support System for transit starting with the actors involved and identifying the information flow and characteristics of the EEDRR-DSS.

Slide 70

Begin with the actors (boxes in the External Network) and talk about how the information flows from the external networks and is processed by the DSS. The resulting decisions are then distributed to the external networks. The decisions focus on information sharing for demographic, routing, and resource allocation in an effort to efficiently and effective organize transportation services for disaster response and recovery.

Slide 72

The communication occurs between the DSS and the External Networks.

Numerous methods are used to communicate information during an emergency and these methods must be included in the DSS specification.

Slide 72

The information flow is managed by the Interface layer from the DSS. Information flow differ from data flow. The elements that drive the information include:

Slide 73

Interface layer gathers and distributes information, and decisions. The Communications methods and information flows are captured in this layer.

Knowledge layer uses modelling to transforms data into information and that information is used to generate the knowledge that is used to influence decisions.

Cloud layer permits the system to operate both inside transit facilities as well as at emergency operation centres without the need of transferring equipment or software.

Slide 74

These are the characteristics of the interface, knowledge and cloud infrastructure layers. They all relate to information gathering and distribution. The details and configuration will depend on Transit's relationship, role and responsibilities within the regional context, as well as the type of event that occurs.

Slide 75

This concludes our discussion on the actors, information flows, and characteristics of the DSS.

Slide 76-77 Question and Answers Learning Objective and recap of main points.