

Project No. \_\_\_\_\_

COPY NO. \_\_\_\_\_

## **NCHRP 20-77 Transportation Operations Training Framework**

FINAL REPORT

Prepared for  
NCHRP  
Transportation Research Board  
of  
the National Academies

TRANSPORTATION RESEARCH BOARD  
OF THE NATIONAL ACADEMIES  
PRIVILEGED DOCUMENT

This report, not released for publication, is furnished only for review to members of or participants in the work of the CRP. This report is to be regarded as fully privileged, and dissemination of the information included herein must be approved by the CRP.

**University of Maryland**  
**Center for Advanced Transportation Technology**

College Park, Maryland

September, 2009

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Philip Tarnoff – Director of the University of Maryland Center for Advanced Transportation Technology. Mr. Tarnoff initially served as the Principal Investigator of the project and later turned the project over to Ms. Frankle after Task 1. He and Mr. Lockwood led Task 1 of the project which provided the base data needed to complete all the other project tasks, participated in the development of the course subject matter, defined knowledge levels for the core competencies by position, reviewed the gap analysis and presented the results of the project at the SSOM meeting in June 2009. He also served as a content matter expert throughout the project.

Kathleen Frankle, Program Manager at the University of Maryland Center for Advanced Transportation Technology. Ms. Frankle served as the Principal Investigator for the majority of the project and was actively involved in all tasks of the project.

Dorothy Parnian, Training Specialist at the University of Maryland Center for Advanced Transportation Technology. Ms. Parnian was a key player in the project. She coordinated with the PACs members in Task 1, compiled the existing courses in Task 2, generated the gap analysis in Task 3, and developed the training packages in Task 6.

Thomas Jacobs – Program Manager at the University of Maryland Center for Advanced Transportation Technology. Midway through the project, Mr. Jacobs became the new Director of the University of Maryland Center for Advanced Transportation Technology. Mr. Jacobs led one of the PAC meetings in Task 1, participated in the development of the course subject matter, defined knowledge levels for the core competencies by position, reviewed the gap analysis, participated in the February meeting with the Review Panel, and served as a content matter expert throughout the project.

Steven Lockwood – Principal Consultant at PB Consult. Mr. Lockwood and Mr. Tarnoff led Task 1 of the project which provided the base data needed to complete all the other project tasks, participated in the development of the course subject matter, defined knowledge levels for the core competencies by position, and reviewed the gap analysis. He also served as a content matter expert throughout the project.

Project Advisory Committee (PAC) members participated in defining functions, positions, and knowledge needs for each of the core functions to be used as the basis for future training. Based on the seven core functions, UMD combined them to create four PACs shown in the list below. The following charts list members of each PAC.

- Policy & Strategic Considerations and Program Planning
- Systems Development and Project Management
- Real-time Operations and Real-time Traveler Information
- Specific Technical Specialties (ITS User Services)

<b>Member</b>	<b>Agency/Organization</b>
<b><i>PAC 1 – Policy &amp; Strategic Considerations and Program Planning</i></b>	
Regina McElroy	FHWA
Bob Pento	Pennsylvania DOT
George Schoener	I-95 Corridor Coalition
Eileen Singleton	Baltimore Metropolitan Counsel
Dick Steeg	Virginia DOT
Phil Tarnoff	University of MD
John Wolf	CalTrans
<b><i>PAC 2 – Systems Development and Project Management</i></b>	
Rick Dye	Maryland SHA
Leslie Fowler	Kansas DOT
Tom Jacobs	University of MD
Chris Hill	Mixon/Hill
Shari Hilliard	Kansas DOT
Paul Olson	FHWA
Tom Phillips	Virginia DOT
Phil Tarnoff	University of MD
Mike Weaver	Pennsylvania DOT
<b><i>PAC 3 – Real-time Operations and Real-time Traveler Information</i></b>	
Tom Batz	TRANSCOM
Scott Cowherd	Virginia DOT
Leslie Fowler	Kansas DOT
Shari Hilliard	Kansas DOT
Tom Jacobs	University of MD
Todd Kell	PBS&J
Chris Leight	Montgomery County TMC
Ling Li	Virginia DOT
Alvin Marquess	Maryland SHA
Doug Noble	ITE
John Riehl	Montgomery County TMC
Phil Tarnoff	University of MD
Greg Windham	Montgomery County TMC
<b><i>PAC 4 – Specific Technical Specialties (ITS User Services)</i></b>	
Steve Cummins	Lexington
Richard Easley	E-Squared
Anne Ferro	Maryland Motor Truck Assoc.
David Helman	FHWA
Tom Jacobs	University of MD
Bob Jordan	MD Transit Authority
Alvin Marquess	Maryland SHA
Michael Pack	UMD – CATT Laboratory

## Abstract

The purpose of NCHRP 20-77 was to develop a training and capacity-building framework for transportation operations technicians, engineers, and managers. The major outcomes of the project were the determination of (1) the training that is needed, (2) the training that is currently available, (3) the gaps between the training that is currently available and what is needed, and (4) the most effective way to deliver the needed training.

The project had five major deliverables to address those outcomes:

1. Development of a matrix that identified the core competencies that are required by personnel at various levels in an organization by core function. This allowed for the identification of needed training by core function and position.
2. Compilation of currently available operations and management training for inclusion in the National Transportation Training Resource (NTTR) database.
3. Compilation of areas in which there is little or no training available in the form of a gap analysis.
4. Development of training packages that consist of existing courses for every competency shown in the matrix described above.
5. Development of marketing materials to publicize the results and deliverables of the project.

Copies of all these deliverables may be found online:

<http://www.catt.umd.edu/research/nchrp-framework.html>



## EXECUTIVE SUMMARY

In this project, the UMD team developed a training and capacity-building framework for transportation operations technicians, engineers, and managers. There were four main questions to be answered in order to accomplish this objective: (1) determine the training that is needed, (2) find available training, (3) identify the gaps in available training, and (4) determine the most effective way to deliver this missing training.

Task 1 of the project answered the question: “What training is needed?” The Project Team worked with several Project Advisory Committees (PACs) to define the detailed competencies that were required by personnel at various levels in an organization (Senior, Mid-level, and Technician). A matrix was developed to organize the specific competencies needed at each of those levels – see Appendix A. The rows of the table represent a group of core functions required to carry out a state-of-the-practice Subcommittee on System Operations and Management (SSOM) program ranging from broad policy through technical development to field activities. Each column represents an agency position—from senior management to field technician. The cell at the intersection of each row and column defines a set of competencies related to a position’s role related to a core function. The completed matrix of core competencies was one of five major deliverables of this project and may be found in Appendix A.

Task 2 of the project answered the question: “What training is currently available?” The competencies that were defined by the PACs were used to develop a list of course subject matter – see Appendix B. Using this list, the Project Team searched for existing courses to address the subject matter and identified competencies. The team found courses from the following types of sources: industry associations, federal government, universities, state departments of transportation, and private industry. All the existing courses were compiled into a searchable access database that contains over 700 courses. This database of existing courses was the second of five major deliverables for this project. To make sure that this compilation of courses was widely available to users, the courses contained in the access database were uploaded into the National Transportation Training Resource (NTTR) database found at <http://www.nttr.dot.gov/>. A screen shot of the NTTR is available in Appendix H.

Task 3 of the project answered the question: “What are the gaps between the training that is currently available and the training that is needed?” To find the answer, the UMD team took the results of Task 1, which identified individual knowledge requirements, and compared them to the existing training compiled in Task 2. The difference between these two data sets provided the team with the gaps in available training. Upon review of the list, it was obvious that current training available for operations and management is not adequate. The gap analysis developed from this task was the third of five major deliverables for this project. The goal is for FHWA and training stakeholders to use this list of training gaps to develop needed training courses. The complete gap analysis is available in Appendix C.

Tasks 4, 6, and 7 answered the question: “What is the most effective way to deliver the missing training?” In Task 4, the Project Team researched a number of different types of training methods that could be used to effectively support operations and management training. A chart of training methods was developed and for each methodology several items were identified such as: the applicable categories of subject matter, students most likely to benefit from the approach,

development costs, delivery costs, specialized skills required, and limitations. The results of this task are shown in Appendix D.

Task 5 was the development of an interim report summarizing the results of Tasks 1-4. This report was completed and forwarded to the review panel as required. The meeting with the NCHRP panel was delayed until after Task 6 so the project team could obtain direct panel feedback on the recommended training packages.

Task 6 consisted of packaging the results of the previous tasks into programs that can be used by state and local agencies for the delivery of traffic management and operations training. Training packages were defined for each cell of the matrix containing a unique set of training requirements. Each training package was defined to include all of the material required for the creation of a training program. A draft version of the training packages were developed and presented to the project review panel. The panel felt there was too much information shown for each package so the group agreed to develop a condensed version of each training package. The final training packages developed from this task were the fourth of five major deliverables for this project. Sample training packages are available in Appendix E. All the training packages can be access at <http://www.catt.umd.edu/documents/NCHRPTrainingFramework.pdf>

At the meeting with the review panel in February 2009, Task 7 was revised to focus specifically on facilitating the use of the framework and other project deliverables by state and local transportation agencies. Two marketing pieces, specifically a tri-fold brochure and PowerPoint presentation, were developed to facilitate “spreading the word” about the deliverables that were developed as a result of this project. The brochure is available in Appendix F and the PowerPoint Presentation is available in Appendix G. The access database of existing courses was also ported into the National Transportation Training Resource (NTTR) database developed by Federal Highway Administration. The NTTR provides a database of courses that is searchable by subject area and competency matrices and was the ideal place to make existing course information compiled in Task 2 easily accessible by state and local transportation agencies. A screen shot of the NTTR is available in Appendix H.

For Task 8, the project team made a presentation on the project to the Joint Committee meeting of the Association of State Highway and Transportation Officials (AASHTO), Subcommittee on Traffic Engineering (SCOTE)/SSOM Groups on June 17, 2009 in Manchester, NH. The PowerPoint presentation developed as a result of Task 7 has been made available to all panel members or for anyone to use in developing their own presentations for meetings they are attending. The project team also plans to present project results during the TRB Annual Meeting in Washington, DC in January 2010.

Informing the transportation community about the availability of the project results is as important as their development. The deliverables have been posted on the UMD and TRB web sites. The link for the UMD web site is shown below. The Project Team has also notified the training officers of all state DOT’s concerning the availability of project deliverables and related information. It is imperative that the Project Team and the Project Review Panel continue to educate their peers about the results of this project long after the project is completed. The results of this project will also be used on other follow on projects such as NCHRP 20-86 for example.

The Project Team feels that further research is required to better determine the critical training areas, especially considering current economic conditions. Funding for training is the first line item to be cut when budgets are lower than expected. A short-list of critical training would be helpful to ensure that at least a minimum threshold of SSOM training is obtained. The results of this project will also be used on other follow-on projects such as a new project that will be started in early 2010, NCHRP 20-86: Attracting, Recruiting, and Retaining Skilled Staff for Transportation System Operations and Management.

All the major deliverables from this project have been posted at:  
<http://www.catt.umd.edu/research/nchrp-framework.html>

## **CHAPTER 1 BACKGROUND**

It is increasingly recognized that the lack of qualified professional and technical staff is the leading barrier to effective mainstreaming of systems operations and management. As management and operations becomes a core function of departments of transportation, a trained and qualified workforce is needed. The need for increased levels of training in transportation management and operations was highlighted during a meeting of the AASHTO Subcommittee on System Operations and Management (SSO), when representatives of several state DOTs, that had committed to greater emphasis on M&O, expressed their frustration with the absence of experienced professional-level personnel, to lead these activities. Two activities were a result of these discussions.

First, the University of Maryland (UMD), with financial support from the I-95 Corridor Coalition, developed and launched a two-week total immersion Management and Operations program designated the Operations Academy, for senior level management personnel. The Operations Academy program was carefully developed to provide focused training, including classroom instruction, workshops, and field trips that emphasize the fundamental principles of operations. The Operations Academy is not intended to represent a complete solution to the transportation community's need for comprehensive M&O training. It has intentionally emphasized the training of senior management personnel on the premise that the introduction of training at this level will potentially have the greatest immediate impact on the transportation community. It is clear that the M&O field is extremely broad, and will require a comprehensive training program spanning many specialties and organizational levels, if the desired shift in emphasis is to be achieved. Thus, the Operations Academy must be viewed as a small first step in the creation of a training framework that deals with the entire functional scope of management and operations.

The second activity was the release of NCHRP 20-77 (this project) to develop a training and capacity building framework for transportation operations technicians, engineers, and managers. The expected outcomes of the project were as follows: (1) What training is needed? (2) What training is currently available, (3) What are the gaps between what training is available and what is needed? and (4) What is the most effective way to deliver the training that is missing?

## **PROJECT DESCRIPTION**

In this project, the Project Team developed a training and capacity-building framework for transportation operations technicians, engineers, and managers. There were four main questions that needed to be answered in order to accomplish this objective: (1) determine the training that is needed, (2) find available training, (3) identify the gaps in available training, and (4) determine the most effective way to deliver this missing training.

Task 1 of the project answered the question: "What training is needed?" The Project Team worked with several Project Advisory Committees (PACs) to define the detailed competencies that were required by personnel at various levels in an organization (Senior, Mid-level, and Technician). A matrix was developed to organize the specific competencies needed at each of those levels (see Appendix A). The rows of the table represent a group of core functions required

to carry out a state of the practice SSOM program ranging from broad policy through technical development to field activities. Each column represents an agency position—from senior management to field technician. The cell at the intersection of each row and column defines a set of competencies related to a position’s role related to a core function. The completed matrix of core competencies was one of five major deliverables of this project and can be viewed in Appendix A.

Task 2 of the project answered the question: “What training is currently available?” The competencies that were defined by the PACs were used to develop a list of course subject matter (see Appendix B). Using this list, the Project Team searched for existing courses to address the subject matter and identified competencies. The team found courses from the following types of sources: industry associations, federal government, universities, state departments of transportation, and private industry. All the existing courses were compiled into a searchable access database that contains over 700 courses. This database of existing courses was the second of five major deliverables for this project. To make sure that this compilation of courses was widely available to users, the courses contained in the access database were uploaded into the National Transportation Training Resource (NTTR) database found at <http://www.nttr.dot.gov/>. A screen shot of the NTTR is available in Appendix H.

Task 3 of the project answered the question: “What are the gaps between the training that is currently available and the training that is needed?” To find the answer, the Project Team took the results of Task 1, which identified individual knowledge requirements, and compared them to the existing training compiled in Task 2. The difference between these two data sets provided the team with the gaps in available training. Upon review of the list, it was obvious that current training available for operations and management was not adequate. The gap analysis developed from this task was the third of five major deliverables for this project. The goal is for organizations to use this list of training gaps to develop needed training courses. The complete Gap Analysis is available in Appendix C.

Tasks 4, 6, and 7 answered the question: “What is the most effective way to deliver the missing training?” In Task 4, the Project Team researched a number of different types of training methods that could be used to effectively support operations and management training. A chart of training methods was developed and, for each methodology, several items were identified such as: the applicable categories of subject matter, students most likely to benefit from the approach, development costs, delivery costs, specialized skills required, and limitations. The results of this task are shown in Appendix D.

Task 5 was the development of an interim report summarizing the results of Tasks 1-4. This report was completed and forwarded to the review panel as required. The meeting with the NCHRP panel was delayed until after Task 6. The project team felt there would be great value in any face-to-face panel feedback on the recommended training packages. The review panel agreed.

Task 6 consisted of packaging the results of the previous tasks into programs to be used by state and local agencies for the delivery of traffic management and operations training. Training packages were defined for each cell of the matrix containing a unique set of training requirements. Each training package was defined to include all of the material required for the creation of a training program. Draft versions of the training packages were developed and presented to the project review panel. During the meeting, the panel felt there was too much

information shown for each package. The group agreed upon a condensed version of each training package. The final training packages developed from this task were the fourth of five major deliverables for this project. A few sample training packages are available in Appendix E. All the training packages can be access at <http://www.catt.umd.edu/documents/NCHRPTrainingFramework.pdf>

During the review panel's face-to-face meeting in February 2009, Task 7 was revised to focus specifically on facilitating the use of the framework and other project deliverables by state and local transportation agencies. Two marketing pieces, specifically a tri-fold brochure and PowerPoint presentation, were developed to facilitate "spreading the word" about the deliverables that were developed as a result of this project. The brochure is available in Appendix F and the PowerPoint Presentation is available in Appendix G. The Access database of existing courses was also ported into the National Transportation Training Resource (NTTR) database developed by Federal Highway Administration. The NTTR provides a database of courses that is searchable by subject area and competency matrices and was the perfect place to make the existing courses information that was compiled in Task 2 easily accessible by state and local transportation agencies. A screen shot of the NTTR is available in Appendix H.

For Task 8, the project team made a presentation on the project to the Joint Committee meeting of the AASHTO SCOTE/SSOM Groups on June 17, 2009 in Manchester, NH. The PowerPoint presentation developed as a result of Task 7 has been made available to all panel members and posted on the web for anyone to be able to use to make their own presentation during a meeting they are attending. The project team also plans to present project results during the TRB Annual Meeting in Washington, DC in January 2010.

All the major deliverables from this project have been posted online: <http://www.catt.umd.edu/research/nchrp-framework.html>

## CHAPTER 2 RESEARCH APPROACH

The research approach for this project was centered on the Operations Framework. See Appendix M for a view of the blank Operations Framework. The development of this matrix was vital in order to accomplish the desired project results. The management and operations discipline is so broad and encompasses a number of different agency positions and responsibilities, that a single curriculum is not sufficient. Instead, a variety of curricula had to be defined in order to respond to the needs of the individuals for whom the training would be provided.

The rows of the matrix represent a group of core functions required to carry out a state of the practice SSOM program ranging from broad policy through technical development to field activities. Each column represents an agency position—from senior management to field technician. The cell at the intersection of each row and column defines a set of competencies related to that position's role and core function. The research approach to this project was based on the use and application of this matrix to each task including the definition of task output.

The objective of this project was to develop a training and capacity-building framework for transportation operations technicians, engineers, and managers. In order to achieve this objective, the project team had to answer four main questions: (1) determine the training that is needed, (2) find available training, (3) identify the gaps in available training, and (4) determine the most effective way to deliver this missing training. The matrix was key to answering each of them.

For example, in Task 1, the Project Team started out with a version of the Operations Framework that had Core Functions defined on the left in the rows and positions defined at the top in the columns. Each individual cell of the matrix was blank. The PACs were used to define the core competencies for each blank cell of the matrix. Figure 2-1 shows some of the core competencies that were identified by PAC 1 for the core function of Program Planning for the two Senior Management positions. In Task 2, those identified core competencies were used as course subject matter to search for and compile existing training courses available to address the core competencies. In Task 3, the Gap Analysis was developed by comparing the individual knowledge requirements (core competencies) from each cell gathered in Task 1 to the existing training compiled in Task 2. In Task 6, training packages were defined for each cell of the matrix. Thus, as you can see, the Operations Framework (or matrix) is the backbone of this entire research project and all project deliverables refer to or use the matrix.

Figure 2-1. Sample Competencies for One Core Function for the two Cells under Senior Management – from the Operations Training Framework

Core Functions	Position	
	Senior Management	
	Central Office Headquarters	Regional Management
<b>Program Planning</b>	Policy Development Operating Practices Standards Vision Development Strategic Thinking (focus and direction for vision) Performance Management (goals, objectives, scorecard) Creative/Innovative Understanding Risk Management Business Process Management <ul style="list-style-type: none"> <li>• Including Organizational Change</li> </ul>	Operating Practices Vision Development Think Strategically, Act Tactically Performance Management (goals, objectives, scorecard) Creative/Innovative Understanding Risk Management Business Process Management <ul style="list-style-type: none"> <li>- Including Organizational Change Management</li> </ul> Change Management Change Management Interjurisdictional Coordination (Goals, etc.)



## CHAPTER 3 FINDINGS AND APPLICATIONS

### TASK 1

#### *Task Description:*

Define core transportation operations functions for use in this project. For each core function, describe key generic positions in transportation agencies and describe core competencies for those positions. Also, describe positions and core competencies for operations management positions.

In order to accomplish the required results for Task 1, the Project Team had several subtasks that were necessary. All of these subtasks are described below.

- A. Create Project Advisory Committees (PACs) - From UMD's response to comments and proposed modifications for this project, four project advisory committees (PACs) were formed to define functions, positions, and knowledge needs (or competencies) for each of the core functions that would be used as the basis for future training. Based on the seven core functions, UMD combined them to create four PACs. A draft list of the PACs and potential members was sent to the project review panel on November 5, 2007. The final list of members of each PAC is shown in the Acknowledgements section.

The four PACs were as follows:

- Policy & Strategic Considerations and Program Planning
- Systems Development and Project Management
- Real-time Operations and Real-time Traveler Information
- Specific Technical Specialties (ITS User Services)

- B. Define Draft Core Functions and Position Descriptions – In order for the Project Team, with the assistance of the PACs, to be able to fill in the cells of the blank Operations Framework (see Appendix A), it was necessary to develop draft versions of the core functions and position descriptions that could be discussed by four project advisory committees (PACs). Draft versions of both were forwarded to the project review panel on November 5, 2007 for their review and final draft versions were sent to the PAC members in preparation for their meetings. The draft core functions sent out to the PACs are shown in Appendix B and the position descriptions are shown in Appendix I.
- C. Coordinate and Participate in PAC Meetings – The PAC meetings were scheduled for the morning and afternoon of Tuesday, December 18 and Wednesday, December 19, 2007; four separate committee meetings were held. The purpose of these meetings was to refine the list of core functions, review, and refine the position descriptions and fill in the competencies by position. A copy of the agenda for each meeting is shown in Appendix J. Prior to the meetings, the Project Team decided upon the cells of the framework (or matrix) for each PAC to consider and complete. The competencies that were identified by each of the PACs are shown in Appendix A.

## TASK 2

### *Task Description:*

Review the literature and conduct telephone interviews with selected transportation agencies to determine training that is available for each position identified in Task 1. Submit a working paper summarizing the results of Tasks 1 and 2. The NCHRP will make this paper widely available and the contractor will keep it up-to-date based on comments received.

In order to accomplish the required results for Task 2, the Project Team completed several necessary subtasks, which are described below.

- A. Compile Course Subject Matter – In order to conduct a search of the existing courses available, the UMD project team met several times via phone to refine the list of core competencies identified by the PACs. There were several core competencies that were missing, some that were duplicated, and some were worded in such a way that it was impossible to search for existing courses on the topic. The group agreed upon the list of course subject matter that is shown in Appendix B. It should be noted that Real-time Traveler Information is listed under Real-time Operations. The Project Team completed their course search based on the topics in that list.
- B. Develop Access Database – An access database was created to house all the information the Project Team gathered on existing courses available for the competencies identified. The fields contained in the database are shown in Appendix K. For sorting purposes, each competency has a name and a corresponding ID code.
- C. Search for Courses Available – The Project Team searched for existing courses available to address the identified competencies. The team found courses from the following types of sources: industry associations, federal government, universities, state departments of transportation, and private industry.
- D. Populate Database - Once a course was found, all the relevant data was entered into the project database, including the course title, description, website, offerer, fees, CEUs, etc. Then, the competencies to which the subject matter of the course apply were identified. There ended up being almost 1,000 records in the database.

## TASK 3

### *Task Description:*

Conduct a gap analysis to determine the training efforts needed to improve skills within core functions, to improve leadership and communications skills, and to foster a broader understanding of systems operations and management. Identify gaps in available training.

In order to accomplish the required results for Task 3, the Project Team completed several subtasks, which are described below.

- A. Assign Levels of Training Required for Each Competency – UMD segmented the training required for each core competency into comprehensive, intermediate, and overview categories

representing the importance of a particular subject to a specific job classification. This was necessary in order to match existing training courses to specific competencies since each existing course was assigned a field called “Level of Detail.”

- B. Develop Matrices of Existing Courses by Core Function and Competency – UMD developed a matrix of existing courses for each competency under the five core functions: Policy and Strategic Considerations (PSC), Program Planning (PP), Systems Development and Information Technology (SDIT), Project Management (PM), and Real-time Operations (RTO). Excel spreadsheets were developed for each Core Function and specific competencies within those core functions. Each spreadsheet contained three worksheets, one for each position type: Senior, Mid-level, and Technician See Appendix A for a sample matrix.
- C. Identify Gaps in Training – Using the matrices developed under B above, UMD was able to identify the gaps between existing training and the training needs. See Appendix C for the full Gap Analysis.

#### **TASK 4**

##### *Task Description:*

Present creative and innovative concepts that support the advancement of operations in transportation agencies and are applicable to this project. These concepts could include a variety of delivery methods, messages, ways to improve awareness of training opportunities, and ways to facilitate shared use of training materials. Explore how these concepts could be expressed in the framework and implementation plan.

In order to accomplish the required results for Task 4, the Project Team completed the subtasks described below.

- A. Developed a List of Training Methods – The Project Team brainstormed to put together a complete list of different types of training methods that could be used effectively to support operations and management training.
- B. Researched Training Methods – Using the above list, the Project Team researched nine different types of training methods. A chart of the different methods was developed that provided the following: a definition of the training type, applicable categories of subject matter, students most likely to benefit, development and delivery costs, specialized skills required, and limitations. The results of this task are shown in Appendix D. This information was used to prepare the recommended training packages under Task 6.

#### **Task 5**

##### *Task Description:*

Prepare an interim report that documents the results of Tasks 1 through 4, and presents detailed descriptions of work to be done for subsequent tasks.

The interim report was submitted to the Project Review Panel in September 2008. A conference call was held on October 8, 2008 to discuss Tasks 3 and 4, as well as UMD's move to Task 6. Following the call, UMD made the appropriate edits to the interim report and the deliverables for Tasks 3 and 4.

## **Task 6**

### *Task Description:*

Package the results of the previous tasks into programs that can be used by state and local agencies for the delivery of traffic management and operations training.

In order to accomplish the required results for Task 6, the Project Team completed several subtasks, which are described below.

- A. Developed Draft Training Packages – Using the matrix of core competencies developed in Task 1, training packages were defined for each cell of the matrix (see Appendix E) that contained a unique set of training requirements. Each training package was comprehensively defined to include all of the material required for the creation of a training program.

For each training package, information was provided for the following items:

- Package title
  - Related packages containing a similar mix of courses (see below)
  - Package description including overall duration
  - Package training objectives
  - Package training outcomes
  - Student profile
  - Course schedule for package
  - Recommended course design addressing such issues as sequence of course presentations, whether or not the training should be presented in one session, or whether it can be divided into multiple sessions, etc.
  - Special facilities required
  - Estimated resources required for package delivery
  - Recommended class size
  - Recommended sources for course material
  - Course listing, including (for each course) a summary course description, course objectives, course outcomes, course duration, course outline, presentation technique (classroom, on-line, hybrid, workshop, etc.), required instructor skills, and special facilities required
- B. Posted the Training Packages on the Web – Since there was so much information for each training package, UMD posted all the training packages on the web for the Review Panel to more easily examine the material. The clickable PDF file of the matrix of core competencies (by core function and position) was used as the entry page. The review panel was able to click on each cell of the matrix to review the training package for that cell.

- C. Face-to-Face Meeting with Review Panel – In February 2009, the Project Team met with the Review Panel in Washington, DC. The panel provided input on the training packages as well as defined the activities of Task 7. The panel felt the on-line presentation of the training packages as clickable PDF files was effective and should be kept in this format for the final deliverable. However, they felt that there was too much information for each training package. Therefore, the information was paired down to provide the following:
- Package Title
  - Courses provided for three different levels: overview, fundamentals, and advanced
  - Course title with a direct link to the detailed course information from the provider
  - Outcomes of the course
- D. Revision of Training Packages – Based on the feedback received from the February meeting with the Review Panel, UMD edited one training package and posted it on the web for comments by the Review Panel. UMD wanted their approval of one of the revised training package before updating all of them. With the panel’s approval of the revised format, UMD then edited the remaining training packages and posted them all on the web site.

UMD found that, in some cases, training packages were subsets of one another. For example, much of the training delivered to senior managers is presented at a broader level than that which is required by engineering staff. A subject like incident management for senior managers includes much of the same information required by engineers: performance measures, staffing, organization, etc. However, it is also important to provide engineers with additional detail regarding the incident response process, including contact information for first responders, as well as the use of various incident response software systems. Incident response field personnel also require this same information, but would also benefit from the virtual reality training described in Task 4.

The information prepared for this task is also adequate for use by those who want to pool their resources with other state and local agencies, such that neighboring agencies can sponsor different training packages with the intent of admitting students from others in the pool. In this way, it is possible for a group of agencies to create a comprehensive training program containing multiple operations training packages.

## **Task 7**

### *Task Description:*

Develop an implementation plan for creating new training, improving existing training, and facilitating the use of the framework by state and local transportation agencies.

During the February 2009 meeting with the project Review Panel, panel members stressed the importance of making the results (deliverables) of the project available to state and local transportation agencies, as well as the national transportation organizations and associations who

share the objectives of emphasized transportation M&O. If not, the information that was developed will just sit on a shelf. The Panel Members and Project Team brainstormed ideas and the ones that were embraced by the whole group became the Task 7 subtasks described below.

- A. Development of a Deliverables Brochure – UMD developed a tri-fold brochure that described the four major deliverables of this project along with why they are so important to state and local transportation agencies. It emphasized the recognized problem with mainstreaming M&O and some of the solutions developed as a result of this project. See Appendix F. This brochure has been posted as a PDF file on the UMD CATT web site at <http://www.catt.umd.edu/research/nchrp-framework.html>. There is also a link to the UMD web site from the NCHRP 20-77 project description/status.
- B. Development of a PowerPoint Presentation – UMD developed a PowerPoint presentation version of the brochure that can be used by Review Panel members or anyone else to present the results of this project at a meeting. See Appendix G. The brochure is the companion piece that can be handed out following the presentation for people to take back with them to the office to share with others. The Review Panel members wanted the brochure and the PowerPoint presentation so that the group could spread the word about the project results/deliverables at the various meetings they normally attend. The group discussed the various meetings that they would be attending and would present the project results.
- C. Import Access Database of Courses into the NTTR Database – In February 2009, Federal Highway Administration posted a National Transportation Training Resource (NTTR) database. It provides a database of courses that is searchable by subject area and competency matrices. This database was the perfect place to port the over 700 M&O related courses that were compiled as part of Task 2. The Review Panel felt that the database of courses compiled as part of this project, needed to be readily accessible to state and local transportation agencies. Before discovering the NTTR database, UMD was planning to propose the development of a searchable on-line database as a follow up to this project. The NTTR was a much quicker way to make the course information available and accessible to the intended audience. The courses were uploaded in the NTTR database in September. The database is found at:  
<http://www.ntrr.dot.gov/Home.aspx>
- D. Outreach to State Training Officers – The Review Panel suggested that the results of the project be made available to all the state DOT training officers. One panel member provided the Project Team with a listing of them all, along with their e-mail addresses. UMD sent out the project results to the list.
- E. Posting of Project Deliverables to a Web Site – The Review Panel felt that the major deliverables of the project were: (1) the matrix of core competencies, (2) the gap analysis, (3) the training packages, (4) the database of existing M&O related courses, and (5) the marketing materials. They wanted to make sure that these items were all made available to the state and local transportation agencies. The UMD Center for Advanced Transportation Technology (CATT) posted a page on its web site describing the project

and posting the project deliverables. The NCHRP web page that describes this project also has a link to the CATT website indicating that the deliverables are available on that web site.

## **Task 8**

### *Task Description:*

Gather feedback from potential customers and champions of the training program, and enlist their support for advancing the program.

The RFP required the Project Team to facilitate discussions at the SSOM Leadership Team meeting at the January 2008 TRB meeting, the executive forum at the Spring 2008 AASHTO meeting, and the workshop at the summer 2008 meeting of the AASHTO SSOM to refine the framework (matrix from Task 1) and implementation plan, and solicit champions for moving the effort forward. This requirement was modified to better work with the project and its schedule.

- A. PAC Committees – Instead of using the three meetings listed above to refine the framework, the Project Team used its PACs instead. They were formed specifically to define functions, positions, and knowledge needs (or competencies) for each of the core functions that would be used as the basis for future training.
- B. SSOM Meeting - The Project Team made a presentation on the project to the Joint Committee meeting of the AASHTO SCOTE/SSOM Groups on June 17, 2009 in Manchester, NH. There was quite a bit of discussion about the project and the brochure was distributed to everyone in attendance.
- C. TRB Annual Meeting - The Project Team plans on presenting project results during the TRB Annual Meeting in Washington, DC in January 2010.

## **Task 9**

### *Task Description:*

Submit a final report documenting the entire research effort.

This report is the result of Task 9.

## CHAPTER 4

### CONCLUSIONS AND SUGGESTED RESEARCH

There were several important findings that resulted from the research of this project. First was the development of the core competencies matrix. This is the first time that these competencies had been identified and documented, allowing for the identification of needed training by core function and position for M&O personnel. As discussed earlier, management and operations is becoming a core function of departments of transportation and a trained and qualified workforce is needed. Unfortunately, there is a lack of qualified personnel and technical staff. The matrix of core competencies was the first step in the process of defining required staff qualifications.

The second important result from this project was the database of existing courses to address and train personnel for the core competencies required and identified. The Project Team was able to identify approximately 700 courses that addressed the core competencies and compiled the information into a searchable access database. The scope of this project did not require the Project Team to do anything more with the database. However, the team discovered the National Transportation Training Resource (NTTR) database, which is a database of courses that is searchable by subject area and competency matrices. This database was the ideal place to store the over 700 M&O related courses that were compiled so the Project Team worked with FHWA to have the courses entered into the existing database. This was a quick and cost effective way to make the course information available and accessible to the intended audience. Had the NTTR not been available, the Project Team would have recommended the development of web accessible database to store course information as a follow up to this project.

There is one item of concern about the NTTR database that should be noted. Currently, the database content is to be maintained by the organizations that enter the data. For this NCHRP project, the Project Team collected course data from a variety of sources. That data was then imported into the database without their knowledge. At this point in time, there is no mechanism in place for that course data to remain current; and the Project Team discovered that the course data for many organizations (most especially Universities) changes quite frequently. Thus, it is important that this issue be addressed either through FHWA who owns the database or as a follow on project.

The third important result from this project was the gap analysis. This is the first time that a thorough examination was done to determine what courses were available verses what course information was still needed to train M&O personnel. The list of courses needed is quite extensive. The Project Review Panel wanted to make sure that this list of courses where little or no training is available was widely distributed. Thus, this document was added to the list of project deliverables that needed to be publicized and distributed. The goal is for organizations to use this list of training gaps to develop the training courses that are needed by M&O personnel. The Project Team recommends working with FHWA and training stakeholders, to develop an organized approach to filling the gaps in available training. This should be done to reduce the possibility of redundant courses and inefficient use of limited training development resources.

It should be noted that for Task 7, the Project Team began the process of contacting content experts to develop outlines for the extensive list of courses that are needed based on the Gap Analysis. During the February 2009 meeting with the Project Review Panel, the Project Team discussed prioritizing the list of courses included in the Gap Analysis. The Project Review Panel felt that a prioritization would be too subjective a process and not a productive use of project



resources and time. Gathering outlines for all the courses listed in the Gap Analysis would have been much too extensive and would have pushed the project over budget. Without a prioritized list of courses in which to pursue outlines, no further outlines were developed. Appendix L contains the outlines of three potential new courses that were developed by content experts.

The fourth important result from this project was the development of the training packages for every competency shown in the matrix. The training packages were developed using the database of currently existing courses and are intended to be used by state and local agencies for the delivery of traffic management and operations training.

Informing the transportation community about the availability of these project results is just as important as their development. Based on direction of the Project Review Panel, the Project Team has developed a brochure and a PowerPoint presentation that highlights the need for M&O training and the deliverables that resulted from this project that provide some of the solutions toward addressing the training needs of M&O personnel. The deliverables have been posted on the UMD and TRB web sites. The Project Team has also sent the availability of this information out to the training officers of all the state DOTs. It is imperative; however, that the Project Team and the Project Review Panel continue to educate their peers about the results of this project long after the project is completed.

The Project Team feels that further research is required to better determine the must-have training areas especially considering today's economic conditions. Funding for training is the first line item to be cut when budgets are lower than expected. A short-list of critical training would be helpful to ensure that at least a minimum threshold of SSOM training is obtained. The results of this project will also be used on other follow-on projects such as a new project that will be started in early 2010, NCHRP 20-86: Attracting, Recruiting, and Retaining Skilled Staff for Transportation System Operations and Management.

## ABBREVIATIONS, ACRONYMS, INITIALISMS, AND SYMBOLS

AASHTO	Association of State Highway and Transportation Officials	ITE	Institute of Transportation Engineers
AMPO	Association of MPOs	ITS	Intelligent Transportation Systems
CATT	Center for Advanced Transportation Technology	KSA	Knowledge, Skill, and Ability
CITE	Consortium for ITS Training & Education	NTOC	National Transportation Operations Coalition
CVO	Commercial Vehicle Operations	PAC	Project Advisory Committee
DOT	Department of Transportation	SSOM	Subcommittee on System Operations and Management
ESL	English as a Second Language	TMC	Traffic Management Center
FHWA	Federal Highway Administration	UMD	University of Maryland
IMSA	International Municipal Signal Association		

## **APPENDICES**

APPENDIX A: TASK 1 DELIVERABLE – COMPLETED MATRIX

APPENDIX B: COURSE SUBJECT MATTER

APPENDIX C: GAP ANALYSIS

APPENDIX D: INNOVATIVE CONCEPTS AND DELIVERY METHODS

APPENDIX E: SAMPLE TRAINING PACKAGES

APPENDIX F: TRI-FOLD PROJECT BROCHURE

APPENDIX G: POWERPOINT PRESENTATION

APPENDIX H: NTTR DATABASE - SCREENSHOT

APPENDIX I: POSITION DESCRIPTIONS

APPENDIX J: PAC MEETING AGENDA

APPENDIX K: ACCESS DATABASE FIELDS

APPENDIX L: NEW COURSE OUTLINES

APPENDIX M: BLANK OPERATIONS FRAMEWORK

APPENDIX N: CORE FUNCTIONS

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## APPENDIX A

### NCHRP 20-77 Operations Framework

#### *PAC 1 - Policy and Strategic Considerations and Program Planning*

<b>CORE FUNCTIONS</b>	<b>POSITION</b>	
	<b>Senior Management – Priority #1</b>	
	<b>Central Office Headquarters</b>	<b>Regional Management</b>
<b>Policy and Strategic Considerations</b>	<ul style="list-style-type: none"> <li>Policy Development</li> <li>Operating Practices</li> <li>Standards</li> <li>Vision Development</li> <li>Strategic Thinking (focus and direction for vision)</li> <li>Performance Management (goals, objectives, scorecard)</li> <li>Creative/Innovative</li> <li>Understanding Risk Management</li> <li>Business Process Management                             <ul style="list-style-type: none"> <li>- Including Organizational Change Management</li> </ul> </li> <li>Change Management</li> <li>Private Sector Relationships</li> <li>Interjurisdictional Coordination (Goals, etc.)</li> <li>Communications/Interpersonal Skills (dumb it down)</li> <li>Results Driven                             <ul style="list-style-type: none"> <li>- Decision-making with Limited/Incomplete Information</li> </ul> </li> <li>Understanding of Organizational Culture</li> <li>Driving Change/Leading Change</li> <li>Coalition Building</li> <li>Outreach/Marketing</li> <li>Customer Service</li> <li>Consensus Building</li> </ul>	<ul style="list-style-type: none"> <li>Operating Practices</li> <li>Vision Development</li> <li>Think Strategically, Act Tactically</li> <li>Performance Management (goals, objectives, scorecard)</li> <li>Creative/Innovative</li> <li>Understanding Risk Management</li> <li>Business Process Management                             <ul style="list-style-type: none"> <li>- Including Organizational Change Management</li> </ul> </li> <li>Change Management</li> <li>Interjurisdictional Coordination (Goals, etc.)</li> <li>Communications/Interpersonal Skills (dumb it down)</li> <li>Results Driven                             <ul style="list-style-type: none"> <li>- Decision-making with Limited/Incomplete Information</li> </ul> </li> <li>Understanding of Organizational Culture</li> <li>Driving Change/Leading Change</li> <li>Coalition Building</li> <li>Outreach/Marketing</li> <li>Customer Service</li> <li>Consensus Building</li> </ul>

*PAC 1 - Policy and Strategic Considerations and Program Planning*

<b>CORE FUNCTIONS</b>	<b>POSITION</b>	
	<b>Senior Management – Priority #1</b>	
	<b>Central Office Headquarters</b>	<b>Regional Management</b>
<b>Program Planning</b>	Program definition, development & design Budgeting, Funding Administration Organization & staffing Data management & evaluation ConOps Performance Management (3 or 4 metrics) Knowledge of & how to work with the planning process Including relationship to operations Coalition Building (eg. Coordination & partnerships) Link between operations & planning Impacts of Policy and Plans on Operations Linkage between politics and the planning process (Overcoming the Barriers, Influence Dynamics of Process)	Program definition, development & design Budgeting, Funding Administration Organization & staffing Data management & evaluation ConOps Performance Management (3 or 4 metrics) Knowledge of & how to work with the planning process Including relationship to operations Coalition Building (eg. Coordination & partnerships) Link between operations & planning Impacts of Policy and Plans on Operations Linkage between politics and the planning process (Overcoming the Barriers, Influence Dynamics of Process)

*PAC 2 - Systems Development and Project Management*

<b>CORE FUNCTIONS</b>	<b>POSITION</b>	
	<b>Senior Management</b>	
	<b>Central Office Headquarters</b>	<b>Regional Management</b>
<b>Systems Development</b>	Business Case (initiation) Cross Departmental Coordination Legislative/Budgetary Authorization Budget Allocation/Management	Business Case (initiation) Interdepartmental Coordination Budget Allocation/Management
<b>Project Management</b>	In-house/Outsourcing Performance Measures (Development and Operational) Policy, legal and institutional issues	In-house/Outsourcing Performance Measures (Development and Operational) Policy, legal and institutional issues

*PAC 2 - Systems Development and Project Management*

<b>CORE FUNCTIONS</b>	<b>POSITION</b>		
	<b>Mid-Level or Project Related – Priority #1 (HQ or regional)</b>		
	<b>Program Planning &amp; Project Managers</b>	<b>Technical Specialists</b>	<b>Operations Managers</b>
<b>Systems Development</b>	Business Case (PM Charter Document) Concept of Operations Planning Requirements Analysis Design Development Integration and Testing Implementation Operations and Maintenance Disposition (of old stuff)	Planning Requirements Analysis Design Development Integration and Testing Configuration Management	Concept of Operations Requirements Analysis Integration and Testing Implementation Operations and Maintenance
<b>Project Management</b>	Coordination Schedule Budget Procurement Development oversight Resource Management Risk Management Stakeholder Collaboration/Coordination Asset and Configuration Management Quality Assurance Performance Measures (Development and Operational) Contract Administration Policy, legal and institutional issues	Coordination Asset and Configuration Management Quality Assurance Performance Monitoring	Coordination (Internal/External) Human Resource Planning Resource Management Risk Management Operational Performance Measures Legal and institutional issues



*PAC 3 - Real-time Operations and Real-time Traveler Information*

<b>CORE FUNCTIONS</b>	<b>POSITION</b>	
	<b>Senior Management</b>	
	<b>Central Office Headquarters</b>	<b>Regional Management</b>
<b>Real-time Operations</b>		
<b>Real-time Traveler Information</b>	Strategic Development	

*PAC 3 - Real-time Operations and Real-time Traveler Information*

CORE FUNCTIONS	POSITION		
	Mid-Level or Project Related – Priority #1 (HQ or regional)		
	Program Planning & Project Managers	Technical Specialists	Operations Managers
<b>Real-time Operations</b>	Planning for Incident Management, Field protocols & procedures (FITM Plans) Safety Planning/Funding for Maintenance and Asset Management (devices, systems software, computers, telecommunications, life cycle) Work Zone /Traffic Control Planning/Funding Customer Service Planning - Interjurisdictional Coordination NIMS/ICS (Incident Command System) – a requirement Contract Administration Traffic Engineering Principles Plan Review of construction documents for operations considerations (public & private) Security – critical infrastructure Legal and Institutional Issues	Safety Maintenance (asset management, devices, systems software, computers, telecommunications, life cycle) IT Hardware/Software Work Zone /Traffic Control NIMS/ICS (Incident Command System) Statistical Analysis Traffic Engineering Signal Timing ITS Devices – CCTV (installation, policy on use)/DMS/HAR/Meters/Detectors Plan Review of construction documents for operations considerations (public & private) Security – critical infrastructure	TMC management & staff activities Field Service Patrols Implementation of Incident Management, Field protocols & procedures (FITM Plans) Safety (incident scene, TMC, coop planning) Work Zone /Traffic Control Budget Control Contract Administration Implementation - Interjurisdictional Coordination NIMS/ICS (Incident Command System) Situational Analysis - Interpretation Traffic Engineering Principles Signal Timing Legal and Institutional Issues Special Event Management

*PAC 3 - Real-time Operations and Real-time Traveler Information*

<b>CORE FUNCTIONS</b>	<b>POSITION</b>		
	<b>Mid-Level or Project Related – Priority #1 (HQ or regional)</b>		
	<b>Program Planning &amp; Project Managers</b>	<b>Technical Specialists</b>	<b>Operations Managers</b>
<b>Real-time Traveler Information</b>	Continuity of Operations 511(Real Time) Travel Times Private Sector Agreements (exclusivity rights) Data Performance Measures Funding – Resources? Customer Service – Public Relations - Marketing Legal and Institutional Issues Strategic Development	Continuity of Operations 511(Real Time) Archived Data Travel Times Devices/Media to convey Info – Distribution Channels Data Performance Measures Marketing	Continuity of Operations Media Coordination Distribution Devices Planned Events – Scheduled Incident Travel Times Data Performance Measures Coordination Public Relations

*PAC 3 - Real-time Operations and Real-time Traveler Information*

CORE FUNCTIONS	POSITION	
	Technician/Field Personnel – Priority #2	
	TMC (inside)	Field (Outside)
<b>Real-time Operations</b>	Situational Analysis - Interpretation Traffic Engineering Use of ITS Devices/Tools/Applications Customer Service Relationship Building Follow Standard Operating Procedures (SOP) NIMS/ICS Hazmat Awareness Computer Skills Map Reading Skills Communications/Radio Etiquette Departmental Knowledge (who to call) Knowledge of MUTCD Security – critical infrastructure System Troubleshooting Special Event Management Crisis Management Dedication – willing to go the extra mile	Work Zone /Traffic Control Incident Traffic Control Situational Analysis - Interpretation Customer Service NIMS/ICS Quick Clearance Techniques Hazmat Awareness Computer Skills Communications/Radio Etiquette Relationship Building Multiagency Coordination First Aid/CPR Blood Borne Pathogen Training Knowledge of MUTCD Inspections - construction Security Portable device deployment/programming/trouble shooting

*PAC 3 - Real-time Operations and Real-time Traveler Information*

<b>CORE FUNCTIONS</b>	<b>POSITION</b>	
	<b>Technician/Field Personnel – Priority #2</b>	
	<b>TMC (inside)</b>	<b>Field (Outside)</b>
<b>Real-time Traveler Information</b>	Media Coordination Distribution Devices Software for Controlling DMS Travel Times Reliability – clear and concise Devices/Media to convey Info – Distribution Channels Public Affairs Coordination (SOP)	Travel Times Reliability Public Relations

## APPENDIX B

### Course Subject Matter

<p><b>1. Policy and Strategic Considerations (PSC)</b></p>
<p>A. Policy Development</p> <ul style="list-style-type: none"> <li>• Strategy Development (mission, vision, strategy objectives)</li> <li>• Public/Decision-maker/Stakeholder Outreach</li> </ul> <p>B. Organizational Change Management</p>
<p><b>2. Program Planning (PP)</b></p>
<p>A. Business Process Management</p> <ul style="list-style-type: none"> <li>• Program definition, Concepts of operation (Conops)</li> <li>• Data management &amp; evaluation</li> <li>• Performance management, accountability</li> <li>• Performance measurement, dashboards, reporting (3 or 4 metrics)</li> <li>• Partnership development (Interjurisdictional coordination [goals, etc], coalition building [coordination &amp; partnerships])</li> <li>• In-house vs. outsourcing</li> </ul> <p>B. Partnerships</p> <ul style="list-style-type: none"> <li>• Public-public partnerships (definition and examples, managing/coordinating, outreach/marketing, consensus-building)</li> <li>• Public-private partnerships (types of partnerships, managing/coordinating) outreach/marketing, consensus-building)</li> </ul> <p>C. Organization &amp; Staffing</p> <ul style="list-style-type: none"> <li>• Organizational architecture (cross-departmental coordination)</li> <li>• Staff development (core capacities: recruiting, training, job specifications)</li> <li>• Staff management (incentives, performance monitoring, innovation, ...)</li> </ul> <p>D. Link between Operations and Planning</p> <ul style="list-style-type: none"> <li>• Integrating operations into the planning process <ul style="list-style-type: none"> <li>○ Impacts of policy and plans on ops</li> <li>○ Linkage between political process and the planning process</li> <li>○ Overcoming barriers, influence, dynamics of process</li> <li>○ Knowledge of and how to work with the planning process</li> <li>○ Planning Interjurisdictional coordination</li> </ul> </li> <li>• Transportation Modeling/Simulation – operations planning emphasis</li> </ul>
<p><b>3. Systems Development/Information Technology for ITS and Operations (SDIT)</b></p>
<ul style="list-style-type: none"> <li>• Systems Engineering process/methods</li> <li>• Systems Architecture</li> <li>• Database Management for Ops (including real-time data)</li> <li>• Programming languages and technologies (web apps, etc.)</li> <li>• Visualization (off-line and online)</li> <li>• Network Security</li> </ul>
<p><b>4. Project Management (PM)</b></p>
<ul style="list-style-type: none"> <li>• Contract management (types)</li> <li>• Outsourcing contract management</li> <li>• Procurement</li> <li>• In-house project management <ul style="list-style-type: none"> <li>○ Legislative/budgetary authorization</li> <li>○ Budget allocation/management</li> <li>○ Policy, legal, institutional issues</li> <li>○ Interdepartmental coordination</li> </ul> </li> </ul>

- Risk Management

## 5. Real-time Operations (RTO)

### A. Operations Strategies

- Planning for Incident Management, field protocols and procedures (FITM Plans)
  - Implementation of Incident Management, Field Protocols and Procedures (FITM plans)
  - NIMS/ICS (Incident Command System)
  - Required laws and regulations
  - Interagency agreements (with PSAs)
  - Field service patrols
  - Agreements and memoranda of understanding (towing, law enforcement, other agencies, etc.)
- Work Zone/Traffic Control
- Ramp metering
- Road weather management
- Freeway management and operations
- Arterial operations
- Active traffic management (speed and flow control)
- Transportation Modeling/Simulation (operations emphasis)
- Value (Congestion) Pricing Strategies
- TMC Development (staffing, technology, relationships)
- Real-time Traveler Information
  - Media Coordination (devices/media to convey info – distribution channels)
  - 511 (devices/media to convey info – distribution channels)
  - Distribution devices
  - Coordination
  - Travel Times (including 511)
- Archived Data
- Special Event Management (planned events)
- Traffic Signal Systems
  - Signal Timing
- Traffic Engineering

### B. Systems and Technologies

- Traffic Monitoring/Surveillance (detectors, probes)
  - Data characteristics (volume, speed, occupancy, travel time, latency, accuracy, etc.)
- Telecommunications (voice, data, wireless, video, process vs. devices, media, protocols)
- ITS Devices
  - CCTV (installation, policy on use)
  - DMS
  - HAR
  - Meters
  - Detectors
  - RWIS
- Planning/Funding for Maintenance and Asset Mgmt
  - Devices
  - Systems software
  - Computers
  - Telecommunications
  - Life cycle
- Electronic Payment Systems
  - Electronic Toll Collection (ETC) Systems
- Automatic Vehicle Location/Identification (AVL/AVI)
  - License plate recognition/reader systems
- Parking Management Systems
- Commercial Vehicle Systems and Technologies
  - Electronic Clearance
  - Roadside Safety Inspections

- Administrative Processes (e-credentialing)
- Truck parking

C. Safety

- Road Safety Audits
- Automated Enforcement (red-light running)

D. Security

- Emergency Mgmt Procedures
- Evacuation Planning and Tools
- Critical infrastructure
- Continuity of Operations

E. Management of RTO Systems

- Customer Service
- Plan Review of Construction Documents for Ops Considerations (public and private)
- Legal and Institutional Issues
- Funding-Resources



## APPENDIX C

### Gap Analysis

The gap analysis defines additional developments required for the assembly of a comprehensive curriculum. In this document, the results of Task 1, which identified individual knowledge requirements, were compared with the existing training that was gathered in Task 2. The difference between these two data sets represents the gaps in available training resources.

Available training is identified using a code that references the database of available training programs and courses. In addition, the training required in each category has been segmented into comprehensive, intermediate, and overview categories representing the importance of a particular subject to a specific job classification.

The set of matrices contained herein make for an ideal starting point for identifying gaps. The gaps are categorized according to (1) areas with NO available training, (2) areas with some available training, and (3) areas with available training that does not cover the subject adequately.

There are five Core Functions for which available training was researched:

- Policy and Strategic Considerations (PSC)
- Program Planning (PP)
- Systems Development and Information Technology (SDIT)
- Project Management (PM)
- Real-time Operations (RTO)

Under each Core Function, there is a set of core competencies. The attached matrices are arranged by core function and competency. The competencies for which no available training was found include:

- RTO-Operations Strategies-Real-time Traveler Information: Coordination (overview)
- RTO-Operations Strategies: Archived data (overview)
- RTO-Operations Strategies: Special event management (comprehensive)
- RTO-Systems Technologies: Electronic Payment Systems (overview)
- RTO-Management of RTO Systems: Plan Review of Construction Documents for Ops Considerations (overview)

The competencies for which very little training or inadequate/incomplete training is available include:

- PSC-Business Process Mgmt: Program definition, conops (intermediate, comprehensive)
- PSC-Business Process Mgmt: In-house vs. Outsourcing (overview, comprehensive)
- PSC-Business Process Mgmt: Performance measurement (comprehensive)
- PSC-Business Process Mgmt: Partnership development (overview, comprehensive)
- PSC-Organizational Change Management (intermediate, comprehensive)
- PP-Organizational architecture (intermediate)
- PP-Staff Development (intermediate)
- PM: Contract Management (overview)
- PM: Outsourcing Contract Management (overview)
- RTO-Operations Strategies: Road Weather Management (overview, intermediate)
- RTO-Operations Strategies: Value (Congestion) Pricing Strategies (overview, intermediate & comprehensive)
- RTO-Operations Strategies-Real-time Traveler Information (overview, intermediate, comprehensive)
- RTO-Operations Strategies-Real-time Traveler Information: 511 (overview, intermediate, comprehensive)
- RTO-Operations Strategies-Real-time Traveler Information: Distribution Devices (overview, intermediate, comprehensive)
- RTO-Operations Strategies-Real-time Traveler Information: Travel Times (overview)

- RTO-Operations Strategies-Real-time Traveler Information: Coordination (comprehensive)
- RTO-Operations Strategies: Ramp metering (overview, comprehensive)
- RTO-Operations Strategies: Arterial operations (intermediate)
- RTO-Operations Strategies: Active traffic management (intermediate)
- RTO-Operations Strategies: Archived data (intermediate, comprehensive)
- RTO-Operations Strategies: Special event management (intermediate)
- RTO-System Technologies: Planning/Funding for Maintenance and Asset Mgmt (overview, intermediate)
- RTO-System Technologies: Electronic Payment Systems (overview)
- RTO-System Technologies: AVL/AVI (overview)
- RTO-System Technologies: Parking Management (overview)
- RTO-System Technologies: CVO (overview, intermediate, comprehensive)
- RTO-System Technologies: Electronic Payment Systems (comprehensive)
- RTO-System Technologies: Traffic Monitoring & Surveillance (intermediate, comprehensive)
- RTO-System Technologies: Telecommunications (intermediate, comprehensive)
- RTO-System Technologies: Parking management systems (overview, intermediate comprehensive)
- RTO-Safety: Road Safety Audits (overview, intermediate)
- RTO-Safety: Automated Enforcement (overview, intermediate, comprehensive)
- RTO-Management of RTO Systems: Customer Service (overview)
- RTO-Management of RTO Systems: Legal and Institutional Issues (overview, comprehensive)
- RTO-Management of RTO Systems: Funding-Resources? (overview)
- RTO-Management of RTO Systems: Plan Review of Construction Documents for Ops Considerations (comprehensive)

## APPENDIX D

### *Innovative Concepts and Delivery Methods*

Applicable Categories of Subject Matter	Students Most Likely To Benefit from Methodology	Development Costs	Cost of Delivery	Specialized Skills	Limitations
<b>Live Topic Lecture (real-time interaction)</b>					
<i>Description:</i> In-person lecture supported with PowerPoint presentation.					
Appropriate for all subject areas	<p>Those who learn best in a structured, instructor/learner style environment.</p> <p>Students, employees or other affinity groups that are already geographically close and/or already using classrooms for related activities</p>	In general, 35-40 hrs of development time translates into 1 hour of classroom time. (\$\$ to \$\$\$)	Cost of delivery for the presenting organization includes salaries, assignment/designation, books, and other materials for distribution, etc. The presenting organization must either have classrooms of their own to use, lease classrooms, or offer on-site training or training close to client locations. (\$\$) Cost to students includes tuition, purchase of books and other materials, travel expenses and time away from work. (\$ to \$\$)	Instructor must have good presentation, interpersonal and interaction skills	Limitations on class size will be dictated by classroom availability, size, and location.

Applicable Categories of Subject Matter	Students Most Likely To Benefit from Methodology	Development Costs	Cost of Delivery	Specialized Skills	Limitations
<p><b>Online Distance Learning (limited interaction)</b>  <i>Description:</i> Course delivered completely by the Internet. Access to instructor via e-mail or online discussion forums only. Some contact with other students if discussion forum available. Taken at students' own pace.</p>					
<p>Appropriate for most subject areas, except those requiring hands-on activities.</p>	<p>Students most likely to benefit from online learning are independent learners, or students who are geographically dispersed, or students who need to learn on schedules of their own choosing.</p>	<p>It is generally thought that 100-130 hours of development time results in 1 hour of instructional time. This is considerably more than the development time (35-40 hours) for an hour of live topic lecture training. The benefit is the fact that more students will have access to the training (no geographical restrictions or travel required). (\$\$\$ to \$\$\$\$)</p>	<p>The cost of development for the presenting organization can be quite high. However, the development cost can be spread over a larger number of students since the course is available through the internet. The cost to students includes Internet access fees, tuition, and materials. (\$)</p>	<p>The presenting organization must either have web developers and instructional designers on staff or outsource to a company specializing in web-based training development.</p>	<p>There are usually very high or no limitations in terms of class size and no limitations on location. Students must have a computer and internet access to participate.</p>

Applicable Categories of Subject Matter	Students Most Likely To Benefit from Methodology	Development Costs	Cost of Delivery	Specialized Skills	Limitations
<p><b>Blended Learning</b></p> <p><i>Description:</i> Combination of online learning and live topic lecture and includes the best features of both. Students interact with the instructor and other students via live teleconference and/or discussion forums. Flexibility of reviewing online material at their own pace (within a specific time window), and delivery of exercises/workshops via discussion forums.</p>					
<p>Appropriate for all subject areas, including those requiring hands-on activities.</p>	<p>Most students would likely benefit from blended learning because this methodology combines the social benefits of live topic lecture with the individualized benefits of online learning.</p>	<p>It is generally thought that 100-130 hours of development time results in 1 hour of instructional time. This is considerably more than the development time (35-40 hours) for an hour of live topic lecture training. The benefit is the fact that more students will have access to the training (no geographical restrictions or travel required). (\$\$\$ to \$\$\$\$)</p>	<p>It costs less to implement than 100% live topic lecture, provides greater flexibility, and, because of the ability to access web-based courses for just-in-time learning, improves your retention and sustains your performance over a longer time period. (\$-\$\$ if course already developed and only paying instructor). The cost to students includes Internet access fees, tuition, and materials. (\$)</p>	<p>The presenting organization must either have web developers and instructional designers on staff or outsource to a company specializing in web-based training development.</p>	<p>There is a maximum number of students (40) per offering if there is to be true interaction between students and instructor. Students must have a computer and internet access to participate.</p>

Applicable Categories of Subject Matter	Students Most Likely To Benefit from Methodology	Development Costs	Cost of Delivery	Specialized Skills	Limitations
<b>Real-time Live Participatory Workshops</b>					
<i>Description:</i> Students attend at same location and are provided with problems to be solved either individually or, usually, as part of a group.					
Appropriate for subject areas in which hands-on activities are essential.	Workshop training is most appropriate for group learning, especially where team ownership is essential and one plan amongst many must be established. Workshops allow the attendees to be exposed to constructive alternatives for doing the work. They also tend to get maximum participation from the attendees.	Developing a workshop costs much less than developing a full course. (\$\$ to \$\$\$)	The costs associated with presenting a workshop include travel expenses for the instructor(s), material production costs, facility rental, etc. (\$\$ to \$\$\$) The costs for students are usually comparable to live topic lecture instruction. (\$ to \$\$)		Based on the amount of interaction involved by the participants, there are limitations to the number of students that can participate per offering. There are also limitations based on course location and participants required to make the workshop successful.  Geographic location of potential audience  Most are group-scheduled
<b>Virtual Reality Participatory Workshops</b>					
<i>Description:</i> Students are presented with computer-generated scenarios that represent realistic, life-like situations. They participate in the scenario(s) as a member of the team in the virtual reality environment.					
Virtual reality training is best suited, but not limited to, the incident and emergency management subject areas.	This is ideal training for first responders who can work together to clear a realistic display of an incident.	The costs associated with developing and delivering a virtual reality environment are extremely high and include, software development, hardware acquisition, facilities management, developer salaries, etc. (\$\$\$\$)	The cost to students varies according to the presenting organization. Some government-funded training is offered at low cost and some is even provided for no fee at all. (\$)	The virtual reality development team must have advanced software programming and systems development skills.	To date, virtual reality systems require extremely expensive hardware and software and are confined mostly to research laboratories.  Must be group-scheduled

Applicable Categories of Subject Matter	Students Most Likely To Benefit from Methodology	Development Costs	Cost of Delivery	Specialized Skills	Limitations
<b>Simulation-Based Task Training</b>					
<i>Description:</i> A form of online training in which individual students are provided with displays similar to those they would use in the real world.					
Simulation-based training is most useful for training in the application of software products and systems requiring user entry of data, such as TOC operator training, and/or training in the use of simulation and signal timing software.	Students most likely to benefit from this type of training include TOC operators, and/or those requiring training in the use of simulation and signal timing software.	The development costs of this type of training are comparatively high, close to the costs associated with virtual reality participatory workshops training development. (\$\$\$\$)	As with virtual reality training, the cost to students varies according to the presenting organization. Some government-funded training is offered at low cost and some is even provided for no fee at all. (\$ to \$\$)	The development team for simulation-based training must have specific, advanced software programming and systems development skills.	The most important limitation of this type of training is that simulation is extremely difficult because most natural phenomena are subject to an almost infinite number of influences.
<b>Hardware/Software In-the-Loop Task Training</b>					
<i>Description:</i> Integration of hardware and software into a system that can be used to train operators and technicians in the use of particular devices and systems.					
Hardware/software in-the-loop training is most useful in providing technician personnel with training in applications such as signal system maintenance and/or the entry of signal timing parameters into signal controllers.	Students most likely to benefit from this type of training include technical personnel for applications such as signal system maintenance and/or the entry of signal timing parameters into signal controllers.	Due to the inclusion of the “real” component, development of this type of training is extremely complex. In turn, the costs are comparatively high. (\$\$\$\$)	The cost to students is more difficult to measure. Since this type of training is so complex, it is usually government-funded. Therefore, the cost to students is mostly likely relatively low. (\$ to \$\$)	It is a form of real-time simulation. Hardware/Software In-the-Loop differs from pure real-time simulation by the addition of a “real” component in the loop such as a traffic signal.	

Applicable Categories of Subject Matter	Students Most Likely To Benefit from Methodology	Development Costs	Cost of Delivery	Specialized Skills	Limitations
<p><b>Case Study Training</b>  <i>Description:</i> A critical analysis of the facilities and/or activities of existing organizations.</p>					
<p>A case study is most useful for reinforcing principles presented during live topic lectures or online study. Therefore, it is a supplemental, not a primary form of instruction. Any of the subject areas in question would benefit from case study presentation.</p>	<p>All students would likely benefit from case study presentation.</p>	<p>The costs of developing a case study are usually negligible compared to the other methods presented here. (\$ to \$\$)</p>	<p>The costs associated with presenting a case study have to do with paying someone to do the research into the subject at hand and write the case study, producing the written document, and presenting it to students. There may also be trips to the location of the case study. If so, the costs would increase and there would be limitations in the availability of the case study. (\$\$) The cost to students is relatively low. (\$ to \$\$)</p>	<p>The only specialized skills required for case study development presentation is expertise in the subject matter and “case” being studied.</p>	<p>Limitations may come into play if field trips are planned.</p>



Applicable Categories of Subject Matter	Students Most Likely To Benefit from Methodology	Development Costs	Cost of Delivery	Specialized Skills	Limitations
<b>Total Immersion Training</b>					
<i>Description:</i> A relatively new phenomenon in the educational vernacular. This training method encourages deep mental involvement in a subject area and uses a mix of classroom instruction, workshops, and analysis of existing systems to ensure the retention of the principles being presented. There are usually opportunities to practice and internalize the principles learned, which is not possible in traditional classes and short courses.					
Can be appropriate for all subject areas, including those requiring hands-on activities.	This type of training can be useful, but perhaps not practical for all types of students, especially at the technician level. It is most often used in management and executive training areas.	The costs to develop and present such an experience fall somewhere in between the high-tech training methods (simulation, hardware/software in-the-loop, virtual reality) and the more traditional training methods (live topic lecture, online, workshops). (\$\$\$) Since students reside on-site for one week or more, the cost to students is more than traditional live topic lecture training. Cost will vary based on the length of the program. Travel costs are also required. (\$\$)		There are no specialized skills required, per se, but because this type of training usually involves a number of different topic areas, experts in those subject areas must be employed.  Requires high level of logistical coordination for program coordinator(s).	The limitations center around securing a facility that is conducive to this type of training environment.

**Key:**

\$ = Up to \$1,000

\$\$ = Between \$1,000 and \$10,000

\$\$\$ = Between \$10,000 and \$100,000

\$\$\$\$ = Over \$100,000

## Appendix E

### NCHRP 20-77

### Operations Training Framework

Core Function	Position						
	Senior Management		Mid-Level or Project Related (HQ or regional)			Technician/Field Personnel	
	Central HQ	Regional Mgmt	Program Planning & Project Mgrs.	Technical Specialists	Ops. Mgrs.	TMC (Inside)	Field (Outside)
Policy and Strategic Considerations (PSC) Policy Development Organizational Change Management	PSC	PSC	PSC	PSC			
Program Planning (PP) Business Process Mgmt Organization & Staffing Link Between Ops & Planning	PP	PP	PP	PP	PP		
Systems Development/Info Technology (SDIT) SE Process/Methods Systems Architecture Database Mgmt for Operations Programming Languages & Technology Visualization Network Security			SDIT	<u>SDIT</u>	SDIT	SDIT	
Project Management (PM) Contract Mgmt Outsourcing Contract Management Procurement In-House Project Management Risk Management	PM		PM		PM		
Real-time Operations (RTO) Operations Strategies Systems & Technology Safety Security Management of RTO Systems	RTO	RTO	RTO	RTO	RTO	<u>RTO</u>	RTO

**Appendix E**  
**NCHRP 20-77**  
**Operations Training Framework**

**Systems Development/Information Technology (SDIT)**

Competency Area	Position						
	Senior Management		Mid-Level or Project Related (HQ or regional)			Technician/Field Personnel	
	Central HQ	Regional Mgmt	Program Planning & Project Mgrs.	Technical Specialists	Ops. Mgrs.	TMC (inside)	Field (Outside)
Systems Engineering Process/Methods (SEPM)			SEPM	SEPM		SEPM	
Systems Architecture (SA)			SA	SA		SA	
Database Management for Operations (DBMO)			DBMO	DBMO	DBMO		
Programming Languages and Technologies (PLT)			PLT	PLT			
Visualization (VIZ)			VIZ	VIZ		VIZ	
Network Security (NETS)			<u>NETS</u>	<u>NETS</u>	<u>NETS</u>	<u>NETS</u>	

**Appendix E**  
**NCHRP 20-77**  
**Operations Training Framework**  
**SDIT - Network Security**

**Overview of Network Security**

Course	Outcomes
<u><b>Introduction to Security</b></u> <b>K-Alliance</b>	<ul style="list-style-type: none"> <li>● Describe the fundamentals of security.</li> <li>● Discuss the ins and outs of implementing security.</li> </ul>
<u><b>Basic Network Security</b></u> <b>K-Alliance</b>	<ul style="list-style-type: none"> <li>● Discuss security concepts.</li> <li>● Explain how to implement security.</li> <li>● Detail the steps in a security implementation.</li> </ul>

**Fundamentals of Network Security**

Course	Outcomes
<u><b>Basic Network Security</b></u> <b>K-Alliance</b>	<ul style="list-style-type: none"> <li>● Discuss security concepts.</li> <li>● Explain how to implement security.</li> <li>● Detail the steps in a security implementation.</li> </ul>
<u><b>Network Security Training</b></u> <b>ENO</b>	<ul style="list-style-type: none"> <li>● Discuss network security risks.</li> <li>● Describe techniques for reducing and controlling network risks.</li> </ul>

**Advanced Network Security**

Course	Outcomes
<u><b>Network Security Training</b></u> <b>ENO</b>	<ul style="list-style-type: none"> <li>● Discuss network security risks.</li> <li>● Describe techniques for reducing and controlling network risks.</li> </ul>
<u><b>Security +</b></u> <b>K-Alliance</b>	<ul style="list-style-type: none"> <li>● Employ network security to protect computer network systems from security breaches.</li> <li>● Describe the techniques and concepts required to pass a certification exam.</li> </ul>

**Appendix E**  
**NCHRP 20-77**  
**Operations Training Framework**

**Network Management & Security**

***Polytechnic University***

- Discuss the human aspects of network management.
- Explain how performance measures are used in network management.
- Identify classical and vendor network management systems.
- Describe unified systems.
- Illustrate OSI network management.
- Discuss fault and performance.
- Explain configuration control.
- Describe security and encryption.

# Project Background

As management and operations becomes a core function of departments of transportation, a trained and qualified workforce is needed. The AASHTO Subcommittee on System Operations and Management highlighted the need for increased levels of training in this area which resulted in:

1. Development of the Operations Academy Senior Management Program <http://www.operationsacademy.org>
2. NCHRP Project 20-77, Transportation Operations Framework



For more  
information contact:

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410-414-2925  
[kfrankle@umd.edu](mailto:kfrankle@umd.edu)

## PROBLEM:

A lack of qualified personnel is hampering the successful mainstreaming of systems operations and management!

## SO, WHAT IS BEING DONE ABOUT IT?!

NCHRP Project 20-77  
Transportation Operations  
Framework has been working  
to provide part of the solution.



**TRB** TRANSPORTATION RESEARCH BOARD  
OF THE NATIONAL ACADEMIES

**CATT**  
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## NCHRP 20-77 Project Deliverables that will Help with Operations and Management Training

### 1. Operations and Management

#### Competencies Have Been Identified –

Competencies (topic areas of skills needed) needed by DOT personnel have been identified at all levels in a DOT organization (Senior, Mid-level and Technician). A matrix was developed to organize the specific competencies needed at each of those levels. You will find a copy of the matrix at: <http://www.catt.umd.edu/documents/NCHRPMatrix.pdf>

### 2. A Database of Training is Currently

**Available** – Training is currently available that will help build the knowledge needed in operations and management. The courses have been compiled into a database to be uploaded in the National Transportation Training Resource (NTR) database found at <http://www.ntrr.dot.gov/>.

### 3. A List of Gaps in Existing Training –

Current training available for operations and management is not adequate. Areas in which there is little or no available training has been compiled. You will find this list at <http://www.catt.umd.edu/documents/GapAnalysis-3-2009.pdf>. If your organization offers training to fill one of these gaps, contact Kathleen Frankle (see back). The goal is for organizations to use this list of training gaps to develop needed courses.

### 4. Training Packages have been Developed

– If you need help putting together a training curriculum for a specific topic area, we have a solution for you. Training packages that consist of existing courses have been developed for every competency shown in the matrix described under #1. You will find the recommended training packages at: <http://www.catt.umd.edu/documents/NCHRPTrainingFramework.pdf>.

# Appendix G

## NCHRP 20-77 Presentation

Do You Have Qualified Personnel for the Successful Mainstreaming of Systems Operations and Management?

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### Problem

There is a lack of qualified personnel that is hampering the successful mainstreaming of systems operations and management

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SO....  
What is being done about it?

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### Discussed at SSOM Meeting

- Results of those discussions:
    - NCHRP Project 20-77 Transportation Operations Framework
    - Development of Operations Academy Senior Management Program
- [www.operationsacademy.org](http://www.operationsacademy.org)

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NCHRP Project 20-77 Transportation Operations Framework has been working to provide part of the solution

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### NCHRP 20-77 Deliverables That Will Help

- Operations and Management Competencies Identified
- Database of Training Currently Available
- Identified Gaps in Existing Training
- Training Packages Developed

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# Appendix G

## NCHRP 20-77 Presentation

### Competencies Identified

- Topic areas of skill needed by DOT personnel identified for:
  - Senior, Mid-level, Technician
- Matrix developed and found at [www.catt.umd.edu/documents/NCHRPMatrix.pdf](http://www.catt.umd.edu/documents/NCHRPMatrix.pdf)

NCHRP 20-77 Operations Framework							
CORE FUNCTIONS	POSITION						
	Senior Management		Mid-Level or Project Related (NCL or regional)			Technician/Field Personnel	
	Central Office (Headquarters)	Regional Management	Program Planning & Project Managers	Technical Specialists	Operations Managers	TMC (Inside)	Field (Outside)
Policy and Strategic Considerations	Policy Development Public Outreach Strategic Development Organizational Change Management	Policy Development Public Outreach Strategic Development Organizational Change Management	Policy Development Public Outreach Strategic Development Organizational Change Management	Policy Development Public Outreach Strategic Development Organizational Change Management			
Program Planning	Business Process Mgmt Organization & Staffing Link Between Ops & Planning	Business Process Mgmt Organization & Staffing Link Between Ops & Planning	Business Process Mgmt Organization & Staffing Link Between Ops & Planning	Business Process Mgmt Organization & Staffing Link Between Ops & Planning	Business Process Mgmt Organization & Staffing Link Between Ops & Planning		
Systems Development			SE Process/Methods Systems Architecture DB Mgmt for Ops Prog. Languages & Tech. Visualization Network Security	SE Process/Methods Systems Architecture DB Mgmt for Ops Prog. Languages & Tech. Visualization Network Security	SE Process/Methods Systems Architecture DB Mgmt for Ops Prog. Languages & Tech. Visualization Network Security	SE Process/Methods Systems Architecture DB Mgmt for Ops Prog. Languages & Tech. Visualization Network Security	SE Process/Methods Systems Architecture DB Mgmt for Ops Prog. Languages & Tech. Visualization Network Security
Project Management	Contract Mgmt Outsourcing Contract Mgmt Procurement In-house PM Risk Mgmt		Contract Mgmt Outsourcing Contract Mgmt Procurement In-house PM Risk Mgmt		Contract Mgmt Outsourcing Contract Mgmt Procurement In-house PM Risk Mgmt		Contract Mgmt Outsourcing Contract Mgmt Procurement In-house PM Risk Mgmt

### Database of Available Training

- Training that is currently available was researched
- Database of courses can be found at: <http://ntrr.dot.gov>

### Gaps in Existing Training

- Current training available is inadequate
- Areas with little or no training was compiled
- Gaps can be found at: [www.catt.umd.edu/documents/GapAnalysis-3-2009.pdf](http://www.catt.umd.edu/documents/GapAnalysis-3-2009.pdf)

Contact us if you know of training that meets any of the gaps

### Training Packages Developed

- Defines a curriculum for you
- Available for each topic area (competency)
- Consists of existing courses
- Process: Competency area => Cell => Package
- Found at: [www.catt.umd.edu/documents/NCHRPTrainingFramework.pdf](http://www.catt.umd.edu/documents/NCHRPTrainingFramework.pdf)

### Typical Entry for Fundamentals of Public/Decisionmaker Outreach

- **Effective Public Involvement ITE**
  - Discuss approaches for involve the public in transportation studies and projects.
  - Resolve conflicts in ways that promote cooperation and effective solutions.
- **Effective Community and Media Communication Kansas University Transportation Center**
  - Implement pro-active communication.
  - Explain issues management.
  - Frame an accurate message.
  - Write effective press releases and fact sheets.
  - Manage public meetings.
  - Conduct press interviews.

# Appendix G

## NCHRP 20-77 Presentation

### Free Training

There are number of FREE training courses that are widely available:

- **Traffic Monitoring and Pavement Design Programs (FHWA-NHI-151044)** – NHI (1-hour overview presented online)
- **Introduction to Urban Travel Demand Forecasting (FHWA-NHI-152054)** – NHI (1-hour overview presented online)
- **Approaches for Building Effective Regional Relationships in the Deployment of ITS – ITS PCB** (1.5-hour webinar)
- **TMC Simulation Program – I-95 Corridor Coalition** (Downloadable E-learning course)
- **Performance Measures – I-95 Corridor Coalition** (Online)
- **NTCIP 1203 (DMS) Deployment Experiences: Using the ITS Standard for Dynamic Message Signs – ITS/JPO PCB** (1.5 hour online course)
- **The National Response Plan: An Introduction – FEMA** (3-hour online course)
- **National Incident Management System (NIMS), An Introduction – FEMA** (3-hour online course)
- **Ramp Metering: Signal for Success – FHWA**(17-minute online course)

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### Low-Cost Training

In addition, there are number of low-cost training courses that are widely available:

- **Interpersonal Relations** – Dynamic Works Institute – \$50 (2-4 hour online course)
- **Contracts in Commercial Transactions** – TrainUp – \$74.95 (4-hour online course)
- **Contractors and Temporary Employees - Managing Temporary Employees** – TrainUp – \$74.95 (2-hour online course)
- **Fundamentals of Road Weather Management Module** – ITE – Member Price: \$ 75.00; Non-Member Price: \$93.75 (CD-ROM Course)
- **Introduction to Ethics - Discussion and Support** – ITE – Member Price: \$ 75.00; Non-Member Price: \$93.75 (CD-ROM Course)
- **Engineering Intersections to Reduce Red-Light Running** – ITE – Member Price: \$75.00; Non-Member Price: \$ 93.75 (CD-ROM Course)
- **Signal Warrant and Intersection Control Analysis** – MD T2 Center – \$115 for MD local gov't employees; \$150 for state and federal employees; \$175 for private and out-of-state participants
- **Intersection Design & Analysis** – MD T2 Center – \$115 for MD local gov't employees; \$150 for state and federal employees; \$175 for private and out-of-state participants
- **Introduction to Temporary Traffic Control** – MD T2 Center – \$115 for MD local gov't employees; \$150 for private and out-of-state employees; \$195 for state and federal employees; \$195 for private and out-of-state participants.

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### Contact Information

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# APPENDIX H

## Screenshot of NTTR Database

U.S. Department of Transportation  
Federal Highway Administration

FHWA Home

### National Transportation Training Resource

Supporting the Development of the Transportation Workforce

[Search the NTTR](#) | [About the NTTR](#) | [Competency Matrices](#) | [What's New!](#) | [Contact Us](#) | [Feedback](#) | [FAQs](#) | [Disclaimer](#)

Search for Transportation Training Resources    User Name:     Password:     [Log In](#)  
[Forgot Password?](#)    [Register](#)

**KEYWORD SEARCH**

**ADVANCED SEARCH**

[Preview Here!](#)

**In the Hot Mix**

- NTTR Database Resource Count: **1191**
- Contributed by **139** organizations
- Advanced Search capability now available.
- Feedback Form is available.

[See More News...](#)

**SEARCH BY TCCC TECHNICAL CATEGORY**

Select a single term in any one or more dropdown to return all related resources.

Please select a Technical Category...

Please select a Subject Area...

Please select a Discipline...

Please select a DMI Level...

Please select a Competency...

RESOURCE TITLE	837 resources found that match your criteria	ORGANIZATION(S)	LENGTH
A Primer on Performance-Based Highway Program Management		AASHTO	
AASHTO Roadside Design Guide (FHWA-NHS-300079)		DOT NH	
ABCs of Safe School Access: Best Practices for School Accessibility and Traffic Control		UC Berkeley ITS	
Access Management, Location and Design		DOT NH	3.50 days
Access Management, Location and Design (FHWA-NHS-133076)		DOT NH	

# APPENDIX I

## *Position Definitions*

### Senior Management

**Central Office/Headquarters** – Top staff person with “Operations” in title. Division Chief for Operations (may report to Asst CEO for Operations and Maintenance or to CEO directly).

Broad responsibilities include all DOT policy and program activities focused on improving the efficiency, effectiveness and safety of the modal systems in light of both recurring and non-recurring congestion including congestion management, intelligent transportation systems (ITS), data management, traffic signals, and freight/people/good/services movement.

Develops, reviews, and evaluates proposed legislation and DOT (or Commission) policies pertaining to division activities. Responsible for representing SO&M in the overall statewide transportation policy, goals, objectives and strategy and for overseeing the conversion of SW policy into strategies appropriate to regions. Represents the DOT in discussions with the Administration and legislature regarding SO&M policy and resources. Represents the SO&M function in development of long-term and annual capital and Operating budgets, including staffing. Oversees the development of SO&M strategies and SO&M ;business plan including goals, standards, performance measures, programs and budgets for principal strategic initiatives such as IM, Freeway operations, traveler information and special initiatives. Monitor Regions and TMC compliance with central operations policies; evaluate and ensure the implementation of new work procedures, processes, products, equipment, and other actions that would improve the quality and efficiency of the division's programs.

Represents the operations perspective with other divisions in development of CWZM and winter management. Responsible for developing and maintaining formal relations and agreements with DOTs operational partners (PSAs and GPLG, MPOs and the private sector) at the state level and insuring related relationships are developed at the regional level. Develops and maintains appropriate organizational structure and staffing in C.O and insures appropriate staffing and training DOT-wide. Proposes and coordinate research which contributes to enhancing division's goals and objectives.

**Regional Management** – Top staff person with “Operations” in (may report to DE or to Asst DE for Operations and Maintenance).

Broad responsibilities include all Regional program activities focused on interpreting DOT operations policies in program terms as appropriate to the region. Represents the SO&M function in development of regional capital and Operating budgets, including staffing. Oversees the development of SO&M programs and projects including performance measures, programs and budgets for principal strategic initiatives. Accountable to C.O for compliance with central operations policies. Oversees project development and project management, including procurement, staffing and day to day operations -- work procedures, processes, products, equipment, and other actions that would improve the quality and efficiency of the region’s operations programs.

Represents the operations perspective with other components of the Region in development of CWZM and winter management. Responsible for developing and maintaining formal relations and agreements with DOTs regional partners (PSAs and GPLG, MPOs and the private sector). Develops and maintains appropriate organizational structure and staffing and insures appropriate training DOT-wide.

# APPENDIX I

## *Position Definitions*

### Mid-Level or Project Related (HQ or regional)

**Program Planning & Project Managers** – Program Planning and Project Managers focus on M&O core functions related to, respectively, planning from a program-wide perspective or project (initiative) specific perspective. Program Planning Managers are responsible for developing M&O strategic and/or business plans including programmatic level budgeting, budget tracking, scheduling, resource management, performance tracking, and administration. Project Managers perform project specific management of M&O initiatives including budget development and tracking, scheduling, staffing, project performance monitoring, contract administration and sign-off of project deliverables. Program Planning and Project Managers generally are supervisory positions.

**Technical Specialists** – Technical Specialists use in-depth knowledge and skills to provide effective (sometimes innovative) problem-solving techniques within a specific core function of management and operations. Because of their particular expertise, a technical specialist may also conduct training. This type of position is generally non-supervisory and provides technical support to Program Planning and Project Managers as well as Operations Managers.

**Operations Managers** – An operations manager is responsible for managing transportation management center or field operations (sometimes both). Operations managers are experienced in M&O core functions relative to addressing recurring and non-recurring congestion from either a center or field perspective (sometimes both). Responsibilities include budget development and tracking, resource (staffing, equipment) management, performance monitoring, developing and administering standard operating procedures, and developing and maintaining interagency/discipline relationships. Operations managers may also perform TMC (inside) and Field (outside) functions (see below). This is a supervisory position.

### Technician / Field Personnel

**TMC (inside)** – A traffic management center technician operates center based control software and communications systems for M&O core functions relative to addressing recurring and non-recurring congestion. Responsibilities include identify transportation system problems, dispatching field personnel, participating in management of transportation incidents, and conducting transportation studies and analyses. This could be a supervisory or non-supervisory position.

**Field (outside)** – Field personnel operate service patrol units for M&O core functions relative to addressing non-recurring congestion. Responsibilities include motorist assistance services, vehicle removal/relocation, setting up temporary traffic control, and participating in multi-agency/discipline response to transportation incidents. This could be a supervisory or non-supervisory position.

# APPENDIX J

## PAC Meeting Agendas

### AGENDA

**Systems Development and Project Management  
Project Advisory Committee (PAC) Meeting  
NCHRP 20-77  
Tuesday, December 18, 2007  
9:00 AM – 12:00 PM**

9:00 AM Welcome and Introductions

9:05 AM Purpose of the Project and Objectives of the Meeting

9:20 AM Description of Operations Framework

9:30 AM Accuracy of Core Functions Identified

- Do the bullets under the core functions of Systems Development and Project Management accurately reflect the activities of those functions?
- Should anything be added or subtracted?

10:00 AM Accuracy of Position Descriptions

- Are the three position descriptions under Mid-Level or Project Related accurate? Program Planning & Project Managers, Technical Specialists, Operations Managers
- Should anything be added or deleted?

10:30 AM Discussion of Required Competencies

- This group will identify competencies for the core functions of:  
Systems Development  
Project Management
- The focus will be on positions under Mid-Level or Project Related on the Operations Framework. If time allows, we will identify competencies for positions under Technician/Field Personnel if applicable.

11:45 AM Next Steps and Wrap Up

12:00 PM Adjourn

# APPENDIX J

## PAC Meeting Agendas

### AGENDA

**Real-time Operations and Real-time Traveler Information  
Project Advisory Committee (PAC) Meeting  
NCHRP 20-77  
Tuesday, December 18, 2007  
1:00 - 4:00 PM**

- 1:00 PM Welcome and Introductions
- 1:05 PM Purpose of the Project and Objectives of the Meeting
- 1:20 PM Description of Operations Framework
- 1:30 PM Accuracy of Core Functions Identified
- Do the bullets under the core functions of Real-time Operations and Real-time Traveler Information accurately reflect the activities of those functions?
  - Should anything be added or subtracted?
- 2:00 PM Accuracy of Position Descriptions
- Are the three position descriptions under Mid-Level or Project Related accurate? Program Planning & Project Managers, Technical Specialists, Operations Managers
  - Should anything be added or deleted?
- 2:30 PM Discussion of Required Competencies
- This group will identify competencies for the core functions of:  
Real-time Operations  
Real-time Traveler Information
  - The focus will be on positions under Mid-Level or Project Related on the Operations Framework. If time allows, we will identify competencies for positions under Technician/Field Personnel if applicable.
- 3:45 PM Next Steps and Wrap Up
- 4:00 PM Adjourn

# APPENDIX J

## PAC Meeting Agendas

### AGENDA

#### Policy and Strategic Considerations and Program Planning Project Advisory Committee (PAC) Meeting NCHRP 20-77

Wednesday, December 19, 2007

9:00 AM – 12:00 PM

9:00 AM Welcome and Introductions

9:05 AM Purpose of the Project and Objectives of the Meeting

9:20 AM Description of Operations Framework

9:30 AM Accuracy of Core Functions Identified

- Do the bullets under the core functions of Policy and Strategic Considerations and Program Planning accurately reflect the activities of those functions?
- Should anything be added or subtracted?

10:00 AM Accuracy of Position Descriptions

- Are the two position descriptions under Senior Management accurate? Central Office Headquarters and Regional Management
- Should anything be added or deleted?

10:30 AM Discussion of Required Competencies

- This group will identify competencies for the core functions of:  
Policy and Strategic Considerations  
Program Planning
- The focus will be on positions under Senior Management. If time allows, we will identify competencies for positions under Mid-Level or Project Related if applicable.

11:45 AM Next Steps and Wrap Up

12:00 PM Adjourn



# APPENDIX J

## PAC Meeting Agendas

### AGENDA

**Specific Technical Specialties  
Project Advisory Committee (PAC) Meeting  
NCHRP 20-77  
Wednesday, December 19, 2007  
1:00 - 4:00 PM**

- 1:00 PM Welcome and Introductions
- 1:05 PM Purpose of the Project and Objectives of the Meeting
- 1:20 PM Description of Operations Framework
- 1:30 PM Core Functions
- Should the technical specialties follow the user service bundles? If not, how should we identify them?
- 2:00 PM Accuracy of Position Descriptions
- Based on the activities of the Specific Technical Specialties defined above, position descriptions need to be outlined for the Mid-Level or Project Related positions as well as the Technician/Field Personnel.
- 2:30 PM Discussion of Required Competencies
- This group will identify competencies for the core functions of:  
Specific Technical Specialties
  - The focus will be on positions under Mid-Level or Project Related on the Operations Framework.
- 3:45 PM Next Steps and Wrap Up
- 4:00 PM Adjourn

## APPENDIX K

### FIELDS IN THE ACCESS DATABASE

- CourseID
- CourseName
- Provider
- Content
- Level of Detail
- Duration
- Presentation
- Website (URL)
- Restrictions
- Location
- Frequency
- CEUs
- Competency ID
- Competency Name
- Audience
- Contact(s)

## Appendix L

### ***New Course Outlines***

#### **Advanced Road Weather Management**

##### ***Course Description***

This course examines the impact of winter storms on transportation systems. Winter storms cost many states millions of dollars a year for removal efforts, increased transportation costs, lost productivity, increased travel time, fuel consumption, and accidents. The course covers a wide range of topics, including administration and management issues, personnel issues, equipment, snow and ice control materials, weather information systems, and storm operations.

##### ***Course Outcomes***

- Describe the impact of winter storms on state, local, and regional transportation systems.
- Discuss issues relating to administration, management and personnel.
- Appraise the effectiveness of snow and ice control materials.
- Identify snow removal equipment.
- Evaluate weather information systems.
- Explain the purpose and details of storm operations.

##### ***Course Outline***

1. Purpose and Principles of a Road Weather Maintenance Program
  - Introduction
  - Climate and Weather
  - Objectives of Snow and Ice Control Programs
2. Administration and Management of a RWMP
  - Policy Guidance for Program Planning
  - Level of Service
  - Communications
  - Intelligent Transportation Systems (ITS)
  - Performance Measures
  - Winter Severity Index
  - Liability and Risk Management
  - Emergency Assignments
3. Environmental Issues
  - Environmental Considerations
  - Guidelines
4. Personnel Issues
  - Management
  - Scheduling and Reporting
  - Drug and Alcohol Policies
  - Safety for Road Users and Crews
  - Training

## Appendix L

### ***New Course Outlines***

5. Equipment
  - Mobile Snow & Ice Control
  - Acquisition
  - Fleet Management Requirements
  - Inspection
  - Storm Procedures
6. Snow and Ice Control Materials
  - Acquisition
  - Specifications
  - Eutectic Information Table for Various Snow and Ice Chemicals
  - Handling and Inventory
  - Recording and Reporting
7. Weather Information Systems
  - National Weather Service
  - Road Weather Information Systems (RWIS)
  - Web Sites
8. Storm Operations
  - Storm Management
  - Storm Preparation
  - Choosing and Applying Materials for Various Storm Conditions
  - Strategies for Storm Management
    - Anti-Icing
    - De-Icing
    - Plowing
    - Other Storm Considerations
  - Ice Control
  - Post-storm Activities
9. Special Considerations
  - Snow Blowers
  - Snow Fences

## Appendix L

### ***New Course Outlines***

#### **Archived Data User Services: Best Practices for Operations, Planning, and Safety**

##### ***Course Description***

Congress called for the development of training to strengthen the ability of State Highway Safety Offices to analyze data, identify state and local behavioral highway safety programs, and provide a hands-on program evaluation experience. This course provides the skills necessary for a data-driven organization to improve efficiency, put resources toward identified problems, and improve accountability.

##### ***Course Outcomes***

Upon completing this course, participants will be able to:

- Understand how well-integrated archives can support planning and operations simultaneously and at substantial cost-savings to both groups.
- Enhance the usefulness of existing archives for day-to-day use.
- Learn to utilize archives to strengthen support of individual programs.
- Incorporate archives into the transportation operations in meaningful and useful ways.
- Strengthen the ability of highway safety professionals to understand the highway safety management process, and subsequently how data, data analysis, problem identification, and evaluation fit into the process.
- Provide the participant knowledge of commonly used procedures for problem identification and program assessment and to show the use of data and data analysis techniques in the process.
- Provide the participant data analysis techniques to identify performance measures and set goals for their Highway Safety Plan at the program/problem area level.
- Describe methods by which data analysis can be integrated into the program evaluation and reporting process.

##### ***Course Outline***

- 1) Common Problems, Common Needs—an Overview of Roles
  - a. Transportation Safety overview and needs
  - b. Transportation Operations overview and needs
  - c. Transportation Planning overview and needs
  - d. Transportation Safety overview and needs
- 2) Introduction to Archived Data User Services
  - a. Archives supporting Planners
  - b. Archives supporting Operations
  - c. Archives supporting Safety
- 3) Data vs. Information
  - a. Common misconceptions
  - b. Data needs and data wants
  - c. Transforming data into useful information
- 4) The four elements of a good archive
  - a. Data: knowing what to store
  - b. Processing: cleansing data
  - c. Technology: hardware and software basics
  - d. Access: policies and tools
- 5) Standards
  - a. The purpose of standards—and why should you care?

## Appendix L

### ***New Course Outlines***

- b. Standards Organizations
- c. What makes a standard work?
- d. Ruining standards
- e. Fixing standards/Ownership
- 6) Common Organizational Challenges
  - a. Dealing with too many archives---stovepipes
  - b. Fear of data—data that helps
  - c. Fear of data—data that hurts
  - d. Fear of data—data that is bad
  - e. Overcoming data fears
- 7) Serving many masters
  - a. Regionalization of archives
  - b. Integration of disparate archives
- 8) Making Better use of your existing archive
  - a. Common problems with archives
  - b. Simple steps to improving an archive
  - c. Daily use of archives
- 9) So you want to start an archive?
  - a. Starting from scratch
  - b. Resources
  - c. Avoiding redundancy and stovepipes
- 10) Examples of well implemented and well used archives
  - a. Private Sector examples
  - b. Public Sector examples
  - c. Multi-agency examples
- 11) Innovative Uses of Archives
  - a. Archives used in real-time
  - b. Archives bringing organizations more funding
  - c. Archives saving lives
- 12) Maximizing the Utilization of Your Archive
  - a. Visual analytics
  - b. Data mining
  - c. Performance Measures
  - d. Operational use
  - e. Specialty applications
  - f. Other non-traditional approaches
- 13) Private vs. Public data archives
  - a. Data quality
  - b. Cost implications
  - c. Accessibility
  - d. Policy considerations
- 14) Archived Data User Services Organizations and Resources

### **ITS Application Technology Real-Time Operations**

## Appendix L

### ***New Course Outlines***

#### ***Course Description***

The overall goal of this course is to provide case study-based instruction in operations of ITS application technology. Departments of Transportation and others have introduced a wide range of new applications in recent years, and new applications emerge rapidly to address congestion, pollution, energy consumption, security, emergency management, and obtaining revenue from the roadways. The course discusses how ITS practitioners have planned, deployed, and operated emerging ITS applications and outlines the lessons they learned.

#### ***Course Outcomes***

Upon completing this course, participants will be able to:

- Understand the types of physical and information architecture of ITS applications.
- Understand the range of facilities, communications, and operational requirements of the applications.
- Fit applications within local, regional or national ITS architecture.
- Understand the significance of standardization and how it may affect selection, implementation, and operation of a given application.
- Evaluate the suitability of an application to a given ITS facility or communication infrastructure.
- Know the real-world operational status of ITS applications.
- Use proven strategies for operating ITS applications.

#### ***Course Outline***

##### Lesson 1. Application Architecture

- a. Information
- b. Applications
- c. Communications requirement
- d. Facilities requirement
- e. Interoperability and standards-compliance

##### Lesson 2. Real-time Traveler Information

- a. Current state-of-the-industry
- b. Example case studies
- c. Best practices from case studies
  - i. Coordination and information gathering
  - ii. Distribution technologies
    - 511
    - Internet browser
    - E-mail / SMS messaging
    - Radio and television broadcast
    - Variable message signs
  - iii. Information types
    - Travel times
    - Congestion and detour routes
    - Planned construction and events
    - Emergency notifications

## Appendix L

### ***New Course Outlines***

#### Lesson 3. Real-time Operational Strategies

- a. Current state-of-the-industry
- b. Example case studies
- c. Best practices from case studies
  - i. Special event management
  - ii. Road weather management
  - iii. Active traffic management
  - iv. Arterial operations
  - v. Congestion pricing strategies

#### Lesson 4. ITS Application Technologies

- a. Current state-of-the-industry
- b. Example case studies
- c. Best practices from case studies
  - i. Electronic payment systems
  - ii. AVL/AVI
  - iii. Parking management
  - iv. CVO
  - v. Traffic monitoring and surveillance
  - vi. Automated enforcement

#### Lesson 5. ITS Application Management

- a. Customer service
- b. Interdepartmental coordination
  - i. Information gathering
  - ii. Infrastructure
- c. Funding and resources
- d. Legal and institutional issues



# Appendix L

## ***New Course Outlines***

### **Introduction to ITS Project Management**

#### ***Course Description***

Absent adequate project management, projects miss deadlines, overrun budgets, and fail to integrate into or coordinate with other initiatives or existing business processes. In an environment where planning, funding, designing, building, testing, operations, and outcome are expected in quick succession, only structured project management can provide the results expected and needed by project stakeholders and the public. This course is a primer on project management for the ITS professional in responsible charge of projects or portions of projects.

#### ***Course Outcomes***

Upon completing this course, participants will be able to:

- Understand the need for program definition and use proven strategies to better define programs and projects.
- Understand and outline a program concept of operations (ConOps).
- Use best practices to determine whether to conduct a project in-house or outsource it.
- Create suitable metrics and measure project and staff performance.
- Understand the types of partnerships that have been successful in ITS and how to create new ones.
- Describe best practices used in ITS and other information technology industries for change management.
- Understand successful organizational structures in the ITS context.
- Have strategies for developing staff abilities.
- Develop strategies for managing contracts given the structure and systems of your organization.

#### ***Course Outline***

##### Lesson 1. Introduction to Project Management: Basic Elements

- a. Definition of Project Management
- b. The Project Framework
  - a. Objectives
  - b. Requirements
- c. Stakeholders
- d. Scope
- e. Implementation Plan
- f. Deliverable(s)/Outcome

##### Lesson 2. Project Definition

- a. Needs Identification
- b. Securing Funding
- c. Concept of Operations
  - i. Definition (IEEE Std 1362-1998)
  - ii. Why is a ConOps needed?
  - iii. Sources of ConOps development
  - iv. Methodologies
- d. Stakeholder Mapping

## Appendix L

### ***New Course Outlines***

- e. Policy Compliance
  - i. Data sharing (CMMI)
  - ii. Security (NIST 800-53, FIPS 199 etc)
  - iii. Organizational/stakeholder regulations
  - iv. Operational Requirements (post-project implementation)
    - ITIL
    - Staffing
    - Procurements
    - Technology Refresh
    - Maintenance and Operation
- f. Other Critical Requirements Gathering
  - i. Capital vs. Recurring Operational Expenses of Matured Project
  - ii. In-Source/Out-Source Operational Staffing
  - iii. Choosing Technologies to Match Capabilities/Constraints
  - iv. Solving the Un-Styled Problems
  - v. A Few Words on Requirements Methodologies
- g. Project Governance
  - i. Project-Organization governance
  - ii. Organization institutional governance
- h. The Project Charter: The first elements – Setting the baseline
  - i. Scope
  - ii. Timeline
  - iii. Deliverables
  - iv. Cost
  - v. Project Team Qualifications: Roles
- i. Setting up Procurement Support
  - i. Matching Deliverables to Procurements
  - ii. Matching Procurement Vehicles to Governance Requirements
    - Types of Contracts and Vendor Monitoring
    - Utilizing Existing Contract Vehicles
    - Project-specific vs. Program Continuity Contracting Needs

#### Lesson 3. Project Execution

- a. Project Tools: Excel and Beyond
- b. The Project Charter: Project Management Elements – Managing a successful project
  - i. Establishing Metrics of Performance
  - ii. Communications Plan
  - iv. Change Management
  - v. Project Closing / Definition of Operational Handoff
- c. Risk Assessment and Mitigation Plan
- d. Project Kick-off
- e. Reaching Stakeholders
- f. Requirements Gathering

## Appendix L

### ***New Course Outlines***

- i. Methodologies
  - ii. Organizational Tools
  - iii. Techniques
  - g. Design Validation
    - i. Revise Design
    - ii. Importance of Revising Charter – Risk, Scope, Deliverables, and Costs
    - iii. Communication and Stakeholder Sign-off
    - iv. Revisiting Contract Requirements
  - h. Technology Deployment
    - i. Asset Tracking and Management
    - ii. Acceptance Testing
    - iii. Integration into Program Operations
    - iv. Vendor Management
  - i. Balancing Cost, Scope, and Time
  - j. Successful Change Management
- Lesson 4. Advanced Governance Management: Working across Boundaries
- a. Working With Too Many Cooks: Regional Projects
    - i. Ensuring Executive Governance
    - ii. Legal And Jurisdictional Constraints
    - iii. Stakeholder Management: Formal and Informal Institutional Forums
  - b. Working Across Organizations
    - i. Respecting Policies and Institutional Requirements
    - ii. Stakeholder Management: Formal and Informal Institutional Forums
    - iii. When to enlist Executive Support
  - c. Case Study: Regional ITS project
- Lesson 5. Successful Project Closing
- a. Validating Findings with Stakeholders
  - b. Project Reporting and Closing
    - i. Validation with Charter
    - ii. Report Outline
  - c. A Project is not a Program
    - i. Transition to Mature Operations
    - ii. Long-Term Viability
    - iii. Lessons Learned (From Project and/or Pilot)
    - iv. Risks and Opportunities

# APPENDIX M

## BLANK OPERATIONS FRAMEWORK

CORE FUNCTIONS	POSITION						
	Senior Management		Mid-Level or Project Related (HQ or regional)			Technician/Field Personnel	
	Central Office Headquarters	Regional Management	Program Planning & Project Managers	Technical Specialists	Operations Managers	TMC (inside)	Field (Outside)
<b>Policy and Strategic Considerations</b>							
<b>Program Planning</b>							
<b>Systems Development</b>							
<b>Project Management</b>							
<b>Real-time Operations</b>							
<b>Real-time Traveler Information</b>							
<b>Specific Technical Specialties (ITS user services)</b>							

**Note:** For each combination of core function and position there is a specific set of core competencies that are relevant, based on current best practices. The intersection of a core function (rows) and a role (column) defines a needed competency. Graphically speaking, each intersection “cell” in the matrix is a competency. Various roles require combinations of competencies. In addition, various functions require a combination of roles (positions).

# APPENDIX N

## CORE FUNCTIONS

### 1. Policy and Strategic Considerations

- ◆ Policy development
- ◆ Strategic planning
- ◆ Performance definition

### 2. Program Planning

- ◆ Program definition, development & design
- ◆ Budgeting
- ◆ Organization & staffing
- ◆ Data management & evaluation ConOps
- ◆ PPP re operations & ETO
- ◆ Interjurisdictional coordination & partnership development
- ◆ Performance reporting

### 3. Systems Development

- ◆ ConOps & architecture
- ◆ Software development & systems integration
- ◆ Information management
- ◆ Hardware development (ITS, TMC & communications)
- ◆ Procurement
- ◆ Installation, construction supervision

### 4. Project Management

- ◆ Coordination
- ◆ Schedule
- ◆ Budget
- ◆ Risk Management
- ◆ Procurement
- ◆ Development oversight
- ◆ Resource Management
- ◆ Risk Management

### 5. Real-time Operations

- ◆ TMC management & staff activities
- ◆ Field Service Patrols
- ◆ Incident Management, Field protocols & procedures
- ◆ Safety
- ◆ Maintenance

### 6. Real Time Traveler Information

## **APPENDIX N**

### **CORE FUNCTIONS**

#### **7. Specific Technical Specialties (ITS User Services)**

- ◆ Signals
- ◆ CVO
- ◆ Freeway Operations
- ◆ Architecture
- ◆ Standards
- ◆ Telecommunications
- ◆ Etc.