TMS Performance Monitoring, Evaluation & Reporting Handbook

University of Virginia

and

SAIC

Overview

- Project team / management
- Background / purpose / objectives
- Intended audience
- Key issues & topics
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Project Team

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Project Management

- University of Virginia
  - Teleconference meeting
  - Handbook and other documents development
    - Primer
    - Tri-fold brochure

- SAIC
  - Document mockups

Background

➢ Lack of standard technical references and/or tools for assessing the operations of Traffic Management Centers (TMC) and Transportation Management Systems (TMS)

➢ While performing TMS performance monitoring, there exist (1) a disconnect between the goals and monitoring efforts, (2) inconsistency in data collection and analysis, and (3) lack of information sharing

Purpose

➢ To develop a handbook that provides guidance and recommended practices for initiating, maintaining, and utilizing information derived from TMS performance monitoring, evaluation, and reporting

Objectives

➢ Provide an overview of TMS performance monitoring, evaluation, and reporting

➢ Discuss the basics and importance of a performance measurement program

➢ Provide examples of agency goals and performance measures

➢ Describe common data requirements, collection, and archiving techniques

➢ Explain performance monitoring, evaluation, and reporting

➢ Provide a self-assessment questionnaire and best practice examples from transportation agencies

Intended Audience

➤ Primary audience: various agency personnel, including operators and managers who oversee TMC facilities and TMSs, who use performance measures obtained from TMSs

➤ Anyone interested in TMS performance monitoring, evaluation, and reporting. This could include transportation engineers and researchers, federal/state/local agencies, and roadway maintenance personnel

Key Issues & Topics

➢ Performance measurement program

➢ Agency goals and performance measures

➢ Data requirements, collection, and archiving

➢ TMS performance monitoring, evaluation, and reporting

➢ Self assessment toolkit

Preliminary Survey

➢ Purpose
  • Understand the state of the practices on the use of performance measures

➢ Web-based survey
  • Consisted of 24 questions regarding their operations and performance measures
  • Launched 8/11/04, closed 10/11/05
  • 80 TMC/TMS personnel were invited
  • 28 completed (35%)

Preliminary Survey Results

➢ **Question 11** – What data do you collect from your traffic monitoring procedures? Check all that apply.

- Average Motorist Speed – 71%
- Recurring Delay – 14%
- Travel Time – 21%
- Traffic Volume – 75%
- Incident Delay – 29%
- Emergency Management Response Times – 25%
- Weather Information – 25%
- None of the Above – 7%

Preliminary Survey Results (cont'd)

➢ **Question 12** – With whom do you share these traffic data? Check all that apply.

- State DOT – 63%
- Other TMCs – 63%
- Emergency Personnel (Fire, Rescue, Police, Etc.) – 48%
- Local Media – 48%
- Transit Agencies – 15%
- Bridge/Tunnel Authorities –11%
- None of the Above – 19%
- Other responses include public, FHWA, local universities, MPOs, and cities

Preliminary Survey Results (cont'd)

- **Question 13 – Does your center archive data?**
  - Yes – 89%
  - No – 11%

- **Question 14** – Has your TMC published any information regarding ITS performance measures?
  - Yes – 14%
  - No – 64%
  - Not Yet, But Will in the Future – 21%

Preliminary Survey Results (cont'd)

➤ **Question 17** – Which of the following performance measures does your TMC analyze? Check all that apply.
- Benefit-Cost Analysis – 57%
- Incident Delay Analysis – 62%
- Travel Time – 29%
- Crash and Fatality Reduction – 38%
- Emissions and Fuel Consumption – 24%
- Dispatcher Evaluations – 19%
- Comment Cards – 19%
- Motorist Phone Calls – 14%
- Website Surveys – 24%
- Website Hits – 38%
- None of the Above – 5%

Preliminary Survey Results (cont'd)

- ➢ **Question 18** – Does your TMC publish performance evaluations reports periodically?
  - Yes – 21%
  - No – 79%
- ➢ **Question 19** – In what format are the reports published?
  - Newsletter – 0%
  - Formal Report – 63%
  - Website Presentation – 0%
  - None, No Reports Published – 25%

Survey Findings

- ➢ Most TMCs archive data (89%)

- ➢ Not many TMCs publish periodic performance evaluation reports (only 21%)

- ➢ Lack of data sharing (19% of TMCs do not share their data with other agencies)

Follow-Up Survey

➢ Purpose

- To understand common TMS performance measurement; data collection; and performance monitoring, evaluation, and reporting practices

- To identify potential agencies to use as case studies for the handbook

Follow-Up Survey (cont'd)

- ➢ Web-based survey
  - 33 statements separated into 3 categories
    - Agency Goals & Performance Measures
    - Data Requirements, Collection and Archiving
    - Performance Monitoring, Evaluation and Reporting
  - Respondent can 'strongly disagree', 'disagree', remain neutral, 'agree', 'strongly agree', or declare N/A
  - Launched on 6/29/05, closed 10/11/05
  - 110 people invited via e-mail
  - 32 complete responses (29%), 1 partial response (1%)

Survey Results

- ➤ "Our agency has a performance measure-based index to gauge the system as a whole."
  - 'Strongly disagree'   -   10%
  - 'Disagree'   -   37%
  - 'Neutral'   -   23%
  - 'Agree'   -   13%
  - 'Strongly Agree'   -   13%
  - 'N/A'   -   3%

Survey Results (cont'd)

➢ "Our agency documents data quality and it is passed onto users and other agencies."

- 'Strongly disagree'   -   10%
- 'Disagree'   -   30%
- 'Neutral'   -   23%
- 'Agree'   -   23%
- 'Strongly Agree'   -   10%
- 'N/A'   -   3%

Survey Results (cont'd)

- "Our agency internally measures the performance of human operators (e.g. response time to incidents, efficiency of operators etc.)."
  - 'Strongly disagree'   -   13%
  - 'Disagree'   -   17%
  - 'Neutral'   -   20%
  - 'Agree'   -   33%
  - 'Strongly Agree'   -   13%
  - 'N/A'   -   3%

Notable Follow-Up Survey Findings

➢ 63% of responding agencies have implemented a performance measurement plan

➢ 73% of responding agencies monitor system performance in real time

➢ 37% of responding agencies periodically review data records to ensure data quality

➢ 46% of responding agencies internally monitor human operations performance

➢ 10% of responding agencies make their performance measurement report available on their web site

Best Practice Case Studies

➢ From the follow-up survey results, several respondents were contacted to provide a more in-depth look at their TMS practices

- Doug Dembowski, WisDOT Milwaukee TMC
- Brian Fariello, TransGuide, San Antonio
- Manny Agah, ADOT Phoenix TOC
- Maggie Cusack, Hudson Valley TMC
- Victor De la Garza, TransVista, El Paso, TX

Handbook At-A-Glance

➢ **Chapter 1 – Introduction**. This chapter defines the background, purpose, and scope of the handbook and the intended audience.

➢ **Chapter 2 – Overview of TMS Performance Monitoring, Evaluation, and Reporting**. This chapter provides a high level overview of TMS performance monitoring, evaluation, and reporting and how they relate to TMSs.

➢ **Chapter 3 – Performance Measurement Program**. This chapter discusses the purpose and importance of, and need for a TMS performance measurement program.

Handbook At-A-Glance (cont'd)

➢ **Chapter 4 – Agency Goals and Performance Measures.** This chapter presents typical performance measurement goals of TMS-related agencies. It also provides high-level performance measures by TMS functions and calculation methods of such performance measures.

➢ **Chapter 5 – Data Requirements, Collection and Archiving.** This chapter provides performance measure data requirements and best practices for data collection, evaluation, and reporting.

Handbook At-A-Glance (cont'd)

➢ **Chapter 6 – Performance Monitoring, Evaluation and Reporting**. This chapter provides various monitoring and evaluation methodologies and processes related to TMS performance. It also discusses recommended reporting techniques, formats, and frequencies for reporting TMS performance.

➢ **Chapter 7 – Self- Assessment.** This self-assessment will be in the form of a checklist of questions drawn from case studies. This checklist can be used by TMCs to assess the status and performance of the TMS. This chapter also includes some best practice examples from selected agencies.

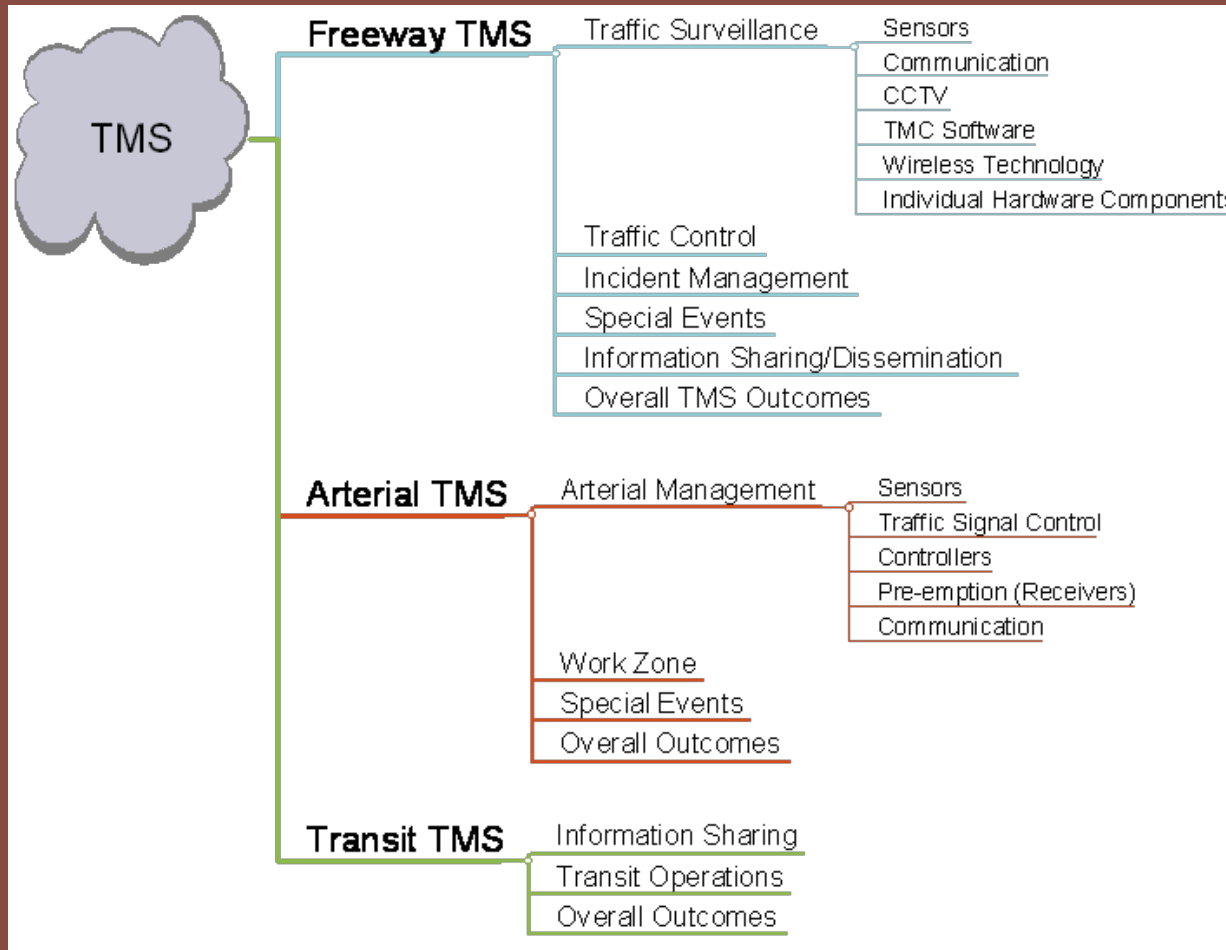➢ **Appendix A – Survey Questionnaire and Results**

Highlights of Handbook Contents

- ➢ Performance measurement program
- ➢ TMS functions and their performance measures
- ➢ Data and key 'data' elements in TMS/TMC
- ➢ TMS/TMC performance monitoring, evaluation and reporting

Performance Measurement Program
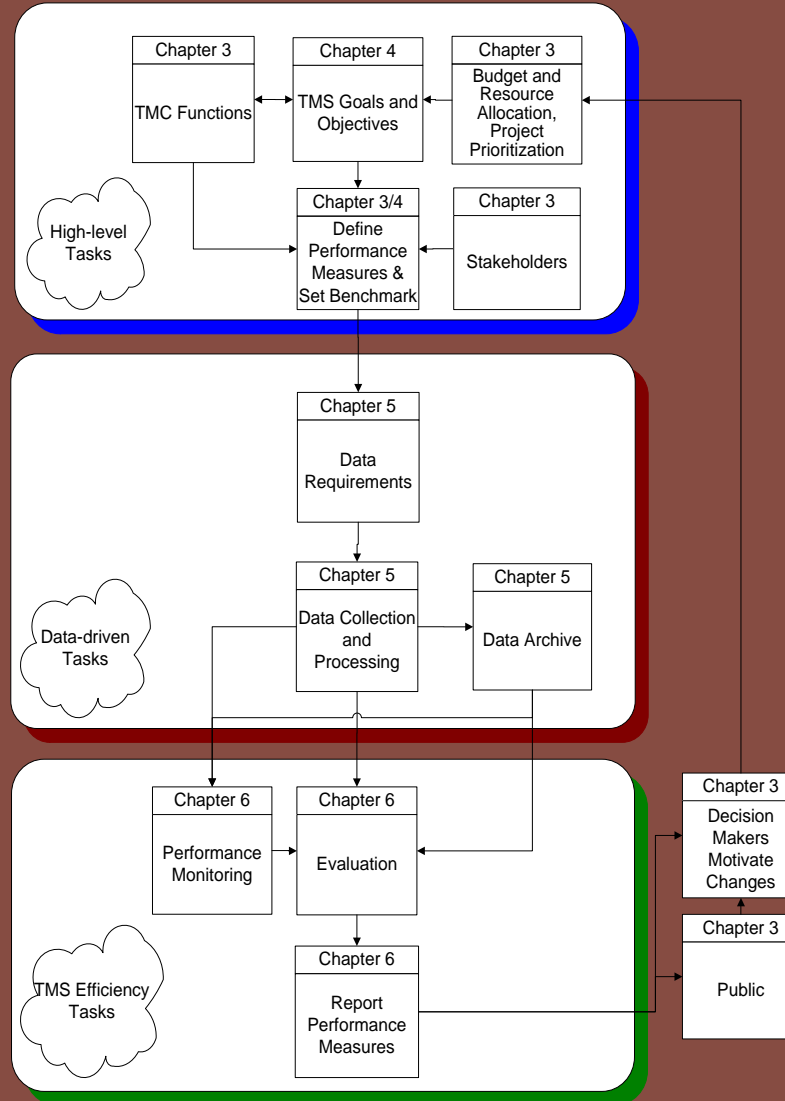
TMS Systems and Their Functions

Performance Measures

➢ Developed high-level performance measures by TMS/TMC functions

- Freeway system
- Signal system
- Transit system

➢ Distinguished output vs. outcome measures

➢ Provided calculation methods of proposed performance measures

Signal System Example

Function Category	Metric	Type	Supplementary Notes	Calculation Example(s)
Special Events	Number of events	External		
	Duration of event	External		
	Person-hours toward special event work	Input	Can also use dollars spent as metric	
	Frequency of evaluating/changing timing plans for special events	Output		*No. reviews per event*
	Number of special event signal operations by time of day, day of week and event types	Output		
	Coordination level with freeway TMCs and other jurisdiction signal systems	Output	Depending on the need to review	
Overall Measures	Total lane-miles being managed	External		
	Person-hours toward arterial management	Input		
	Number of cycle failures, per intersection/corridor	Output	Classified by cause of failure (poor timings or excessive demand)	$\dfrac{No.\,Cycle\,Failures}{Day/Month}$
	Efficiency of bandwidth	Output		$Efficiency = \dfrac{Bandwidth}{CycleLength} \times 100\%$
	Travel time delay	Outcome		
	Maximum queue length	Outcome		$Cum.\,Arrival - Cum.\,Departure$
	Customer satisfaction	Outcome		
	Number of positive/negative feedback calls vs. total calls	Outcome		$\dfrac{No.\,Feedback\,Calls\,Received}{Total\,Calls\,Received}$
	Average speeds along corridors	Outcome		Average for n vehicles, $\dfrac{\sum\limits_{i=1}^{n} Speed_i}{n}$
	Travel time reliability	Outcome		
	Level of service by intersection/corridor	Outcome		

Key "Data" Elements in TMS/TMC
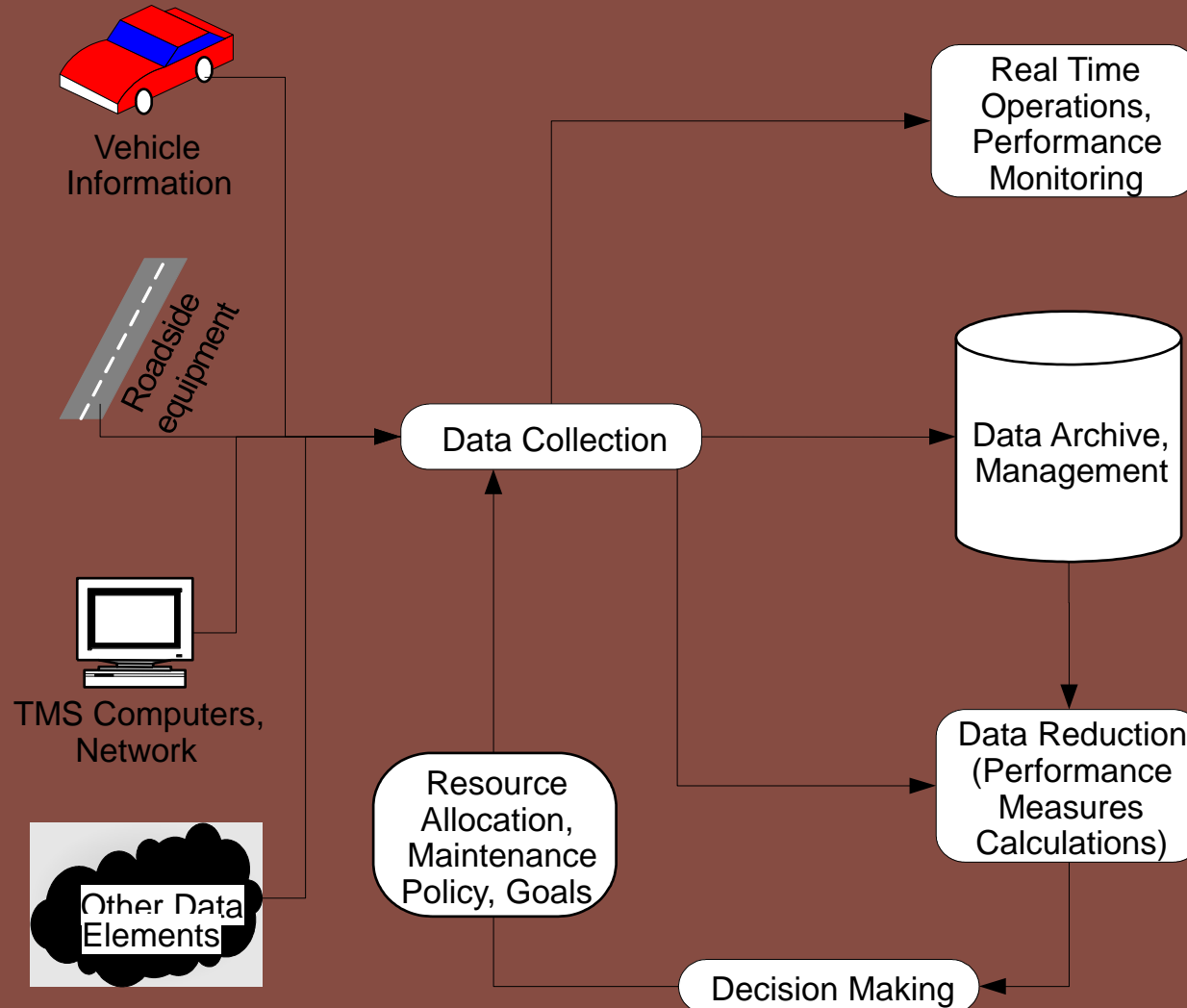
Performance Measure/Program Data	Mobility-travel time (Congestion)	VMT	Safety-incidents	Environ-mental Analysis	Information Dissemi-nation	HOV study	Incident Manage-ment	Ramp Metering	Arterial Mobility
Traffic volumes	X	X	X	X		X	X	X	X
Speeds	X			X		X		X	X
Vehicle Classification	X	X	X	X		X			
Probe data (AVL, GIS, AVI)	X			X	X				X
Incident/Event log (VMS, HAR, 511, HOV/RHOV open time logs)	X		X	X	X	X	X	X	X
Travel time	X			X	X		X		X
Maintenance log	X	X	X		X		X	X	
Signal data (light times, offsets, queues)							X	X	X
Weather data	X		X	X	X		X		
Video or image stream					X		X		
Air/Water/Noise pollution				X	X				

Performance Monitoring, Evaluation and Reporting

- ➤ **Performance monitoring:** Examines the actual system conditions through observed data

- ➤ **Evaluation**: Analyzes the collected data and compares the results to benchmark performance measures

- ➤ **Reporting**: Provides visual information and an interpretation of these graphs to decision makers and the public

- ➤ **Highlighted Best Practices**

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