Multi-Modal Traveler Information System

Corridor User Needs and Data Exchange Elements Working Paper # 18380.01

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TABLE OF CONTENTS

LIST OF TABLES

APPENDICES

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1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this Working Paper is to support the design, development and integration of the Multi-Modal Traveler Information System (MMTIS) in meeting the needs of travelers and operators within the Gary-Chicago-Milwaukee (GCM) Corridor. This Working Paper focuses on understanding the types of transportation/traveler information that are currently available within the GCM Corridor and understanding the needs regarding the types of transportation/traveler information that should be exchanged within the GCM Corridor.

1.1.1 Goals of This Working Paper

The goal of this Working Paper is to summarize and evaluate the needs of various public agencies, transit agencies, traffic reporting services, trucking firms and other transportation related companies with respect to transportation/traveler information within the GCM Corridor.

1.1.2 Intended Audience

This Working Paper is to be used as a resource to provide direction for the members of the GCM Deployment Committee, Architecture Communication and Information Work Group, project managers, system designers, system developers and system integrators.

1.1.3 Working Paper Organization

This Working Paper is organized into four sections. Section 1 provides the introduction to the Working Paper. Section 2 details the interview processes and methodology of the data collection efforts. Section 3 relates the results and data compilation from the questionnaire. Section 4 discusses the data exchange elements and briefly addresses results of data source inventory (results also shown in Appendix C) . Section 5 provides a summary of the paper. Finally, the appendices provide sample question formats and both summaries and individual responses from the participating agencies.

1.2 PROJECT OVERVIEW

The Multi-Modal Traveler Information System (MMTIS) project involves a large number of Intelligent Transportation System (ITS) related tasks. It includes research of the ITS initiatives in the Corridor which are currently deployed as well as proposed ITS systems identified in regional strategic plans and early deployment studies. This information will be used to recommend a Corridor system architecture which best suits the characteristics of the diverse resources within the corridor. To develop this system architecture, however, it is necessary to determine the data types available and desired inside the GCM Corridor and also the requirements for data exchange.

1.3 DEFINITIONS, ACRONYMS AND ABBREVIATIONS

The following terms, acronyms or abbreviations are used in this paper:

*999 Private based cellular emergency system used in the Chicago Metropolitan area

ATMS	Advanced Traffic Management System
CAD	Computer Aided Dispatch
CATS	Chicago Area Transportation Study
CCTV	Closed Circuit Television
CDOT	Chicago Department of Transportation
CORBA	Common Object Request Broker Architecture
CTA	Chicago Transit Authority
Data Pipe	Provides a backbone communication system for transportation agencies and systems in the GCM Corridor. The intent is to connect existing transportation systems and integrate them to support other GCM program areas.
DBMS	Database Management System
Du-Comm	Emergency Dispatch Service (911 calls are routed through them) for DuPage County
ETTM	Electronic Toll and Traffic Management
FTMS	Freeway Traffic Management System
Gateway	The replacement for the C-TIC. Currently at the beginning stages of design through the Multi-Modal Traveler Information System (MMTIS) project.
GCM	Gary-Chicago-Milwaukee
IDOT	Illinois Department of Transportation
INDOT	Indiana Department of Transportation
ISTHA	Illinois State Toll Highway Authority
ITS	Intelligent Transportation System
LRMS	Location Reference Message Specification
Metra	Operator of the heavy rail commuter system in the Chicago area.
MMTIS	Multi-Modal Traveler Information System
MONITOR	The operations facility in Milwaukee which manages information on the freeways in the Metropolitan Milwaukee area.

NTCIP	National Transportation Communication for ITS Protocol
NWCD	Northwest Central Dispatch, a 911 system in the northwest suburbs of Chicago.
ODBC	Open Database Connectivity
OODBMS	Object Oriented Database Management System
Pace	Operators of the bus transit system in the Chicago suburbs.
RDBMS	Relational Database Management System
SQL	Structured Query Language
TIS	Traveler Information System
WisDOT	Wisconsin Department of Transportation

Refer also to the MMTIS Project Glossary Document #17100-1 for related terms.

1.4 RELATED DOCUMENTS

This working paper is part of a series of documents and working papers produced to support the design of the GCM Corridor Multi-Modal Traveler Information System.

Related documents and working papers include:

- Document #17150 - Gateway Traveler Information System (TIS) System Definition Document
- Document #17200 - GCM Corridor Architecture Functional Requirements Document
- Document #17250 - Gateway TIS Functional Requirements Document
- Document #17300 - GCM Corridor Architecture Interface Control Requirements Document
- Document #17350 - Gateway TIS Interface Control Requirements Document
- Working Paper #18250 - Cellular 911 - State of the Practice
- Working Paper #18400 - Current and Proposed ITS Initiatives
- Working Paper #18500 - GCM Corridor Strategic Plan
- Working Paper #18520 - Performance Criteria for Evaluating GCM Corridor Strategies & Technologies
- Working Paper #18550 - Alternative GCM Corridor Technologies and Strategies
- Working Paper #18600 - System Interfaces and Information Exchange
- Working Paper #18700 - Information Clearinghouse - Initial Administrative Network
- Working Paper #18790 - Information Clearinghouse - Final Network
- Working Paper #18830 - Weather Detection System Standard Message Sets
- Working Paper #19140 - Gateway TIS Phased Implementation Plan
- Working Paper #19210 - Gateway Lessons Learned
- Working Paper #19220 - Gateway Design Options
- Working Paper #19840 - Variable Message Signs (VMS)/Highway Advisory Radio (HAR) State of the Practice
- Working Paper #19845 - VMS/HAR Suggested Guidelines.

Related information is also contained in the GCM Corridor Coalition's "Gary-Chicago-Milwaukee ITS Priority Corridor, *Initial Program Plan*," dated June 1995 and the "*Draft Program Plan Update*," dated April 1997.

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2.0 DATA COLLECTION

2.1 METHODOLOGY

A combination of mailed questionnaires and telephone surveys was used to gather information for this paper. A mailed "User Needs Questionnaire", with appropriate telephone follow-up, was the primary means used to determine current and potential data user needs. A "Data Source Inventory" telephone survey of GCM Corridor agencies with data collection capabilities was also conducted to determine information on the types of data currently available and expected to be available in the near term.

Each of these processes and their related instruments are individually described below.

2.2 USER NEEDS QUESTIONNAIRE

2.2.1 Respondents

In order to fully identify the transportation data interests and needs within the GCM Corridor, the GCM MMTIS User Needs Questionnaire was disseminated to a very wide spectrum of parties participating in the GCM Corridor Program. The list of recipients for this questionnaire was developed from the GCM stakeholder mailing list database of GCM interested parties created by BRW, Inc. The questionnaire was distributed by mail to each member of each GCM committee and work group, including the Coordination Work Group, the Commercial Vehicle Operations Work Group, the Architecture, Communications and Information Work Group, the Traffic and Transit Management Work Group, the ITS Deployment Committee, as well as to any other "critical stakeholders" identified as particularly interested in the development of the GCM Program. This list of stakeholders, tabulated in Appendix A, is composed of staff from state and city agencies; other organizations (e.g. media, commercial vehicle operators and planning organizations); private entities and elected officials from Northwestern Indiana, Northeastern Illinois and Southeastern Wisconsin. The questionnaire solicited information on: type of organization; considerations on sharing travel information with the GCM Corridor; type and frequency of data generated and desired; methods of data transmission and receipt; and, other related items.

2.2.2 Format

The questionnaire made heavy use of check boxes with only a few fill-in items. A sample blank form is illustrated in Appendix A.2. A follow-up letter was sent to each addressee who did not respond to the questionnaire within the requested time period, verifying they had received the initial questionnaire and reminding them of the importance of participating in this effort. If an agency responded that they had not received the initial mailing, a questionnaire was faxed to them. In isolated cases, telephone follow-up calls were made to clarify or fill-in information. Collected data was entered into a database program for later sorting and compilation.

2.2.3 Returns

In all, 397 questionnaires were mailed out. Seventy-five (75) questionnaires, 19% of those mailed, were returned. Appendix A.3 lists those individuals that responded to the Questionnaire. Appendix B shows the compiled results for Questions #5 and #6 of the User Needs Questionnaire which asked about specific data available and desired. In the event that a respondent listed more than one frequency for a data type on Question #5 or #6, the most frequent was recorded (i.e. if a respondent chose both real-time and hourly, real-time is recorded since hourly data could be obtained from the real-time data.) Further evaluation and

analysis of this data is discussed in Section 3.

2.3 DATA SOURCE INVENTORY

2.3.1 Respondents

Thirty-three (33) key agencies participating in the GCM Corridor Program were selected for this telephone survey. These agencies were selected based upon their generally known capabilities as a current or near term provider or user of transportation related information, as well as, upon their demonstrated interest in the GCM Corridor Program. These key respondents also represent the diverse institutional interests across the Corridor, ranging though the levels of local, county and state governments, suburban and city, roadway and rail, emergency and police, and private information services. It is noted that all 33 agencies targeted for this inventory [with the exception of Surface Systems Inc. and the Chicago Skyway] were also mailed the User Needs Questionnaire discussed in Section 2.2.

They are listed below:

Chicago DOT - Bureau of Traffic Signal Systems
Chicago Police Dept. 911 Center
Chicago Skyway, Const. & Maint.
Chicago Skyway
Chicago Transit Authority
Conor Communications Co. - *999
Du-Comm
Gary Public Transit Corporation
IDOT - Comm. Center Const. & Maint.
IDOT - Emergency Traffic Patrol
IDOT - Signal System
IDOT - Traffic System Center
Illinois State Police - Dist. 15 CAD
Illinois State Police - Dist. Chicago
Indiana State Patrol
INDOT - Borman ATMS
INDOT - Construction & Maintenance
INDOT - Indiana Tollway
INDOT - Indiana Tollway, Const. & Maint.
ISTHA - Construction & Maintenance
ISTHA - I-PASS System
Metra
Metro Networks
Milwaukee County Sheriff
Milwaukee County Transit
Milwaukee Signal System
Northwest Central Dispatch
Pace
Regional Transit Authority
Shadow Traffic
Surface System Inc. (SSI)
Wisconsin State Patrol
WisDOT - MONITOR System

2.3.2 Format

A check list of desired information was used during each telephone interview. See Appendix C.2 for a sample Data Source Inventory Outline. A verbatim script was not followed. The inventory questions addressed: the identification of transportation related system hardware and software; type of network, operating system, database, location referencing system and operating mode; associated privacy and security issues; actual data available, including type and frequency; external interfaces; and other questions including those related to future plans.

2.3.3 Returns

Responses by telephone to this inventory were compiled from 26 of the 33 selected agencies. Pollers were unable to interview seven agencies.

Of the 26, nine did not return the more detailed User Needs Questionnaire [*999, Chicago Police Department 911 Center, Gary Public Transportation Corporation, INDOT - Division of Tollways (neither ETTM or Construction and Maintenance), Metro Networks, Milwaukee Signal System, Northwest Central Dispatch, and WisDOT MONITOR System].

Of the seven agencies not inventoried by telephone, five did submit a completed mail questionnaire [Du-Comm, Illinois State Police - Chicago District, Illinois State Police District 15, Illinois State Toll Highway Authority (Construction and Maintenance), and Wisconsin State Patrol] and two agencies did not respond to the mailed questionnaire [Gary Public Transportation Corporation and Metro Networks.] Therefore, when considering both the completed telephone survey and the questionnaire, no information was obtained from only two of the selected 33 agencies.

2.3.4 Results of the System and Data Source Inventory

Based on the completed inventories the following summaries can be made:

- Ten of the 26 agencies polled stated that they envision some sort of direct connection to the Gateway to provide/receive traveler information.

- Sixteen of the 26 agencies polled requested traveler/traffic information in addition to that they currently have access to.

- Among those agencies that utilize a location referencing system, the majority of the schemes are different than one another.

- Most agencies have implemented different system hardware components, system software components (platforms and operating systems), network configurations and databases.

- Eight of the 26 agencies noted concerns about security issues and nine agencies about privacy issues. There were eight agencies unsure at this point whether they have security or privacy issues.

Further discussion on the inventory results are discussed briefly in Section 4: location referencing (Section 4.2), database issues (4.3), security and privacy of data (4.4) and data types (4.5). Also a record of selected data related to the responses are depicted in Table C-1 in Appendix C. It is noted that other aspects of this inventory will be reported upon in greater detail in Working Paper #18600, *System Interfaces and Information Exchange.*

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3.0 ANALYSIS OF USER NEEDS AND INFORMATION AVAILABILITY

To ensure that the transportation data connections created for the Gary-Chicago-Milwaukee (GCM) ITS Priority Corridor address both the data available and the specific needs of transportation agencies and other organizations in the Corridor, responses to the previously noted questionnaire will be utilized. This section presents an analysis of the results.

A brief discussion on the inventory results are included in Section 4 and selected data related to the telephone responses are depicted in Table C-1 in Appendix C. It is noted that other aspects of this inventory will be reported upon in greater detail in Working Paper #18600, *System Interfaces and Information Exchange.*

The first question that was asked in the questionnaire was the extent to which the respondent was knowledgeable of the GCM Corridor in regards to its development and purpose. Forty-eight percent (48%) responded that they were "very knowledgeable, understand the benefits and future capabilities of proposed systems for the Corridor". Forty-four percent (44%) responded that they were "somewhat knowledgeable, I have heard of the development of systems for the Corridor". Finally, only 8% stated that "this was the first time I have heard of the Corridor and know little about Intelligent Transportation Systems." It is noted that all of these 8% that had never heard of the GCM Corridor, having had the questionnaire referred to them by individuals from within their agency that were mailed questionnaires.

3.1 FUNCTIONAL CLASSIFICATION OF RESPONDENTS

Of the 75 individuals that responded to the questionnaire, the breakdown by state is as follows:

50%	Illinois (37 respondents)
31%	Wisconsin (23)
19%	Indiana (15)

The organizations represented by those individuals that responded were classified as follows:

- Operate/Maintain Public Roadways - This includes public agencies (typically, cities, counties and DOTs) that take care of public roadways.
- Disseminate Transportation Related Data - This includes agencies that distribute information to both other agencies and the public (typically, media organizations).
- Emergency Services - This includes agencies that provide emergency services (typically, police departments).
- Law Enforcement - This includes agencies performing law enforcement inside the GCM Corridor. (typically, cities, federal agencies and police departments).
- Operate Transit Services - This includes agencies that operate buses or train service inside the GCM Corridor (e.g., Pace, METRA, etc.).
- Provide Weather Information - This includes agencies that either collect or distribute weather information within the GCM Corridor (typically, DOTs, tourism and media).

- Operate Commercial Transport - This includes agencies that operate commercial vehicles inside the GCM Corridor (typically, shipping companies and bus companies).

- Operate Public Parking Facilities - This includes agencies that operate public parking facilities inside the GCM Corridor. Typically these are city government organizations.

- Operate Public Airports - This includes agencies operating airports inside the GCM Corridor. The City of Gary (2 respondents) and Milwaukee County (1 respondent) were the only respondents.

- Other - This includes responding agencies that do not fall into the previously mentioned categories, such as the following:
  - Planning Organizations (4 respondents: Chicago Area Transportation Study, Northeastern IL Planning Commission, Northwestern Indiana Planning Commission, Will County Governmental League)
  - Environmental Organizations (2 respondents: Illinois Environmental Protection Agency and Indiana Department of Environmental Management)
  - Safety Organizations (3 respondents: FHWA - Office of Motor Carriers, Indiana State Police and Milwaukee Safety Commission)
  - Programming Agencies (2 respondents: Dupage Mayors and Managers Conference and South Suburban Mayor and Managers)
  - Operate Private Toll Roads (1 respondent: Illinois State Toll Highway Authority)

The following Table 3-1 shows the breakdown by state of each of the agency functions:

Table 3-1 Agency Location by State for Questionnaire Respondents

Agency Location / *Agency Function*	Illinois	Wisconsin	Indiana
Operate Roadways	54%	32%	14%
Emergency	44%	37%	19%
Disseminate Data	58%	19%	23%
Law	24%	40%	36%
Transit	54%	33%	13%
Weather Info	22%	45%	33%
Operating Parking	25%	75%	0%
Commercial Veh.	33%	0%	67%
Operate Airports	0%	33%	67%
Other	67%	8%	25%
Overall	50%	31%	19%

A breakdown of respondents by functional classification follows:

37%	Operate/Maintain Public Roadways (28)	12%	Provide Weather Information (9)
36%	Emergency Services (27)	5%	Operate Public Parking Facilities (4)
35%	Disseminate Transportation Related Data (26)	4%	Operate Commercial Transport (3)
33%	Law Enforcement (25)	4%	Operate Public Airport (3)
20%	Operate Transit Services (15)	16%	Other (12)

Note: many respondents classified their organizations in more than one function. The number in parenthesis is the number of respondents that chose the particular function. Hence, the sum of these numbers (152) exceeds the total respondents (75).

Table 3-2, Functional Classification of Respondents, shows how each of the respondents classified his/her particular agency (with an X denoting a function of the agency). If an agency qualified themselves with an "other" function, that is also listed in the table.

It is noted that there is an inherent bias towards roadway transportation related agencies created in the results due to the agencies that responded. Forty-eight (48) of the 75 respondents indicated function classifications that were roadway transportation related (Operate and Maintain Public Roadways or Disseminate Transportation Related Data) agencies.

3.2 AVAILABLE GCM CORRIDOR INFORMATION/DATA

One of the main intentions of this questionnaire is to determine the types of information that are currently available or will become available in the future. Twenty-two (22) types of data were listed in the questionnaire with provisions for write-ins, if an available data type was not covered. Shown below are those 22 data types:

Roadway closures	Ridesharing/carpooling data
Roadway traffic conditions	Transit schedules
Roadway surface conditions	Vehicle locations
Incidents (accidents, etc.)	Transit fares
Construction operations	Toll pricing
Maintenance operations	Itinerary planning
Link travel time data	Parking availability
Traffic signal timing plans	Parking fees
Traffic signal malfunctions	Scheduled flights
Alternative Routes (detours for delays)	Flight delays
Route planning	Weather conditions

The questionnaire asked respondents to mark each type of data which that organization currently generates or planned to generate. Then the respondent was asked to indicate how frequently the data is generated and whether it is available now, will be available within five years or will be available in more than five years. For this question, many responses only contained the frequency of the data available and not when they would like to start receiving it. This response was taken as being unsure at the present time about when they would start providing this information. Therefore this response was marked in Appendix B (tabulation of responses for questions 5 and 6) with the word "future".

Table 3-2 Functional Classification of Respondents

Company	Operate Roadways	Emergency	Disseminate Data	Law	Operate Transit	Provide Weather Info	Operate Parking	Operate Comm. Transport	Operate Airports	Other
A A A Wisconsin		X				X				
Bulkmatic Transport Co.								X		
CDOT - Bureau of Traffic	X		X							
Chicago Area Transportation Study			X							Metropolitan Planning Organization (MPO) for NE Illinois
Chicago Fire Dept.		X								
Chicago Transit Authority					X					
Chicago Transit Authority					X					
Chicago Transit Authority					X					
City of Gary	X	X	X	X	X				X	
City of Glendale, WI	X	X		X						
City of Naperville	X									
City of Racine	X	X	X	X	X		X			
City of Racine, Belle Urban System					X					
City of Valparaiso	X	X	X	X						
City of Wauwatosa, WI	X	X	X	X			X			
City of Whiting	X	X		X						
Cook County Hwy Dept.	X									
Du-Comm		X		X						
DuPage County Development Dept.										Does not apply to our organization
DuPage County DOT	X									
Dupage Mayors and Mangers Conf.										Programming Agency (STP-Local) - Provides Forum for Intergovernmental dialogue
FHWA, Office of Motor Carriers			X	X						Commercial Vehicle Safety
Gary Regional Airport									X	
Greendale Police Dept.				X						
Greyhound Lines Inc.								X		
Hammond Transit System					X					
IDOT			X							
IDOT	X	X								
IDOT - Emergency Traffic Patrol	X	X	X							
IDOT, District 1	X	X	X							
IDOT, Division of Highways	X	X	X							
IL Sec. of State, Comm. Farm Truck Division										Registering Trucks and Autos
Illinois Environmental Protection Agency		X								Vehicle Emissions Testing
Illinois State Police		X		X		X				
Illinois State Police				X						
Illinois State Toll Highway Authority										O/M Toll Highway System in Illinois
Illinois State Tollway	X	X								
Indiana Dept of Environmental Management		X								Ozone Action Days
Indiana State Police		X	X	X		X				Collect commercial motor veh. data and inspect CMV's for compliance with 49 CFR Federal Motor Carrier Safety Regs.
Indiana State Police				X		X				
INDOT	X		X			X				
Kane County Div. of Transportation	X		X							
Kenosha County Public Works	X									
Kenosha Police Dept.		X		X						
Lake County DOT	X									
Madison Metro Transit					X					
McHenry County	X	X		X						
Metra					X					
Metra					X					
Milwaukee County Transit					X					

Table 3-2 Functional Classification of Respondents (cont.)

Company	Operate Roadways	Emergency	Disseminate Data	Law	Operate Transit	Provide Weather Info	Operate Parking	Operate Comm. Transport	Operate Airports	Other
Milwaukee Safety Commission										Provide safety information
Milw. County Sheriff's Dept.		X		X						
NE IL Planning Commission			X							Disseminate Planning Data
NIRPC										Metropolitan Planning
Oak Creek Police Dept.		X		X						
Ozaukee County Sheriff's Dept.		X		X						
Pace			X		X					
Pace					X					
Regional Transportation Authority			X							Regional Transit TIC
Shadow Broadcast Services			X			X				
South Suburban Mayors & Managers			X							Trans. Council through MPO process. Program local STP funds
Town of Merrillville			X	X						
Tri-State Coach Lines, Inc.								X		
Village of Arlington Heights	X	X	X	X			X			
Village of Orland Park	X	X	X	X	X					
Walworth County Emerg. Management		X								
Walworth Co. Hwy. Dept.	X									
Washington County HW Dept.	X									
Waukesha Police Department		X		X						
WI State Patrol District 2				X						
Will County Governmental League	X		X							represent the needs/interests of local elected officials in the reg. trans. planning process
Wisconsin Dept. of Tourism			X			X				Wis. Travel information center for tourism
WisDOT	X		X	X		X				Administer statewide highway constroction program. Provide full spectrum of motor vehicle service including: comm. veh. credential and related enforcement activities.
WisDOT	X		X	X		X				Administer statewide highway constroction program. Provide full spectrum of motor vehicle service including: comm. veh. credential and related enforcement activities.

Listed below are the ten most common types of data available overall from responding organizations inside the GCM Corridor:

Rank	Data Type (% of all respondents)
1.	Roadway Closures (64%)
2.	Incidents (52%)
3.	Maintenance Operations (52%)
4.	Roadway Surface Conditions (47%)
5.	Construction Operations (46%)
6.	Roadway Traffic Conditions (44%)
7.	Weather Conditions (35%)
8.	Alternative Routes(detour for delays)(32%)
9.	Traffic Signal Malfunctions (30%)
10.	Vehicle Locations (26%)

It is noted that three data types (hazardous material closings, construction permit status and safe driving information) were listed as "other" available data types in the returned questionnaires.

Table 3-3 Frequency of Data Availability (Overall)

frequency =>	**Real-time**				**Hourly**				**Daily**				**Weekly**				**Monthly**				**Other**	**TOTAL**	**%**	**RANK**
Data Type availability =>	now	<5 yrs	>5yrs	future	now	<5 yrs	>5yrs	future	now	<5 yrs	>5yrs	future	now	<5 yrs	>5yrs	future	now	<5 yrs	>5yrs	future	no frequency	out of 75		
Roadway Closures	4	10	4	6	1	1			2	4	2	3	1				2	1	1			48	**63.8%**	#1
Roadway Traffic Conditions	10	3	3	5	1	3				1	1	1					1					33	**44.1%**	#6
Roadway Surface Conditions	3	6	4	6	2	2	3			2	1	1					1					35	**47.1%**	#4
Incidents	10	3	3	7	1	3			1	3	1						1			1		39	**51.7%**	#2
Construction Operations	2	2	2	5		2		1		7	1	3	1			1	1	1	1			34	**45.6%**	#5
Maintainance Operations	2	1	3	5		4		1	2	5	1	6		1			1	1	1			39	**51.7%**	#2
Link Travel Time Data	4	2	1			1		2			1									1		14	18.2%	#15
Traffic Signal Timing Plan	5	1		2					1	1	2							1		1		16	21.3%	#12
Traffic Signal Malfunctions	6	3	1	2		3		2		1	1	1										23	**30.4%**	#9
Alternative Routes	2	1	2	1		2		2	1	2	2	1	1	2		1		1				24	**31.9%**	#8
Route Planning	1	3	1			1		1		2	1			1		1				1	2	17	22.8%	#11
Ridesharing/Carpooling											2	1				2	1					7	9.1%	#21
Transit Schedules	5	2		1						1		3					1				1	16	21.3%	#12
Vehicle Locations	6	4	1	2		1		1				1					1					19	**25.8%**	#10
Transit Fares	1	2	2			2						4					1			1	1	16	21.3%	#12
Toll Pricing				1		1																2	3.0%	#22
Itinerary Planning		2									2										3	8	10.6%	#18
Parking Availability	1		1	1						2						1	1					8	10.6%	#18
Parking Fees		1		1						2		2				1	1					9	12.2%	#16
Scheduled Flights	1	4	1	1																	1	9	12.2%	#16
Flight Delays	2	3	1					1														8	10.6%	#18
Weather Conditions	6	3	2	2	2	3	1		3			1										26	**35.0%**	#7

Data Type Totals by Projected Availability

	TOTALS				**Percentage**				**Ranking**				**Under 5 years***			**Overall****
Data Type availability =>	now	<5 yrs	>5yrs	future	now	<5 yrs	>5yrs	future	now	<5 yrs	>5yrs	future	Total	%	RANK	Rank
Roadway Closures	10	16	7	9	**15%**	**24%**	**11%**	**14%**	#4	#1	#2	#3	26	**39%**	#1	#1
Roadway Traffic Conditions	12	7	4	6	**18%**	**11%**	**6%**	**9%**	#2	#7	#4	#6	19	**29%**	#3	#6
Roadway Surface Conditions	6	10	8	7	**9%**	**15%**	**12%**	**11%**	#6	#4	#1	#5	16	**24%**	#6	#4
Incidents	13	9	4	8	**20%**	**14%**	**6%**	**12%**	#1	#5	#4	#4	22	**33%**	#2	#2
Construction Operations	4	12	4	10	6%	**18%**	**6%**	**15%**	#11	#2	#4	#2	16	**24%**	#6	#5
Maintainance Operations	5	12	5	12	**8%**	**18%**	**8%**	**18%**	#10	#2	#3	#1	17	**26%**	#4	#2
Link Travel Time Data	4	3	2	3	6%	5%	**3%**	5%	#11	#14	#10	#13	7	11%	#14	#15
Traffic Signal Timing Plan	6	3	2	3	**9%**	5%	**3%**	5%	#6	#14	#10	#13	9	14%	#11	#12
Traffic Signal Malfunctions	6	7	2	5	**9%**	**11%**	**3%**	**8%**	#6	#7	#10	#7	13	**20%**	#8	#9
Alternative Routes	4	8	4	5	6%	**12%**	**6%**	**8%**	#11	#6	#4	#7	12	**18%**	#9	#8
Route Planning	1	7	2	3	2%	**11%**	**3%**	5%	#17	#7	#10	#13	8	12%	#13	#11
Ridesharing/Carpooling	1	0	2	3	2%	0%	**3%**	5%	#17	-	#10	#13	1	2%	#21	#21
Transit Schedules	6	3	0	4	**9%**	5%	0%	**6%**	#6	#14	-	#10	9	14%	#11	#12
Vehicle Locations	7	5	1	4	**11%**	8%	2%	**6%**	#5	#11	#17	#10	12	**18%**	#9	#10
Transit Fares	2	4	2	5	3%	6%	**3%**	**8%**	#14	#12	#10	#7	6	9%	#15	#12
Toll Pricing	0	1	0	1	0%	2%	0%	2%	-	#22	-	#19	1	2%	#21	#22
Itinerary Planning	0	2	2	0	0%	3%	**3%**	0%	-	#19	#10	-	2	3%	#20	#18
Parking Availability	2	2	1	2	3%	3%	2%	3%	#14	#19	#17	#18	4	6%	#18	#18
Parking Fees	1	3	0	4	2%	5%	0%	**6%**	#17	#14	-	#10	4	6%	#18	#16
Scheduled Flights	1	4	1	1	2%	6%	2%	2%	#17	#12	#17	#19	5	8%	#16	#16
Flight Delays	2	3	1	1	3%	5%	2%	2%	#14	#14	#17	#19	5	8%	#16	#18
Weather Conditions	11	6	3	3	**17%**	**9%**	**5%**	5%	#3	#10	#9	#13	17	**26%**	#4	#7

KEY

Percentage = % of Respondants selecting data type

Ranking= Ranked in order of most available types of data (top 10 data types are bold)

now = data type available now

< 5yr = data available in less than 5 years

> 5yr = data available in more than 5 years

future = data available at unknown point in the future

other = no frequency specified

*= now + < 5yrs

**= now + < 5yrs + >5yrs + future

Table 3-3, Frequency of Data Availability (Overall), shows the complete tabulation of all responses received for Question #5 of the User Needs Questionnaire. Question #5 asked the respondents to specify which types of data they currently generated or anticipated generating in the future. For each data type respondents were asked to specify frequency of availability (e.g., real-time, monthly, etc,) and also the anticipated availability (e.g., now, less than five years, more than five years). The rankings shown above are derived from this table.

The rows of Table 3-3 represent each of the 22 types of data available (i.e. roadway closures, roadway traffic conditions, etc.) and the columns represent the frequency that the data is generated (i.e. real-time data, monthly data, etc.) and also the projected availability (i.e. available now, within five years, etc.) The numbers in each cell of the upper table represent the number of respondents that chose the particular data type, frequency and projected availability.

The bottom half of Table 3-3 shows the responses broken down only by projected availability (without frequency). This makes it easier to see which types of data are available now and in the future. Also shown is the projected availability within the next five years since it is anticipated that this is the data that will be used to establish the Gateway. The overall ranks shown in the top half of the table are repeated as the last column on the bottom half of the table.

Separate tables similar to Table 3-3 are available in Appendix B for each individual agency function. The percentages shown in Table 3-3 and also in Appendix B are combined into Table 3-4 described in Section 3.2.2 below.

3.2.1 Frequency of Data Availability

The responses received indicated that the preferred method of making almost all data available was in real-time. But there were some types of data that were commonly being generated daily. Among daily generated data, the following are the most common types indicated as available now and/or in the future

Daily Basis
- Maintenance Operations
- Construction Operations
- Roadway Closures
- Alternative Routes
- Incidents

Note: Construction and Maintenance Operations are projected to be as commonly generated on a daily basis as they are in real-time, among those responding to the questionnaire.

Overall though real-time is the preferred method of distributing data. The top five ranked available real-time data types are as follows (where the # in parenthesis is the total respondents indicating availability in real time for the particular data type):

Roadway Closures (24)
Incidents (23)
Roadway Traffic Conditions (21)
Roadway Surface Conditions (19)
Weather Conditions (13)
Vehicle Locations (13)

3.2.2 Functional Categories

While it is important to look at the overall picture in the type of information available, it is also useful to look at the information available by organizational function. All agency functions will be looked at in-depth to highlight the differences in the type of data available.

Table 3-4, Data Type Availability Summary by Agency Function, shows the overall percentage of data availability by data type and also breaks it down by each individual agency function. The rows of this table represent each of the 22 types of data available (i.e. roadway closures, roadway traffic conditions, etc.) and the columns represent the nine agency functions (with the number of respondents in parenthesis at the bottom of each column) along with an overall total. Each cell represents the percentage of that particular agency types respondents that have that particular data type available. The five highest percentages of availability are bold (Note: some agency functions have more than five bolded data types due to ties for the fifth most available data type.)

Responses grouped by agency function are reviewed below. The order of agency functional groupings follows the relative participation in the information collection activity.

3.2.2.1 Operate/Maintain Public Roadways

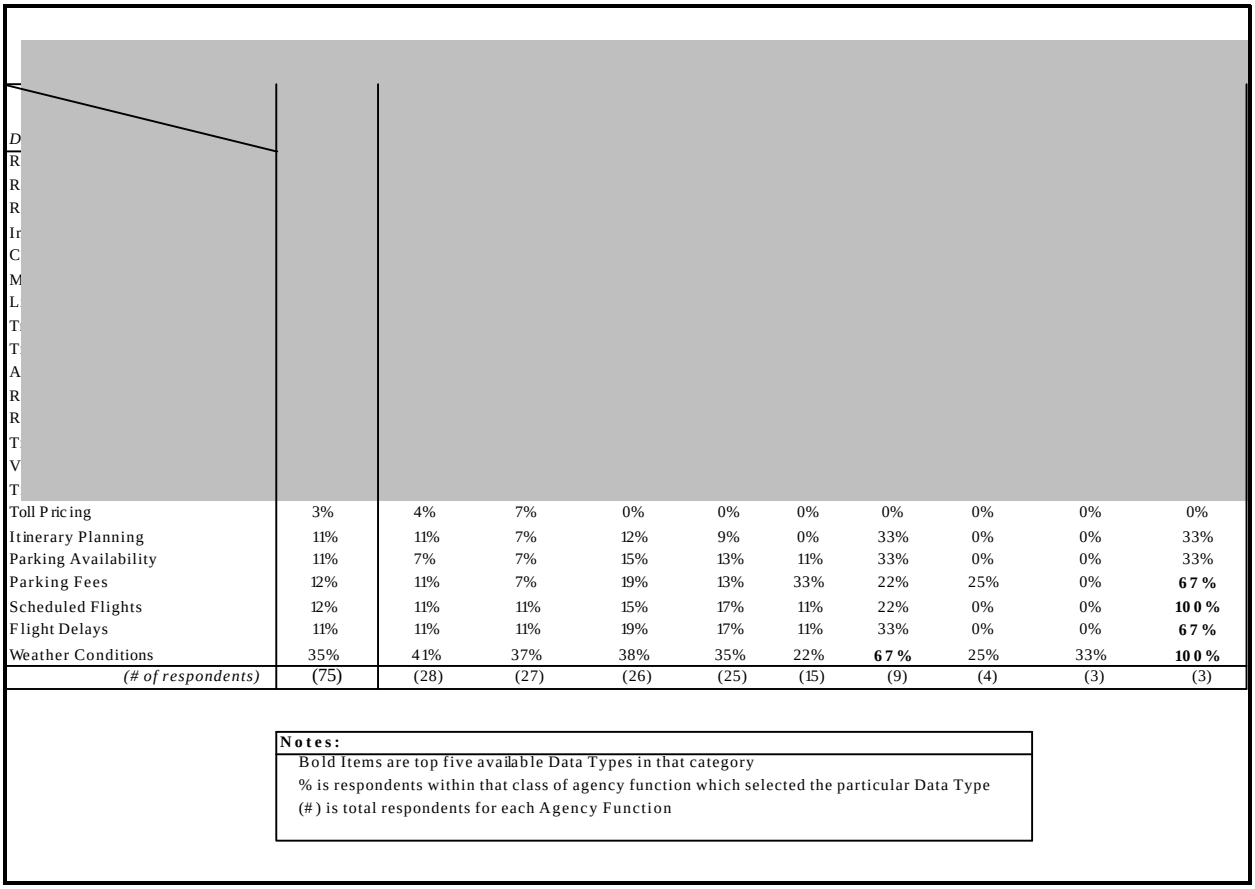
The five most common types of information available from agencies that operate/maintain public roadways are the same types of information available overall from responding agencies(in a slightly different order). Appendix Table B-1 is a breakout from Table 3-3, Frequency of Data Availability, for only this type of agency. Below are the top five types of data available by agencies that operate/maintain public roadways with the percent of these respondents indicating this data type:

Rank	Data Type (% of all respondents)
1.	Roadway Closures (89%)
2.	Construction Operations (82%)
2.	Maintenance Operations (82%)
4.	Roadway Surface Conditions (56%)
5.	Incidents (52%)
5.	Roadway Traffic Conditions (52%)

3.2.2.2 Emergency Services

The top five types of information available from agencies that operate emergency services are the same types of information available overall from all agencies (in a slightly different order). Appendix Table B-2 is a breakout from Table 3-3, Frequency of Data Availability, for only this type of agency. Below are the top five types of data available from agencies that provide emergency services.

Rank	Data Type (% of all respondents)
1.	Roadway Closures (76%)
2.	Incidents (72%)
3.	Maintenance Operations (56%)
3.	Construction Operations(56%)
5.	Roadway Surface Conditions (52%)
5.	Roadway Traffic Conditions (52%)



D R R R Ir C M L T T A R R T V T										
Toll Pricing	3%	4%	7%	0%	0%	0%	0%	0%	0%	0%
Itinerary Planning	11%	11%	7%	12%	9%	0%	33%	0%	0%	33%
Parking Availability	11%	7%	7%	15%	13%	11%	33%	0%	0%	33%
Parking Fees	12%	11%	7%	19%	13%	33%	22%	25%	0%	**67%**
Scheduled Flights	12%	11%	11%	15%	17%	11%	22%	0%	0%	**100%**
Flight Delays	11%	11%	11%	19%	17%	11%	33%	0%	0%	**67%**
Weather Conditions	35%	41%	37%	38%	35%	22%	**67%**	25%	33%	**100%**
(# of respondents)	(75)	(28)	(27)	(26)	(25)	(15)	(9)	(4)	(3)	(3)

Notes:

Bold Items are top five available Data Types in that category

% is respondents within that class of agency function which selected the particular Data Type

(#) is total respondents for each Agency Function

3.2.2.3 Disseminate Transportation Related Data

The top five types of information available from agencies that disseminate transportation related data are the same types of information available overall from all agencies (in a slightly different order). Most notably, roadway traffic conditions data is more commonly available among these agencies than incident or roadway surface condition data. Appendix Table B-3 is a breakout from Table 3-3, Frequency of Data Availability, for only this type of agency. Below are the top five types of data available by agencies that disseminate transportation related data.

Rank	Data Type (% of all respondents)
1.	Roadway Closures (69%)
2.	Construction Operations (65%)
3.	Maintenance Operations (62%)
4.	Roadway Traffic Conditions(56%)
5.	Roadway Surface Conditions (50%)
5.	Incidents (50%)

3.2.2.4 Law Enforcement

The top five types of information available from agencies that perform law enforcement are the same types of information available overall from all agencies (slightly different order), except alternative route data replaces roadway surface and traffic conditions data. Appendix Table B-4 is a breakout from Table 3-3, Frequency of Data Availability, for only this type of agency. Below are the top five types of data available by agencies that perform law enforcement.

Rank	Data Type (% of all respondents)
1.	Roadway Closures (83%)
2.	Incidents (70%)
3.	Maintenance Operations (48%)
3.	Construction Operations(48%)
5.	Alternative Routes (detour for delays) (43%)

3.2.2.5 Operate Transit Services

Of all the agency functions, transit services showed the most specialized type of information available. Where all the other agency functions (with the exception of operators of airports) have roadway related information, transit services generated information unique to their operations that would not be available from any other source (i.e., schedules and fares). This is not surprising since the majority of respondents focus on roadway related activities. Appendix Table B-5 is a breakout from Table 3-3, Frequency of Data Availability, for only this type of agency. Below are the top five types of data available from transit agencies.

Rank	Data Type (% of all respondents)
1.	Transit Schedules (100%)
1.	Transit Fares (100%)
3.	Vehicle Locations (78%)
4.	Incidents (44%)
4.	Maintenance Operations (44%)

3.2.2.6 Provide Weather Information

Even though it would be expected that agencies that provide weather information would have very different types of data available, the top five data types are similar to overall agencies with the exception of route planning and weather conditions (replacing construction and maintenance operations data). Appendix Table B-6 is a breakout from Table 3-3, Frequency of Data Availability, for only this type of agency.

Rank	Data Type (% of all respondents)
1.	Roadway Surface Conditions (100%)
2.	Incidents (88%)
2.	Roadway Closures (88%)
4.	Roadway Traffic Conditions (75%)
4.	Route Planning (75%)
4.	Weather Conditions (75%)

3.2.2.7 Operate Public Parking Facilities

With the exception of traffic signal timing plans (replacing roadway surface conditions), the top five types of information available from agencies that operate public parking facilities are similar types of information available overall from all agencies (in a slightly different order). Appendix Table B-7 is a breakout from Table 3-3, Frequency of Data Availability, for only this type of agency. Below are the top five types of data available by agencies that operate public parking facilities. [Note: only four respondents were classified as operating public parking facilities].

Rank	Data Type (% of all respondents)
1.	Roadway Closures (100%)
1.	Maintenance Operations (100%)
3.	Incidents (75%)
3.	Traffic Signal Timing Plan (75%)
3.	Construction Operations (75%)

3.2.2.8 Operate Commercial Transport

Eight types of data are indistinguishably the most common available from the limited responses from agencies that operate commercial transportation [only three]. These includes the same types of information available overall from all agencies (in a slightly different order) plus alternative routes and vehicle location data. It is noted that alternative routes were on the Law Enforcement list (Sec. 3.2.2.4) and vehicle locations were on both the Transit Operators (Section 3.2.2.5) and Airport Operators (Section 3.2.2.9) lists of most commonly available data. Appendix Table B-8 is a breakout from Table 3-3, Frequency of Data Availability, for only this type of agency. Below are the top types of data (eight are shown due to a tie for first) available by agencies that operate commercial transportation.

Rank	Data Type (% of all respondents)
1.	Roadway Closures (67%)
1.	Construction Operations (67%)
1.	Maintenance Operations (67%)
1.	Roadway Traffic Conditions (67%)
1.	Roadway Surface Conditions (67%)

1. Incidents (67%)
1. Alternative Routes (detour for delays) (67%)
1. Vehicle Locations (67%)

3.2.2.9 Operate Public Airports

Agencies that operate public airports have different information available than the majority of agency types. [Note: Only three respondents were classified as operators of public airports]. These agencies, similar to the transit agencies, supply information not readily available from other agency types. Appendix Table B-9 is a breakout from Table 3-3, Frequency of Data Availability, for only this type of agency. It is difficult, however, to determine how accurate the below data is due to only receiving information from three (3) agencies classified as operators of public airports.

Rank	Data Type (% of all respondents)
1.	Weather Conditions (100%)
1.	Scheduled Flights (100%)
3.	Transit Schedules (67%)
3.	Transit Fares (67%)
3.	Vehicle Locations(67%)

3.2.3 Summary of Available Data/Information

After compiling the types of data available from all of the responding agencies it is seen that all of the agencies, with the exception of transit agencies (airport operators and parking operators did not respond in a number large enough to draw adequate conclusions), have very similar types of data available even though these agencies have different functions. This is not surprising when it is noted that there was a heavy bias towards roadway agencies in regard to the distribution of the questionnaire.

3.3 DESIRED GCM CORRIDOR INFORMATION DATA

Along with determining the type of information available it is also important to determine what type of information organizations would like to receive to complement their existing information. The questionnaire asked each individual to select the types of data, of the same 22 types listed in Section 3.2, they would like to receive, the frequency at which they would like to receive the data and when they would like to start receiving this information (now, less than 5 years in the future or more than 5 years in the future). For this question many responses only contained the frequency of the data desired and not when they would like to start receiving it. This response was taken as being unsure at the present time about when they would like to start receiving information. Therefore this response was marked in Appendix B with the word "future". Listed below are the ten most common types of data desired by responding organizations inside the GCM Corridor:

Rank	Data Type (% of all respondents)	Rank	Data Type (% of all respondents)
1.	Roadway Closures (82%)	6.	Maintenance Operations (61%)
2.	Roadway Traffic Conditions (76%)	7.	Alternative Routes (detour for delays) (59%)
3.	Roadway Surface Conditions (73%)	8.	Weather Conditions (59%)
4.	Incidents (73%)	9.	Traffic Signal Malfunctions (50%)
5.	Construction Operations (70%)	10.	Link Travel Time Data (47%)

It is noted that three data types (Commonwealth Edison problems, commercial motor vehicle data and on/off ramp volumes) were listed as "other" desired data types on the returned questionnaires.

Table 3-5, Frequency of Data Desired (Overall), shows the complete tabulation of all responses received for Question #6 of the User Needs Questionnaire. Question #6 asked the respondents to specify which types of data they currently would use if it were available. For each data type respondents were asked to specify frequency they would like to receive the data (e.g., real-time, monthly, etc,) and also the anticipated desirability (e.g., now, less than five years, more than five years). The rows of this table represent each of the 22 types of data desired (i.e. roadway closures, roadway traffic conditions, etc.) and the columns represent the frequency that the data is wanted (i.e. real-time data, monthly data, etc.) and also the projected desirability (i.e. desired now, within five years, etc.) The numbers in each cell of the upper table represent the number of respondents that chose the particular data type, frequency and projected desirability.

The bottom half of Table 3-5 shows the responses broken down by only projected desirability (without frequency). This makes it easier to see which types of data are desired now and in the future. Also shown is the projected desirability within the next five years since it is anticipated that this is the data that will be distributed when the Gateway is established. The overall ranks shown in the top half of the table are repeated as the last column on the bottom half of the table.

Separate tables similar to Table 3-5 are available, in Appendix B, for each individual agency function. The numbers shown in Table 3-5 and in Appendix B are combined into Table 3-7 described in Section 3.3.4 below.

3.3.1 Frequency of Data Desired

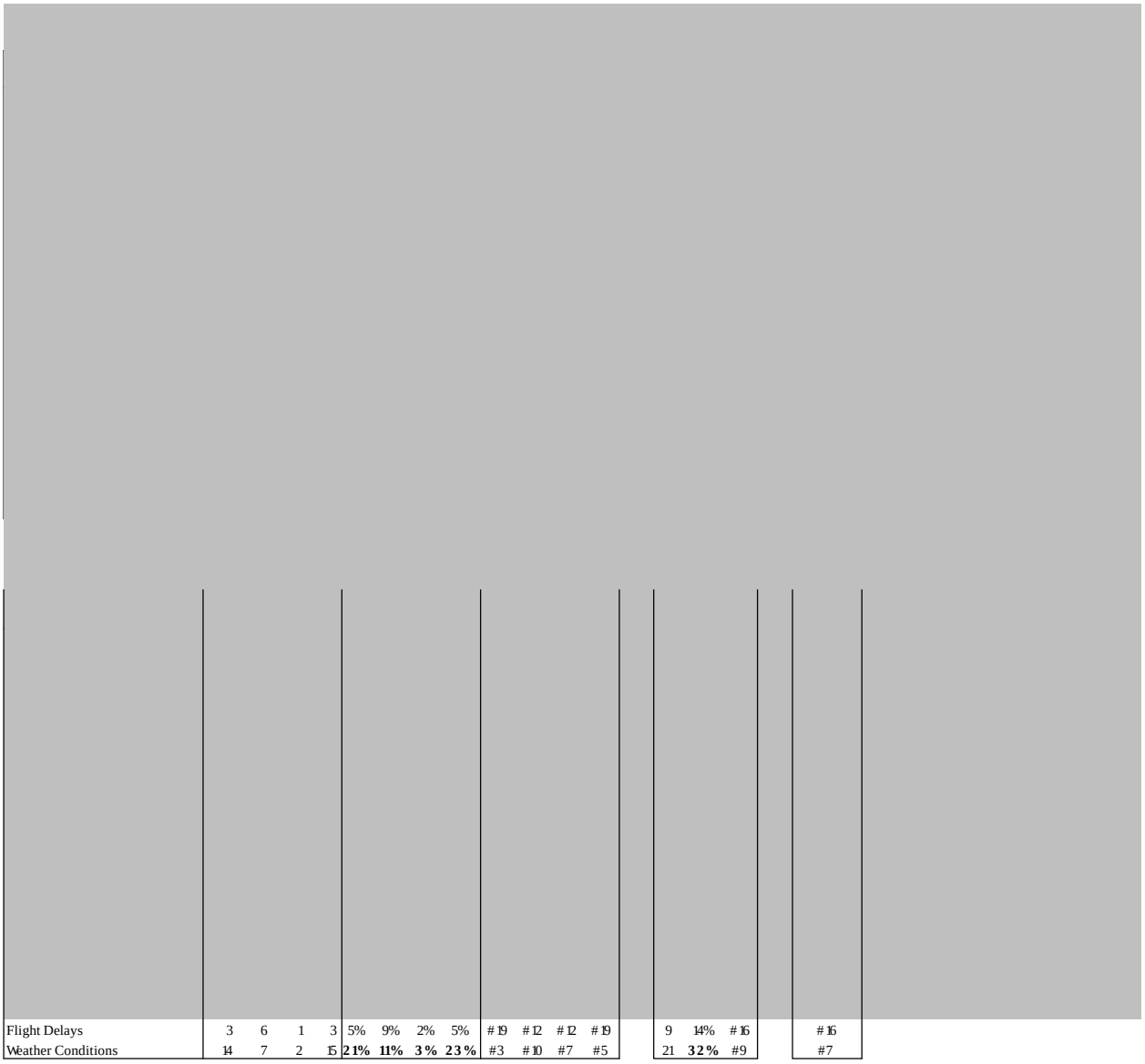
Similar to available information, most desired information is requested to be in a real-time availability. Major exceptions to this are requests for information on a Daily and Monthly Basis. Among daily and monthly desired data, the following are the most common types currently, now and/or in the future desired:

Daily Basis
- Construction Operations
- Maintenance Operations
- Roadway Closures
- Alternative Routes
- Traffic Signal Timing Plans

Monthly Basis
- Transit Schedules
- Transit Fares
- Toll Pricing
- Parking Fees

Overall though real-time is the preferred method of receiving data. The five most desired real-time data types are as follows (where the number in parenthesis is the number of respondents who desire the particular data type in real-time):

Roadway Traffic Conditions (37)
Incidents (36)
Roadway Surface Conditions (33)
Roadway Closures (33)
Weather Conditions (31)



Flight Delays	3	6	1	3	5%	9%	2%	5%	#19	#12	#12	#19	9	14%	#16	#16
Weather Conditions	14	7	2	15	**21%**	**11%**	**3%**	**23%**	#3	#10	#7	#5	21	**32%**	#9	#7

3.3.2 Desired Coverage Area

It is also of interest what coverage area is desired by the responding organizations. Table 3-6 depicts the general geographic Corridor areas for which transportation data is desired by the various agency functions defined in Section 3.1.

Table 3-6 Desired Coverage Area Within GCM Corridor

Agency Function	NE Illinois	NW Indiana	SE Wisconsin	Corridor Wide
Operate Roadways (28)	32%	11%	18%	21%
Emergency (27)	37%	19%	30%	19%
Disseminate Data (26)	31%	12%	8%	35%
Law (25)	28%	16%	32%	20%
Transit (15)	13%	13%	23%	23%
Weather Info (9)	11%	22%	11%	44%
Operate Parking (4)	0%	0%	75%	0%
Commercial Veh. (3)	33%	33%	0%	66%
Operate Airports (3)	33%	33%	33%	33%
Other (12)	33%	17%	17%	33%
Overall (75)	29%	12%	17%	24%

It should be noted that the breakdown by state of the respondents was as follows: 50% Illinois, 31% Wisconsin and 19% Indiana (see Table 3.1 for breakdown by agency type). This tends to account for the greater number of requests for Illinois information and not as many requests for Indiana. Also note that some respondents indicated more than one desired coverage area, some noted no coverage area and still others indicated additional specific areas. There was also 34% of the respondents that wanted specific local information (i.e. the Borman Expressway, City of Naperville, Walworth County, etc.). Seventy-five percent (75%) of this requested local information concerned counties within the jurisdiction of the responding organization.

3.3.3 Desired Incident Types

Along with the types of transportation related data which organizations would like to receive, individuals were asked to indicate the types of incidents that affect their organization. The six incident types, with the percentage indicated, were:

Rank	Data Type (% of all respondents)
1.	Roadway Closures (82%)
2.	Weather Related (80%)
3.	Internal Accidents (67%) - within organizations operations

4. External Accidents (62%) - outside of organizations operations
5. Traffic Signal Malfunction (56%)
6. Transit Shut-Down (36%)

3.3.4 Functional Categories

Similar to the types of data available, it is useful to look at functional groups of agencies to see if there are large differences in the types of data that they would like to receive. All agency functions will be looked at in-depth to highlight the differences in the type of data desired.

Table 3-7, Data Type Desired Summary by Agency Function, shows the overall percentage of data desired by data type and also breaks it down by each individual agency function. The rows of this table represent each of the 22 types of data desired (i.e. roadway closures, roadway traffic conditions, etc.) and the columns represent the nine agency functions (with the number of respondents in parenthesis above the function name) along with an overall total. Each cell represents the percentage of that particular agency types respondents that desired that particular data type. The five highest percentages of desired data are bold (Note: some agency functions have more than five bolded data types due to ties for the fifth most desired data type.)

Responses grouped by agency function are reviewed below. The order of agency functional groupings follows the relative participation in the information collection activity.

3.3.4.1 Operate/Maintain Public Roadways

The types of data desired by agencies that operate/maintain public roadways is almost the same data types desired by the overall agencies (in a slightly different order) with the exception that maintenance operations replaces incident data. Appendix Table B-10 is a breakout from Table 3-5, Frequency of Data Desired, for only this type of agency. Below are the top five types of data desired by agencies that operate/maintain public roadways.

Rank	Data Type (% of all respondents)
1.	Construction Operations (89%)
2.	Roadway Closures (85%)
2.	Roadway Traffic Conditions(85%)
2.	Roadway Surface Conditions (85%)
5.	Maintenance Operations (78%)

3.3.4.2 Emergency Services

For the agencies that provide emergency services the top five desired types of data are identical to the overall desired types of data for all respondents. Appendix Table B-11 is a breakout from Table 3-5, Frequency of Data Desired, for only this type of agency. Below are the top five types of data desired by emergency service providers.

Rank	Data Type (% of all respondents)
1.	Roadway Closures (84%)
2.	Roadway Traffic Conditions(80%)
2.	Roadway Surface Conditions(80%)

4. Incidents (72%)
5. Construction Operations(64%)

Table 3-7 Data

Agency Function / *Data Type*	OVERALL	O and M Roadways								
Roadway Closures	**82%**	**85%**								
Roadway Traffic Conditions	**76%**	**85%**								
Roadway Surface Conditions	**73%**	**85%**								
Incidents	**73%**	**74%**								
Construction Operations	**70%**	**89%**								
Maintainance Operations	61%	**78%**	**56%**	**46%**	**70%**	**20%**	75%	**100%**	**67%**	33%
Link Travel Time Data	47%	37%	41%	58%	52%	20%	**88%**	25%	33%	0%
Traffic Signal Timing Plan	44%	52%	30%	50%	43%	20%	50%	**75%**	67%	33%
Traffic Signal Malfunctions	50%	56%	44%	58%	52%	27%	88%	**100%**	67%	33%
Alternative Routes	59%	48%	48%	65%	**61%**	33%	**100%**	50%	**100%**	33%
Route Planning	38%	26%	30%	50%	43%	20%	**63%**	25%	67%	0%
Ridesharing/Carpooling	21%	26%	22%	31%	17%	7%	38%	0%	33%	0%
Transit Schedules	32%	22%	15%	35%	26%	**40%**	38%	25%	33%	0%
Vehicle Locations	30%	26%	30%	31%	39%	**27%**	50%	50%	**33%**	**67%**
Transit Fares	20%	15%	11%	27%	17%	**33%**	0%	50%	33%	0%
Toll Pricing	12%	7%	11%	8%	9%	7%	0%	0%	67%	0%
Itinerary Planning	14%	11%	7%	12%	13%	20%	25%	0%	33%	0%
Parking Availability	24%	15%	11%	35%	17%	13%	38%	50%	33%	**67%**
Parking Fees	21%	15%	11%	27%	22%	13%	25%	25%	33%	33%
Scheduled Flights	20%	15%	11%	19%	22%	0%	38%	0%	67%	0%
Flight Delays	21%	11%	15%	15%	22%	13%	50%	25%	67%	**67%**
Weather Conditions	59%	56%	52%	50%	52%	27%	**88%**	50%	**100%**	**67%**
(# of respondents)	(75)	(28)	(27)	(26)	(25)	(15)	(9)	(4)	(3)	(3)

Notes:

Bold Items are top five desired Data Types in that category

% is respondents within that class of agency function which selected the particular Data Type

(#) is total respondents for each Agency Function

3.3.4.3 Disseminate Transportation Related Data

For the agencies that disseminate transportation related data, as defined in Section 3.1, the top five desired types of information are the same as the overall desired information types (slightly different order). Appendix Table B-12 is a breakout from Table 3-5, Frequency of Data Desired, for only this type of agency. Below are the top five types of data desired by agencies that disseminate transportation related data.

Rank	Data Type (% of all respondents)
1.	Roadway Closures (81%)
2.	Roadway Surface Conditions(77%)
3.	Incidents(73%)
3.	Roadway Surface Conditions(73%)
5.	Construction Operations(69%)

3.3.4.4 Law Enforcement

For the agencies that provide law enforcement the top five desired types of data are the same as the overall desired types of data for all respondents. The top five are also the same (in a different order) as those for Emergency Services. Appendix Table B-13 is a breakout from Table 3-5, Frequency of Data Desired, for only this type of agency. Below are the top five data types desired by emergency services.

Rank	Data Type (% of all respondents)
1.	Roadway Surface Conditions (83%)
2.	Roadway Traffic Conditions (78%)
3.	Roadway Closures (74%)
4.	Construction Operations (74%)
5.	Incidents (74%)

3.3.4.5 Operate Transit Services

Unlike in 3.2.2.5, where the top five types of data available to transit operating agencies varied greatly from the overall available information, agencies that operate transit services desired data which is almost identical to the overall desired data with the single exception of transit schedules (in place of construction operations data). Appendix Table B-14 is a breakout from Table 3-5, Frequency of Data Desired, for only this type of agency. Below are the top five types of data desired by transit services.

Rank	Data Type (% of all respondents)
1.	Roadway Closures(78%)
2.	Roadway Traffic Conditions(67%)
2.	Roadway Surface Conditions(67%)
2.	Incidents (67%)
2.	Transit Schedules (67%)

3.3.4.6 Provide Weather Information

Agencies that provide weather information desire similar types of data as agencies overall with the following exceptions: alternative routes replaces construction operations as a significant data type, and four data types tie for fifth ranking, i.e., incident data, link travel time data, traffic signal malfunctions and

weather conditions. Among these last three, weather condition data is ranked a high concern only of airport operators and traffic signal malfunctions are a high priority among parking facility operators. No other group placed a high priority on link travel time data. Appendix Table B-15 is a breakout from Table 3-5, Frequency of Data Desired, for only this type of agency. Below are the top five types of data desired by agencies that provide weather information:

Rank	Data Type (% of all respondents)
1.	Roadway Traffic Conditions (100%)
1.	Roadway Closures (100%)
1.	Alternative Routes (detour for delays) (100%)
1.	Roadway Surface Conditions (100%)
5.	Incidents (88%)
5.	Weather Conditions (88%)
5.	Link Travel Time Data (88%)
5.	Traffic Signal Malfunctions (88%)

3.3.4.7 Operate Public Parking Facilities

Agencies that operate public parking facilities had similar desired data types compared to the overall respondents except also they placed high priority on traffic signal malfunctions and maintenance operations. [Note: Only four respondents were classified as operators of public parking.] Appendix Table B-16 is a breakout from Table 3-5, Frequency of Data Desired, for only this type of agency. Below are the most desired data types for agencies that operate public parking facilities:

Rank	Data Type (% of all respondents)
1.	Traffic Signal Malfunctions (100%)
1.	Roadway Traffic Conditions (100%)
1.	Roadway Closures (100%)
1.	Construction Operations (100%)
1.	Incidents (100%)
1.	Roadway Surface Conditions (100%)
1.	Maintenance Operations (100%)

3.3.4.8 Operate Commercial Transport

Agencies that operate commercial transport desired similar data types when compared to the overall data desired by all respondents with the exception that alternative routes data replaces roadway surface conditions among their high concerns. Appendix Table B-17 is a breakout from Table 3-5, Frequency of Data Desired, for only this type of agency. Below are the most desired data types for operators of commercial transportation [Note: Only three respondents were classified as operators of commercial transportation.]:

Rank	Data Type (% of all respondents)
1.	Alternative Routes (detour for delays) (100%)
1.	Roadway Traffic Conditions (100%)
1.	Roadway Closures (100%)
1.	Construction Operations (100%)
1.	Incidents (100%)

3.3.4.9 Operate Public Airports

The data types desired by operators of public airports are completely different from those of the overall respondents. It is difficult to determine how accurate these results are due to receiving only three responses, i.e., Gary Public Airport (2 responses) and Milwaukee County. Appendix Table B-18 is a breakout from Table 3-5, Frequency of Data Desired for only this type of agency. Below are the most desired data types for agencies that operate public airports:

Rank	Data Type (% of all respondents)
1.	Vehicle Locations (67%)
1.	Parking Available (67%)
1.	Flight Delays (67%)
1.	Weather Conditions (67%)
5.	Ten data types tied for Fifth (33%)

3.3.5 Summary of Desired Data/Information

After compiling the types of data desired from all of the responding agencies it is seen that with the exception of operators of public airports, all of the agencies, including transit agencies, have very similar needs when it comes to the types of data wanted, even though these agencies have very different functions. As noted above, responses were only received from two airport operators (three respondents) and therefore the results may not accurately represent all such agencies.

It is also interesting to note the data types that were not desired by a majority of respondents. Transit agencies did not desire scheduled flight information. Weather Services did not desire transit fares and toll pricing. Neither parking operators nor airport operators desired ridesharing/carpooling, toll pricing, itinerary planning and scheduled flight data. However, the undesired data for those agency functions with four or less respondents (parking operators, commercial vehicle operators and airport operators) may not accurately represent the agency function due to the lack of responses.

3.4 UTILIZATION OF CORRIDOR DATA/INFORMATION

Determining the information that is available (or going to be available) and the information that is desired is very important, but without a means to process and distribute this data effectively it would be useless. Initially it has to be determined if organizations are willing to share or make their data available to outside sources. It was determined that **81%** (61 of 75 respondents) of those responding to the questionnaire would be willing to share their data. Shown in Table 3-8 is the breakdown, by agency type, for the responding agencies which indicated a willingness to share data (note: the numbers in parenthesis are the number of agencies that chose the particular agency function and the number of these willing to share data.)

Table 3-8 Agencies Willing to Share Data

Agency Function	Willing to Share Data
Operate Roadways (28)	89% (25)
Emergency (27)	85% (23)
Disseminate Data (26)	85% (22)
Law (25)	88% (22)
Transit (15)	93% (14)
Weather Info (9)	78% (7)
Operate Parking (4)	75% (3)
Commercial Veh. (3)	100% (3)
Operate Airports (3)	100% (3)
Other (12)	92% (11)
Overall (75)	81% (61)

It is noted of the fourteen respondents who did not say "yes" to sharing data only six said "no", three others stated the question was "not applicable to their agency" and five did not answer the question. Thus it could be stated that only 8% (six of 75 respondents) would be unwilling to share data.

3.4.1 Privacy Measures

Along with the sharing of information between organizations, comes the need for additional processing to remove private and proprietary information from the data stream (phone #'s, names of individuals, license plate #'s, etc.). From this questionnaire, only 29% overall stated that they would require this type of security measure. This number is anticipated to increase as more and more information becomes available electronically. Typically the stripping of private or proprietary information will be accomplished at the data source. Shown below, in Table 3-9, is the breakdown, by agency function, of the respondents requiring privacy measures (note: the numbers in parenthesis are the number of agencies that chose the particular agency function and the number of these willing to share data.)

Although only three respondents each, Commercial Vehicle Operators appear the least concerned while Airport Operators appear to be most concerned about the privacy issues. High relative concern by Law Agencies could have been anticipated, but Weather Agencies' high concern may be attributed to liability/risk or the commercial value of their information.

Table 3-9 Agencies Requiring Privacy Measures

Agency Function	Security Required
Operate Roadways (28)	25% (7)
Emergency (27)	37% (10)
Disseminate Data (26)	23% (6)
Law (25)	44% (11)
Transit (15)	27% (4)
Weather Info (9)	56% (5)
Operate Parking (4)	25% (1)
Commercial Veh. (3)	0% (0)
Operate Airports (3)	66% (2)
Other (12)	25% (3)
Overall (75)	29% (22)

3.4.2 Methods of Receiving Data

Once the type of data that an organization will receive is determined, the method of distribution needs to be considered. From the User Needs Questionnaire the following methods, shown in Table 3-10, of receiving data were preferred. The most preferred method of receiving data is **bold** for each agency function (some respondents chose more than one form of transmission):

Table 3-10 Methods of Receiving Data by Agencies

Receiving Method=> *Agency Function*	Fax Machine	GCM Internet Page	Dedicated Phone Line / Modem Connection	E-mail	Dial-Up	Pager
Operate Roadways (28)	**68%**	39%	29%	29%	21%	11%
Emergency (27)	**67%**	37%	41%	22%	22%	11%
Disseminate Data (26)	**54%**	**54%**	35%	19%	27%	19%
Law (25)	**76%**	40%	36%	16%	32%	20%
Transit (15)	47%	33%	**60%**	27%	13%	0%
Weather Info (9)	44%	**67%**	**67%**	11%	33%	33%
Operate Parking (4)	**75%**	50%	50%	50%	0%	0%
Operate Airports (3)	**100%**	0%	33%	0%	33%	0%
Commercial Veh. (3)	**100%**	0%	0%	0%	0%	0%
OVERALL (75)	**56%**	38%	27%	26%	20%	9%

3.4.3 Methods of Distributing Data

Individuals were also asked to state how (if applicable) they currently distribute transportation related data. Below, in Table 3-11, are the responses for each of the three categories of recipients (i.e. in-house, other agencies and to the public. The three most common methods in each category are **bold** for clarity):

Table 3-11 Methods of Distributing Data

Data Recipient / *Distribution Method*	In-house only	To other agencies	To public
Highway Advisory Radio	7.5%	1.5%	14%
Variable Message Sign	4.5%	3%	15%
In-house Radio Channel	**36%**	14%	6%
Pager	**33%**	6%	3%
Telephone	**38%**	**41%**	**24%**
Fax	26%	**35%**	6%
Press Release	12%	**33%**	**52%**
Internet	4.5%	9%	**18%**

It should be noted that although mailed letters/memos was not an option on the questionnaire, it was written in by 7% (5 respondents) as a method of distributing information to the public.

From these responses it can be seen that most agencies are still using conventional methods for distributing the data that they have available. The most notable exception is the use of Internet distribution to the public. It is anticipated that in the future as more electronic information becomes available, electronic dissemination will become more and more common. Note: it was not possible to determine if respondents referred to telephone distributed data as voice or electronic data, based on the question asked.

3.4.4 Electronic Data

Even though there was a very positive response to the sharing of information (61 of 75 respondents), only 43% of those organizations willing to share (26 of 61 respondents) currently have their information available electronically. Note, overall only 36% (27) of all respondents (75) have electronic data available. Shown below, in Table 3-12, are the percentage of agencies, by function, that are willing to share and have electronic information available. The number of agencies that classified themselves by each function type is shown in parenthesis. [Note: numbers in parenthesis are the number of agencies that chose the particular agency function (and were also willing to share) the number following the percentage is the number of respondents with electronic information available].

Table 3-12 Availability of Electronic Data

Agency Function	Electronic Info Available (and willing to share)
Operate Roadways (25)	52% (13)
Emergency (23)	39% (9)
Disseminate Data (22)	59% (13)
Law (22)	27% (6)
Transit (14)	50% (7)
Weather Info (7)	71% (5)
Operate Parking (3)	100% (3)
Commercial Veh. (3)	33% (1)
Operate Airports (3)	33% (1)
Overall (61)	43% (26)

3.5 COMPARISONS OF USER NEEDS AND AVAILABILITIES

Overall, when combining all organization functional categories and data frequencies, the top nine data types desired and available are the same (in a slightly different order) for all responding agencies overall. Below are the overall ten most desired and available data types (in order):

Most Available	Most Desired
Roadway Closures	Roadway Closures
Incidents (accidents, etc.)	Roadway Traffic Conditions
Maintenance Operations	Roadway Surface Conditions
Roadway Surface Conditions	Incidents (accidents, etc.)
Construction Operations	Construction Operations
Roadway Traffic Conditions	Maintenance Operations
Weather Conditions	Weather Conditions
Alternative Routes (Detours for Delays)	Alternative Routes (detours for delays)
Traffic Signal Malfunctions	Traffic Signal Malfunctions
Vehicle Locations*	Link Travel Time Data**

[Note: not ranked in ten most desired (*) or most available (**)]

Since a majority of the responding agencies are directly involved in roadway related activities, it is not surprising that both the most desired and available data type lists are dominated by roadway influenced data types. Below is a comparison of data desired and available by each agency function group.

The five most common real-time data type are the same (roadway closures, incidents, roadway traffic

conditions, roadway surface conditions and weather conditions) for both desired and available data types. There are also three other data types (vehicle locations, traffic signal malfunctions and construction operations) that are in the top ten for both desired and available (different order). The following are the most available and desired data types (both current and future) in real-time when counting all categories of respondents:

Most Available (in real-time)	Most Desired (in real-time)
Roadway Closures (24)	Roadway Traffic Conditions (37)
Incidents (23)	Incidents (36)
Roadway Traffic Conditions (21)	Roadway Surface Conditions (33)
Roadway Surface Conditions (19)	Roadway Closures (33)
Weather Conditions (13)	Weather Conditions (31)
Vehicle Locations (13)	Alternative Routes (23)**
Traffic Signal Malfunctions (12)	Traffic Signal Malfunctions (22)
Construction Operations (11)	Link Travel Time Data (18)**
Maintenance Operations (11)*	Vehicle Locations (16)
Traffic Signal Timing Plan (8)*	Construction Operations (14)
Transit Schedules (8)*	

[Note: not ranked in ten most desired (*) or most available (**)]

From the respondents it was also seen that there was desirability and availability for data that was generated on a daily basis. Below are the five most available and desired daily generated data types:

Most Available (daily)	Most Desired (daily)
Maintenance Operations	Construction Operations
Construction Operations	Maintainance Operations
Roadway Closures	Roadway Closures
Alternative Routes	Alternative Routes
Incidents	Traffic Signal Timing Plans

When monthly data was looked at it was determined that there were a few data types that were being generated on a frequent basis but was only desired monthly. The following four data types are the most desired on a monthly basis:

Transit Schedules
Toll Pricing
Transit Fares
Parking Fees

See Appendix B for the complete results of the data types desired and available by agency type.

3.5.1 Operate/Maintain Public Roadways

For these agencies it was seen that the same ten data types (in slightly different orders) were both the most available and the most desired. Below are the ten most desired and available data types (in order):

Most Available	Most Desired
Roadway Closures	Construction Operations

Construction Operations	Roadway Closures
Maintenance Operations	Roadway Surface Conditions
Roadway Surface Conditions	Roadway Traffic Conditions
Incidents (accidents, etc.)	Maintenance Operations
Roadway Traffic Conditions	Incidents (accidents, etc.)
Traffic Signal Timing Plan	Traffic Signal Malfunctions
Traffic Signal Malfunctions	Weather Conditions
Weather Conditions	Traffic Signal Timing Plan
Alternative Routes (detours for delays)	Alternative Routes (detours for delays)

Even though these agencies already have their own data they would like to get more of the same from other similar agencies.

3.5.2 Emergency Services

These agencies are similar to the agencies that Operate/Maintain Public Roadways in that they have the same top nine "available" and "desired" data types. Below are the ten most desired and available data types (in order):

Most Available	Most Desired
Roadway Closures	Roadway Closures
Incidents (accidents, etc.)	Roadway Surface Conditions
Construction Operations	Roadway Traffic Conditions
Maintenance Operations	Incidents (accidents, etc.)
Roadway Traffic Conditions	Construction Operations
Roadway Surface Conditions	Maintenance Operations
Weather Conditions	Weather Conditions
Traffic Signal Malfunctions	Alternative Routes (detours for delays)
Alternative Routes (detours for delays)	Traffic Signal Malfunctions
Route Planning*	Link Travel Time Data**
Traffic Signal Timing Plan*	
Vehicle Locations*	

[Note: not ranked in ten most desired (*) or most available (**)]

3.5.3 Disseminate Transportation Related Data

With the exception of Maintenance Operations (#3 ranked most available data type) the "available" and "desired" data types have nine of the same ten top data types. This is once again similar to the Operate/Maintain Public Roadway agencies desire for more of the same data that you already have. Below are the ten most desired and available data types (in order):

Most Available	Most Desired
Roadway Closures	Roadway Closures
Construction Operations	Roadway Surface Conditions
Maintenance Operations*	Incidents (accidents, etc.)
Roadway Traffic Conditions	Roadway Traffic Conditions
Incidents (accidents, etc.)	Construction Operations
Roadway Surface Conditions	Alternative Routes (detours for delays)

Alternative Routes (detours for delays)	Link Travel Time Data
Traffic Signal Malfunctions	Traffic Signal Malfunctions
Weather Conditions	Route Planning
Link Travel Time Data	Traffic Signal Timing Plan
Traffic Signal Timing Plan	Weather Conditions
Route Planning	
Vehicle Locations*	

[Note: not ranked in ten most desired (*) or most available (**)]

3.5.4 Law Enforcement

With the exception of Link Travel Time Data (#9 most desired data type), the "available" and "desired" data types for law enforcement agencies have nine of the same ten top data types. This is once again similar to the Operate/Maintain Public Roadway agencies in the fact that this group of agencies want more of the same data which they already have. Below are the ten most desired and available data types (in order):

Most Available	Most Desired
Roadway Closures	Roadway Surface Conditions
Incidents (accidents, etc.)	Roadway Traffic Conditions
Construction Operations	Construction Operations
Maintenance Operations	Incidents (accidents, etc.)
Alternative Routes (detours for delays)	Roadway Closures
Traffic Signal Malfunctions	Maintenance Operations
Traffic Signal Timing Plan*	Alternative Routes (detours for delays)
Weather Conditions	Link Travel Time Data**
Roadway Surface Conditions	Traffic Signal Malfunctions
Roadway Traffic Conditions	Weather Conditions
Route Planning*	

[Note: not ranked in ten most desired (*) or most available (**)]

3.5.5 Operate Transit Services

The responses from the transit agencies showed that they had most of the data that they needed from transit agencies (namely their own data) and would prefer to receive data that involved roadway activity. This can be seen in the fact that Transit Schedules and Transit Fares are the top "available data type" but are only sixth on the "desired data type" list. The top "desired data type" Roadway Closures is sixth on the "available data type list." Listed below are the ten most desired and available data types in order.

Most Available	Most Desired
Transit Fares	Roadway Closures
Transit Schedules	Incidents (accidents, etc.)
Vehicle Locations	Roadway Surface Conditions**
Incidents (accidents, etc.)	Roadway Traffic Conditions**
Maintenance Operations*	Transit Schedules
Construction Operations	Alternative Routes (detours for delays)
Parking Fees*	Construction Operations
Roadway Closures	Transit Fares
Traffic Signal Malfunctions	Traffic Signal Malfunctions

Alternative Routes (detours for delays)	Vehicle Locations
Traffic Signal Timing Plan*	Weather Conditions
Weather Conditions	

[Note: not ranked in ten most desired (*) or most available (**)]

3.5.6 Provide Weather Information

For agencies that Provide Weather Information eight of the top eleven data types desired and available were the same. The exceptions were route planning for "available" data types and link travel time data and traffic signal malfunctions for "desired" data types. This trend is consistent with almost all of the agencies types in that they typically wish to receive the same type of data that they already create for themselves. Below are the ten most desired and available data types (in order):

Most Available	Most Desired
Roadway Surface Conditions	Alternative Routes (detours for delays)
Incidents (accidents, etc.)	Roadway Closures
Roadway Closures	Roadway Surface Conditions
Roadway Traffic Conditions	Roadway Traffic Conditions
Route Planning*	Incidents (accidents, etc.)
Weather Conditions	Link Travel Time Data**
Alternative Routes (detours for delays)	Traffic Signal Malfunctions**
Construction Operations	Weather Conditions
Maintenance Operations	Construction Operations
Vehicle Locations*	Maintenance Operations

[Note: not ranked in ten most desired (*) or most available (**)]

3.5.7 Operate Public Parking Facilities

The agencies that operate public parking facilities had ten of the same data types (in different orders) as the most "desired" and most "available" data types. Below are the ten most desired and available data types (in order):

Most Available	Most Desired
Maintenance Operations	Construction Operations
Roadway Closures	Incidents (accidents, etc.)
Construction Operations	Maintenance Operations
Incidents (accidents, etc.)	Roadway Closures
Traffic Signal Timing Plan	Roadway Surface Conditions
Alternative Routes (detours for delays)	Roadway Traffic Conditions
Roadway Surface Conditions	Traffic Signal Malfunctions
Roadway Traffic Conditions	Traffic Signal Timing Plan
Traffic Signal Malfunctions	Alternative Routes (detours for delays)
Transit Fares	Parking Availability**
Transit Schedules*	Transit Fares
	Vehicle Locations**
	Weather Conditions**

[Note: not ranked in ten most desired (*) or most available (**)]

Note, there are eleven in the available list and thirteen in the desired list due to a tie for the tenth ranking.

3.5.8 Operate Commercial Transport

For agencies that operate commercial transportation ten of the top eleven data types "available" and "desired" (with the exception of #1 (tied)Vehicle Location for "data available") were the same. Below are the ten most desired and available data types (in order):

Most Available	Most Desired
Alternative Routes (detours for delays)	Alternative Routes (detours for delays)
Construction Operations	Construction Operations
Incidents (accidents, etc.)	Incidents (accidents, etc.)
Maintenance Operations	Roadway Closures
Roadway Closures	Roadway Traffic Conditions
Roadway Surface Conditions	Weather Conditions**
Roadway Traffic Conditions	Flight Delays**
Vehicle Locations*	Maintenance Operations
	Roadway Surface Conditions
	Route Planning**
	Scheduled Flights**
	Toll Pricing**
	Traffic Signal Malfunctions**
	Traffic Signal Timing Plan**

[Note: not ranked in ten most desired (*) or most available (**)]

Note, that there are eight in the available list due to no respondents picking any data types other than those eight. Also there are fourteen data types in the desired list due to a tie for the tenth rank.

3.5.9 Operate Public Airports

It is difficult to draw conclusions for the agencies that Operate Public Airports due to the low number of responses received (3). From those responses, however, it was determined that three of the top four for each of "desired" and "available" data types were the same (vehicle locations, flight delays and weather conditions) . This indicates that agencies that operate public airports would like to receive more of the same types of data that they already receive. Below are the ten most desired and available data types (in order):

Most Available	Most Desired
Scheduled Flights*	Flight Delays
Weather Conditions	Parking Availability**
Flight Delays	Vehicle Locations
Parking Fees*	Weather Conditions
Transit Fares*	
Transit Schedules*	
Vehicle Locations	

[Note: not ranked in ten most desired (*) or most available (**)]

Note, that there are seven data types listed for most available due to the remaining data types all being tied for eighth rank. Also only four desired data types are listed since the remaining data types are all tied for fifth rank.

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4.0 DATA EXCHANGE ELEMENTS

There are many characteristics which define the data exchange procedure. This section concentrates on five aspects: the format in which the data will be sent/received, the location referencing scheme that will be used, the database in which the information will be stored, data security and privacy issues and the various data types that are available. These five elements need to be coordinated for effective exchange of data and to enable the utilization of interoperable field devices among different agencies.

4.1 MESSAGE SET STANDARDS

A problem that exists in an environment of multiple computer systems is obtaining and translating information from those systems into a common single format. This general problem is particularly prevalent in large geographic regions where multiple agencies own and operate transportation management systems. Typically each system has its own unique way of representing and storing information and thus distribution of this information can become misinterpreted without the proper translation tools. Within the GCM Corridor, there are many agencies that collect and distribute their own traveler information. In order for this information to be distributed to other agencies and the general public, it is necessary to translate/convert their data into a common, single format for easier distribution and understanding.

In order to implement a common format, the class or type of information being sent needs to be determined. Based on the data received from the GCM participants, the following list represents the information most commonly requested:

- Real Time Roadway Traffic Conditions (including traffic volume and speed)
- Real Time Real Time Incident Information
- Real Time Roadway Closures
- Construction and Maintenance Operations
- Real Time Roadway Surface Conditions and Weather Information

This information currently needs to be collected, translated and aggregated into a standard message set and then disseminated to the various agencies and to the public through various transmission options. This translation and aggregation could be done at the local agency level, the provider of the data, or by the Gateway, the receiver of the data. Translation of the data might not be necessary if all agencies involved used the same common message format. If local agencies do not conform to the standard message structure, they may need to convert the information provided by the Gateway back into their own format. The common standard location referencing system to be used by the GCM Gateway will be defined by the Location Referencing Message Specification (LRMS).

In addition to the location referencing system, there is a need to standardize protocol used in MMTIS. The GCM Coordinating Committee has adopted the National Transportation Communications for ITS Protocol (NTCIP) as their standard. The following sections address some of the issues associated with location referencing and protocol between/within differing systems.

4.2 LOCATION REFERENCING

In order for any transportation data to be useful for an end user, the information must be in relation to a known location; that is, it must convey a locationing scheme. A locationing scheme tells where the information is happening in relation to fixed objects (i.e., streets, landmarks, lat/long coordinates). Data

without some form of location referencing cannot be used effectively. For example: if an agency is collecting travel times, it is imperative that the travel times are associated with a certain roadway, likewise, if there is an incident effecting traffic, it must be known (mile marker, crossroad, etc.) where the incident is located. When different traffic management systems begin distributing location information to each other, the systems need to be using the same referencing scheme or perform translations in order to define the same point in space for location purposes.

4.2.1 Within the GCM Corridor

There are many different locationing schemes currently being operated within the GCM Corridor. This poses a problem in how the data will be transferred from one locationing scheme to another so that the information is readable and correctly interpreted by sharing agencies.

Table 4-1 provides information from the multiple state and city agencies and private firms interviewed from the System and Data Source Inventory and the various Location Referencing Systems they operate.

Table 4-1 Location Referencing Systems of Other Agencies within the GCM

NAME OF DATA SOURCE	BASE MAP	REFERENCING SCHEME
*999	NavTech Map Database	Link/Node and segment ID's.
Borman Expressway ATMS	TIGER Files	State based mile markers[1]
CATS	Etak (lat/long nodes) and IDOT (State Plane Coordinate)	link/segments and addresses mile marker
CDOT	Coordinate Grid (0,0 is Madison Ave./State St.)	Street address.
Chicago 911 Project	Ameritech ANI/ALI[2]	Street address unless it is an expressway, then it is by mile marker.
Chicago Skyway - Construction/Maintenance	None	Cross streets and mile markers along the Skyway.
Chicago Skyway - Electronic Toll Collection	None implemented at this time.	None implemented at this time.
Chicago Signal System	None	No exact locations used.
CTA Control Center	Chicago 911 map	Street address unless it is an expressway, then it is by mile marker. ArcInfo is the underlying implementation software.
IDOT - Com Center	None	Each specific station has a unique identifier (i.e., Pump House #42)
IDOT - C-TIC	NavTech Map Database	Link/Node and Segment ID's.

[1]United States Census Bureau TIGER files. The TIGER files use lat/long coordinates. Note: This scheme for the Borman Expressway ATMS will change to Geodetic (GDS) when the next phase is implemented.

[2]Automatic Number Identification/Automatic Location Identification.

NAME OF DATA SOURCE	BASE MAP	REFERENCING SCHEME
IDOT - ETP	State Plane Coordinate (TM[3])	The database only contains significant reference points and mile markers. No cross streets are used. ArcView/ArcInfo is the implementation software.
IDOT - Signal System	City maps	Street name/Addressed based.
IDOT - Statewide System	State Plane Coordinate (TM)	Key Route[4]
IDOT - TSC	Detector IDs[5]	Look up table and display map.
Indiana State Police - NW Dispatch	Area wide maps covering Interstates only.	Mile markers and exit numbers.
Indiana Tollway - ETTM	None implemented at this time.	None implemented at this time.
INDOT - Division of Tollroads, Construction & Maintenance	No specific system.	No specific system. Use of mile markers, exit numbers and cross streets.
INDOT - Statewide System	TIGER Files	FIPS[6]
ISTHA - IPASS 2000	None implemented at this time.	None implemented at this time.
METRA	County and Metropolitan area maps.	By train line name, station name and station reference number.
Milwaukee County Sheriff Department	County area maps.	Route name/number, Mile Marker and cross street or exit number where applicable.
Milwaukee County Transit System	City wide map tied into the Tiger File system.	GPS in vehicles translates to Lat/Long.
Milwaukee Traffic Signal System	City wide maps.	By intersection name (i.e., street/cross street).
Northwest Central Dispatch (NWCD)	Graphical mapping by Logisys[5]	Street address.
PACE	None Implemented.	None Implemented.
RTA	None implemented.	None implemented.
Shadow Traffic	City maps	Place names and street addresses

[3]Transverse Mercator.

[4]This key route requires a route name and a mile post marker. Each map intersection has been tied into the latitude/longitude / state plane coordinates to verify its location.

[5]System to be replaced.

[6]Federal Identification Positioning System. A route segment is identified by a number for each county. Each route segment ends at the county boundaries. In addition to this identifier a reference post (mile marker) is added.

NAME OF DATA SOURCE	BASE MAP	REFERENCING SCHEME
Surface Systems, Inc. (SSI)	Geodetic coordinates	Station numbers for the different pavement sensors.
WisDOT - MONITOR System	MapView which uses TIGER Files with an added link-node system	Route name, direction/distance to a cross street (incorporates lat/long also)
WisDOT - Statewide System	State Plane Coordinate (TM) & TIGER Files	Center-line referencing (point to point).

Since there are many different locationing systems currently in use, translation of the locationing scheme will need to be accomplished between the various location systems in order for the agencies to effectively use each other's information. This might be in the form of "converter boxes" at each specific agency; the Gateway receiving the information and performing the translation; or by the connected agencies adopting a standardized location message format (i.e., LRMS). It is intended, however, that the Gateway will incorporate a standardized location message format (i.e., LRMS) for all data redistribution. If this occurs it might then be the responsibility of the receiving agency to provide the necessary hardware and software to convert the standard location message sets into the location format for use if they do not adopt the standard location referencing system.

4.2.2 Location Reference Message Specification

The Location Reference Message Specification (LRMS) establishes standard formats for messages used within message sets to convey locations. The LRMS is a federally funded objective which is being tested in different areas around the country including the GCM Corridor. The GCM LRMS team will propose a standard message specification based on the different but accurate referencing systems currently in use in the GCM Corridor. The design of the LRMS is based on three fundamental concepts:

- The transfer of a location as a message in itself,
- The choice of location message format from a set of formats appropriate to different location message methods,
- The use of a set of well known ground control points to permit registration of different map databases to one another so that locations transferred can be understood with minimal ambiguity.

The purpose of the LRMS is to provide a standard interface for the electronic transfer of a location of an event or object of interest to a transportation application. This information is carried in LRMS messages, which are themselves composed of records and fields. The specification does not define software interfaces or how applications implement transfers, rather the LRMS is a standard rule between applications to use public domain, well documented message formats, for transferring location information within user message sets of any kind.

4.2.3 Converting Between Different Location Referencing Systems

The use of the LRMS alone does not solve all the problems with location referencing. The LRMS only provides standard ways of describing locations; it does not specify any translations between the different defined profiles. The specific LRMS profiles currently expected to be used in the Gateway system and the Data Pipe would probably include X/Y coordinate, link/node, and street address references. The individual systems within the Corridor and connected to the Gateway would only have to know how to translate

between these LRMS profiles and their own system specific local referencing systems. However, other problems arise when it is necessary to convert from one type of profile to another. In general, it is best if a system can include more than one type of information in a location reference, so other systems can minimize the conversions necessary. The following sections provide a description of the probable LRMS profiles that will be used for the GCM Corridor and the translation options between them.

4.2.3.1 LRMS Profile - X/Y Coordinates (lat/long)

In order to be able to transfer X/Y coordinates between systems, a common datum and numbering system must be chosen for communication throughout the GCM Corridor. The most appropriate common datum and numbering system would be based on definitions from the LRMS. The actual process is then fairly straightforward to convert coordinate references from each system to the chosen standard. None of the individual systems would have to use the GCM Corridor coordinate system internally; the process, or "Black Box", located at each individual agency would just convert to and from the standard when exchanging data with other systems in the GCM Corridor.

4.2.3.2 LRMS Profile - Link/Node

Some systems within the GCM Corridor, such as MONITOR, identify locations by references to links and nodes in a system map, instead of by X/Y coordinates. To a system concerned with incident management, the street or roadway link or node ID on which the incident is located is more important than the actual coordinates of the incident. The LRMS profile provides ways of describing and sharing this type of reference, but both systems would need to have a common link/node database in order to know which link is actually being referenced. An option is that they could exchange the street name of the link, but this can still lead to ambiguities with similar street names and misidentified locations. Therefore, when multiple systems are required and/or limited to exchanging link/node references, it may be necessary to provide a area-wide server with a common link/node reference model for the GCM Corridor or at a minimum the area of coverage in which the systems limited to link/node reference are contained. The detail required in this type of model is determined by the required uses.

4.2.3.3 LRMS Profile - Street Names

Location references based on street names can be translated fairly well to a link/node reference, but duplicate or similar street names can cause problems, as can variances in street names between geographic information systems (GIS). An alternative that can assist with these problems is that the system supplying the reference should include as much information as possible, such as street numbers, city names, and zip codes, to aid in correct identification of the reference. If the source system knows the X/Y coordinates of the location, that should also be made available.

4.2.3.4 LRMS - Translation Between Profiles

Translating between link/node and X/Y coordinates can be problematic. If an X/Y coordinate is known, it may be possible to perform a feature-location operation on map database to find the nearest street, but this may not always identify the correct street. If the name of a street link is known, then geographic lookups can be performed on a map database, but this also does not guarantee correct results. Again, one solution would be for a system such as MONITOR, when creating the location reference to store both a link/node and an X/Y coordinate for the desired point, and transmit both. Receiving systems could use whichever profile they require.

Additionally, both the CTA Control Center and the IDOT Emergency Traffic Patrol systems use ArcInfo as their underlying user interface which has both street name and lat/long information available. When an incident location is identified, both pieces of information would be supplied to the Gateway server. Systems connected to the Gateway receiving this data which just want to place an incident icon on a map, such as the Internet Web Server or connections to other Internet Service Providers (ISPs) such as Metro Traffic and Shadow Traffic, would use the lat/long information. Other systems such as the TSC, the Com Center, MONITOR, etc., which want to continue tracking the incident would use the street name.

4.3 NATIONAL TRANSPORTATION COMMUNICATIONS FOR ITS PROTOCOL (NTCIP)

The principle national standard in regard to Intelligent Transportation Systems is the NTCIP. The primary objective of the NTCIP is to provide a communications standard that ensures the interoperability and interchangeability of traffic control and ITS devices. The NTCIP is the first protocol for the transportation industry that provides a communications interface between different hardware and software products from multiple vendors. The goal of the NTCIP is to not only maximize the use of existing infrastructure, but also allow for flexible expansion in the future without reliance on specific equipment vendors or customized software. The NTCIP covers both the transmission rules and the format, including the meaning, of standardized messages transmitted using those rules. The NTCIP is based on existing standards in the telecommunications and computer industries where possible. Of particular interest in MMTIS is the NTCIP's TMC to TMC protocol which will facilitate the connection between management centers and sharing of data. This protocol will address real-time data exchange, including remote control/commands capability between transportation management centers and systems such as traffic operations centers, traveler information systems, emergency management centers, transit operations centers, traffic signal systems and freeway management systems. More details on NTCIP can be found in Working Paper #19220, *Gateway Design Options*, and in Working Paper #18500, *GCM MMTIS Strategic Plan*.

4.3.1 Shared Monitoring and Control of Field Devices

Another consideration that must be acknowledged is the fact that shared monitoring and control of various field devices (i.e., VMS, HAR, CCTV, traffic signal timing, etc.) between multiple agencies is more easily facilitated if a common interface is used. The concept of shared control is a major focal point in the development of an effective multi-modal traveler information system. The NTCIP is a standard that will support shared use of devices.

The NTCIP is continually expanding to address additional needs. The initial standard provides protocols for real-time communications between a master or computer and such field devices as traffic signal controllers, environmental sensor stations, variable message signs, highway advisory radio, CCTVs and freeway ramp meters.

4.4 DATABASE ISSUES

4.4.1 Relational Databases versus Object Oriented Databases

Throughout the GCM Corridor, different agencies will be accessing the Gateway to obtain or transfer traveler information. This wide "network" needs assurance that the data exchange effort will be seamless and executed in an efficient, timely manner. This procedure is directly related to the type of database implemented for the operation. In the realm of data distribution, a distributed database best fits these needs but should appear to a user as a local database. The distribution of data should be completely transparent

to the application developer and the user.

Either relational or object oriented databases are typically used on a network in a client/server model. In this model, the database is kept on one central server, and all the clients, or workstations, access the data across the network. This works well on small office Local Area Networks (LANs), but tends to run into performance problems when used on a Wide Area Network (WAN), which sometimes includes slower links.

A distributed database maintains copies of records (i.e., data) and the relationship between them. In a distributed database architecture, there are multiple servers in different locations on the network, arranged so that each client workstation can connect to a server through a fast link. The servers "talk" to each other and exchange data between themselves so that they all maintain a current copy of the database. This type of database works best in situations where the data is not changing frequently or when the data is mostly coming from one source and is being distributed to many widespread clients. This works well in a document-centric collaboration environment, but is not really applicable to a high volume, data-centric application. Depending on the architecture of the network and the number of servers, it can take minutes or hours for a change to propagate throughout the system. Problems can arise when there are many clients trying to update the same data since it is very difficult to perform true record locking.

The relational database management system (RDBMS) maintains the relationship between data records by using a table format. Most RDBMSs have the ability of the servers to maintain copies of the database at multiple sites; this is called replication. Normally, this is set up as a master/slave relationship, where there is one master server which contains the "real" database and multiple "slaves" which receive copies of the data when it changes. Usually, data can only be updated at the master site, not at the slave sites, but there are some applications where the replication can be done in both directions. This issue of multiple remote updates to the same data must be considered. This is still a new technology and requires much more effort in fine tuning the systems to run efficiently.

Some RDBMS servers offer another form of distributed database management called the "remote query." The data is not "technically" distributed, but is kept in different servers in different locations on the network. When a client wants to perform a request that requires data from multiple sites, it can issue a single query to its local server. The local database server then issues distributed queries to the other servers on the network which contain the desired data. The results are collected on the local server and returned in one set to the client which requested the information. This can still have problems with the frequent transmission of large amounts of data over the network, but can greatly simplify client software architecture.

Object oriented database management systems (OODBMS) provide traditional database functionality (i.e., distribution, integrity, concurency, recovery, etc.) but represent information models based on object models rather than relational models (i.e., complete units of data ready to be used vs. table based elements which need to be constructed into whole units). They typically provide permanent, constant object identifiers to guarantee data integrity. Since OODBMSs keep data together with the code that knows how to manage the data together, objects in a database are more efficient in moving data around within a network environment. Each client would have its own "local" copy of the database objects and code within the objects would manage the distribution of data in the most effective way for the particular application. OODBMSs are an evolving technology and need to be evaluated further.

Common areas of investigation for both kinds of DBMSs include:

- Scalability (portability across platforms)
- Load balancing (distributing data across the network for performance optimization)
- Concurrency and locking of data (maximizing concurrent usage while minimizing contention)
- Client/Server implementation (server-centric model, client-centric model or balanced client/server model)
- Disk space management
- CPU utilization

4.4.2 Translation Between Different Databases

When exchanging data between systems using different database architectures, the following issues must be considered:

- access methods
- intended usage
- performance requirements

4.4.2.1 Access Methods

When there are many systems exchanging data with each other, it becomes more logical to interface all systems to one standard access method, instead of requiring each system to know how to access all the other systems directly. This implies writing an interface layer for each system that would provide the necessary interface to the standard access method. When changes occur in individual systems, only the interface layer for that system must be updated. The other systems will still be able to access its data using the defined access method.

Within the GCM Corridor, the standard access method would be used by individual systems as the interface to the Gateway server.

4.4.2.2 Intended Usage

The primary factor that will determine the choice of access methods will be how the data is intended to be used. If the data being accessed consists of large tables of historical records, then the most likely way it would be used would be through off-the-shelf report generator package. If the data consists of current status information which is updated periodically, then the most likely use would be through some form of custom-written data display application. This is the type of access method used by the current C-TIC system, which to date, takes data received from systems such as the TSC, NWCD, *999 and MONITOR, aggregates it, and makes it available for display through a web server.

Intended Usage - Database Access If the intended usage of the data is through a report generator, then a standard access method using direct database access can be defined by using industry standards such as ODBC (Open DataBase Connectivity) and SQL (Standard Query Language). ODBC drivers are available for all commercial RDBMSs and most OODBMSs. Using ODBC, an individual system within the GCM Corridor simply connects to another system's database server across the network, issues SQL queries to that system's local database, and generates reports from the data returned. One problem with this approach is that if there are multiple systems supplying data, then individual queries must be directed to each system. It may be necessary to provide a central server which periodically queries the individual systems and stores the results in a central database. Individual systems throughout the GCM Corridor can then perform queries

on the central database and retrieve information derived from all of the systems involved.

Although the current C-TIC implementation does not use this type of access method, there are some potential uses for it. Database access would provide the ability to generate historical reports on aggregate data sets covering the entire GCM Corridor. This could include traffic volume analysis and incident management tracking.

Since there are security and privacy risks in opening an individual system's database directly to a wide-area network, access would probably be done indirectly. Either the Gateway server itself would be authorized to run queries on local systems and place the results in a central database, or the individual systems would be able to place their own, selected/screened data in the central database periodically. With either of these, users would only be able to run reports on the central database, not on individual system databases. Only data intended for general availability, whether to the public or private sector, would be placed in the central database. There would then be different privilege levels assigned to access this information.

Intended Usage - Current Status If the data coming from individual data source systems is primarily current status data, not historical data, then it may not be necessary to access the data using database techniques at all. It may be more appropriate (and faster) to provide a direct network access method by writing a network interface program for each data source system. A network interface program takes data from the local database and makes it available on the network in a standard format. A common way of doing this is to write a Common Object Request Broker Architecture (CORBA) "wrapper" program for each system. CORBA provides the mechanisms by which objects transparently make requests and receive responses. The wrapper program runs as part of the local system. It is written to provide a certain set of status data to the network, without allowing access to the entire local database. CORBA wrappers can be written for systems using either relational or object-oriented databases, or no database at all. There are off-the-shelf tools for providing CORBA access to almost any commercial database. CORBA brokers are available for all major computing platforms, and most brokers will interoperate with brokers from other vendors. CORBA objects are not directly accessible from standard database-access report generation tools, but there are off-the-shelf tools for accessing CORBA objects from SQL queries, Small Network Management Protocol (SNMP) systems, Java programs, and Web browsers.

The CORBA approach facilitates both a server-based distribution system, such as the current C-TIC prototype, and a more flexible peer-to-peer architecture. In the server-based system, development of the server is simplified because the interface to all the client systems is the same. Maintenance is reduced because changes in data source systems are dealt with in the system's individual wrapper code, not in the server. The peer-to-peer capability provided by CORBA would allow future enhancements allowing systems to exchange data directly with each other, instead of going through a central server. For example, two systems performing incident management in the same area could instantly notify each other when new incident reports are generated.

Although there are many ways to provide a standard network interface to a corridor-wide network, CORBA is gaining industry acceptance as a way to provide a standard interface on almost any platform. Even though it is available on almost all current computing platforms, there may still be some legacy systems unable to support a network interface at all. These systems would be supported by a serial link to another computer, possibly the Gateway Server itself. The other computer would then provide the "wrapper" code necessary to provide the legacy system's information to the network in the standard format.

4.4.2.3 Performance Requirements

Performance requirements need to be determined based on the intended uses of the system. For access to small amounts of data, direct network access methods such as CORBA will generally be faster then with database access, because there is no disk access required. If large amounts of data are being transferred at one time, then database access may be preferable if the data is already on disk. One problem with using direct SQL/ODBC access is that it is difficult to know the size of the result of a query in advance. An incorrectly formatted query can unintentionally generate a large result, which could tie up a slow network link for an unnecessarily long time. With a CORBA interface, access to the data can be controlled within the wrapper code. However, CORBA can also require a significant amount of network bandwidth. If it is necessary to retrieve large numbers of small objects, the overhead of the object references can be larger than that of transferring the data itself.

4.5 SECURITY AND PRIVACY OF DATA

In the exchanging of any information, consideration must be given to protecting sensitive and proprietary data and maintaining the integrity of both the data and its source. Measures must be enacted to prohibit corruption or contamination of the data and to ensure user confidence to both public and private agencies and individuals.

When receiving data from many different sources it is necessary, in some cases, to strip sensitive data (i.e., names of individuals, personal telephone numbers, details of accidents, license plate numbers, etc.) before the information is disseminated to the public. This issue, related to maintaining privacy, needs to be defined prior to traveler information sharing. In most cases, the sensitive information will be stripped by the agency responsible for sending the data, but in turn, there needs to be a guarantee that there will be no access back into that information.

The following are examples of agencies that would provide the GCM Corridor with traveler information but would require maintenance of privacy:

- NWCD - personal and detailed accident information (i.e., names and phone numbers, etc.)
- *999 - personal and detailed accident information (i.e., names and phone numbers, etc.)
- Milwaukee County Sheriff Department - detailed accident information, location of personnel, etc.
- Indiana State Police - detailed accident information, location of personnel, etc.

The security issue deals with the concept of protecting the access of the data or the computer system from unauthorized users, who would damage or corrupt the data being disseminated. When controlled access is desired, as in a dedicated or dial-up system, a username and password could be required. As the physical connection between the client and the server does not traverse a public network, as in the Internet, there is little danger of someone being able to steal these passwords and enter the system illegally.

For a system that utilizes the Internet for data distribution, more secure methods must be achieved. The concerns are that someone could see an unsecured password on the public network and duplicate it later to access the system and in doing so, it is likely that other computer systems at the control center could be jeopardized. There are several ways to address these problems. First, systems at the participating agencies could utilize a “firewall,” which is a computer strictly dedicated for security purposes. Firewall systems allow users inside the system access out but do not allow outside users access privileges into the system. Another precaution which can be implemented on the data server, which contains the information, is applying a secure-sockets layer (SSL). This is a method of encryption which is unreadable by anyone who does not have the appropriate decryption key. The decryption key is only local on the system computer that

is accessing the decoded information. A third method involves the use of a "Virtual Private Network," where secure data between two points are channeled through the public Internet hidden from unauthorized users.

The following are examples of agencies that would provide the GCM Corridor with traveler information but would require maintenance of security:

- CTA - There are some concerns about making the time performance of trains and buses public information.
- IDOT Emergency Traffic Patrol - Connection to the Illinois Criminal Justice Information Agency's computer system requires strict monitoring of unauthorized access.

Additionally, when joint control/monitoring of field devices is implemented, security measures must be enacted to ensure that the proper agency has control over the device and that another agency cannot override that authority. The proper agency in this case may not always be the owner of the field devices, but rather an agency with concerns about an incident that has a direct impact on traffic/travel operations in and around its boundaries. This may take the form of an affected agency calling the owning agency of the field device and verbally requesting a certain message for a VMS, HAR or view from a CCTV. At the other extreme, it can also be accomplished by the affected agency having actual control of the field device in order to view an incident via CCTV and then posting a respective traveler warning. In either case, strict rules and security must be enforced and implemented to protect against conflicting usage of the field devices.

4.6 DATA TYPES

The breakdown of the data types, categories and availability are summarized and provided in the various Tables in Section 3. A blank questionnaire is provided in Appendix A.2 and the results from questions #5 and 6 are provided in Appendix B. The traffic related data types that are available throughout the GCM Corridor come in a wide variety of categories. The following bullet items illustrate some common forms of data and their units/components.

- Loop Detector Information (volume, occupancy, speed, time stamp, ID#, status, location)
- Route Travel Time Information (total travel time, time stamp, # of links that make up the route, lane indicators, link location)
- Incident Information (ID#, lane indicator, confirmation flag, start time, end time, type, involvement, textual details, response plan, location)
- VMS Information (sign status, message text, start time of message, end time of message, sign ID#, location)
- HAR Information (message status, message text, message audio, start time of message, end time of message, station ID#, location)
- Construction and Maintenance Information (ID#, type, lanes affected, start time, end time, textual details, location)
- Weather Information (station ID#, time stamp, conditions, sensor status, location)
-

The following data types may become available within the GCM Corridor in the future:

- Transit Information (type, schedule/route information, schedule/route ID#, location)
- Probe Data Information

4.6.1 Data Issues

There are several issues that need to be recognized in order to provide efficient and compatible sharing of information. The following section discusses the different concerns that develop when sharing data types between diverse agencies.

The problems that arise with arranging all of the above data into one consolidated format becomes the way in which the information is provided and collected. As shown, each category has its own unique breakdown of data. The data itself can then be broken down into units (i.e., seconds, vehicles per hour, percent, etc.) and format (i.e., numeric, character or both). The problem becomes how to handle similar data types from different agencies that use different frequencies of data availability (i.e., every hour versus every minute). One system may provide speed data once per minute and another may provide it every five minutes, or as with the construction and lane closure updates, data may be provided only once daily. This problem can be simplified by having each system make its most recent data available all the time. Client systems would read the data at whatever rate they needed it. They would not necessarily get new data each time they read it; and they would not necessarily see every change in the data. However, the rate that the data is provided and the rate that it is collected can be de-coupled in order to achieve the desired use of network bandwidth. For example, if a web server is set up to provide updated maps every five minutes, it would just collect the current state of the desired data as it built the map image. It would not matter if a particular piece of data were updated more or less frequently than this. The update rate of the web server could be increased or decreased (within bandwidth limitations) without requiring changes to the data sources.

Another issue exists in that some data being provided by the different agencies are provided in different thresholds or units (i.e., for congestion levels). For example, one system could provide volume measurements in vehicles per hour, and another in vehicles per minute. One system could describe congestion using a speed in miles per hour, and another may uses speed range bins or classification of congestion. If a set of standard data requirements is defined for the entire network, each system can convert to that format before providing the data to the network. In this case, a set of standard data requirements should be defined for the entire network. Then each system can convert to that format prior to providing the traveler information to the network.

The Gateway may be responsible for taking the information provided and translating it into one consistent package for redistribution. The information and frequency of data that the Gateway will provide will be directly related to when and what information will be available. In other words, even if travel times are given to the Gateway every minute by the TSC, the Gateway may only send out that data on an average of every five minutes to other agencies or the public. In the same manner, construction and maintenance information may not be updated as often as incident information which is event driven.

Data verification is another issue that raises concerns. In most cases, the agency that sends the Gateway data will be responsible for checking to ensure it is correct. The Gateway will then assume the validity of the data except some verification (if possible) may be done to ensure correct translation to the LRMS. In other instances, the source may not be able to verify the data and it will be received at the Gateway as unconfirmed. For example, an incident from *999 received at the Gateway may be flagged as unconfirmed until a second report is received from *999 or a report on the incident is received from a validated source (i.e., the State Police). Additionally, there may be instances where once the information is disseminated, there may be a need for additional data verification by the receiving agency.

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5.0 SUMMARY

This paper documents the collection and analysis of traffic and traveler information from a wide variety of state, local and private agencies throughout the entire GCM Corridor. This section summarizes that activity, its findings and, where appropriate, any recommendations.

5.1 DATA

Data was collected by the use of questionnaires and telephone inquiries.

- There were 397 questionnaires distributed to the various agencies and firms in the GCM Corridor of which 75 responses were returned. The geographical breakdown of respondents is: 50% (37 of 75) from Illinois, 31% (23 of 75) from Indiana and 19% (15 of 75) from Wisconsin.
- There were 33 targeted telephone interviewees for the System and Data Source Inventories of which 26 were completed. Note: these results are only briefly discussed in this Working Paper and will be further analyzed in detail in Working Paper # 18600, *System Interfaces and Information Exchange*.

The questionnaire provided nine specific functional categories of public/private agencies/organizations from which respondents indicated the most relevant to their own organization. Note, many respondents checked more than one functional category. Additionally, a number of individual respondents represented the same basic organization as another respondent, although usually a different department or bureau. Lastly it is noted that the data collected and analyzed should be expected to exhibit a bias toward roadway transportation, not only because this is one of the main focuses of the GCM Corridor , but primarily because most of the respondents' activities relate to it.

The questionnaire also identified 22 different data types as cited in Section 3.2. "Other" types of data indicated as available to individual respondents were hazard material closings, construction permit status and safe driving information. "Other" types of data indicated as desired to individual respondents were Commonwealth Edison problems, commercial motor vehicle data and on/off ramp volumes.

5.2 QUESTIONNAIRE RESULTS

The following summarizes the data reported as available and as desired in the questionnaires returned for all respondents overall and for each organizational function as indicated by the individual respondents.

Overall. When combining all organization functional categories and data frequencies, the nine data types most commonly desired and available are the same (in a slightly different order) for all responding agencies overall. Below are the overall ten most desired and available data types in order (where the number in parenthesis is the percent of respondents indicating this data type):

Table 5-1 Overall Available and Desired Data Types

Most Available		Most Desired	
Rank	Data Type (% of all respondents)	Rank	Data Type (% of all respondents)
1.	Roadway Closures (64%)	1.	Roadway Closures (82%)
2.	Incidents (52%)	2.	Roadway Traffic Conditions (76%)
3.	Maintenance Operations (52%)	3.	Roadway Surface Conditions (73%)
4.	Roadway Surface Conditions (47%)	4.	Incidents (73%)
5.	Construction Operations (46%)	5.	Construction Operations (70%)
6.	Roadway Traffic Conditions (44%) (44%)	6.	Maintenance Operations (61%)
7.	Weather Conditions (35%)	7.	Alternative Routes (59%)
8.	Alternative Routes (32%)	8.	Weather Conditions (59%)
9.	Traffic Signal Malfunctions (30%)	9.	Traffic Signal Malfunctions (50%)
10.	Vehicle Locations (26%)	10.	Link Travel Time Data (47%)

Real-time. When the frequency of data reports is considered, the respondents indicated that overall the five most common data types available and desired in real-time (now or in the future) are the same, and they are respectively included in the overall (combining all organization functional categories and data frequencies) top ten most commonly available and desired data types. They are:

Table 5-2 Real-Time Data Types

Most Available (real-time)	Most Desired (real-time)
1. Roadway Closures	1. Roadway Traffic Conditions
2. Incidents	2. Incidents
3. Roadway Traffic Conditions	3. Roadway Surface Conditions
4. Roadway Surface Conditions	4. Roadway Closures
5. Weather Conditions	5. Weather Conditions

Daily. When considering daily generated data, overall the four most available and desired daily data types are the same. The five most commonly available and desired daily generated data are:

Table 5-3 Daily Data Types

Most Available (daily)	Most Desired (daily)
1. Maintenance Operations	1. Construction Operations
2. Construction Operations	2. Maintenance Operations
3. Roadway Closures	3. Roadway Closures
4. Alternative Routes	4. Alternative Routes
5. Incidents	5. Traffic Signal Timing Plans

Monthly. Very few respondents indicated data being generated on a monthly basis. In fact none of the five most commonly available monthly data below were indicated in more than four boxes. When examining the five most commonly desired monthly data types overall (combining all organization functional categories), the top four emphasize infrequently changing schedules and rates. The five most commonly available and desired monthly generated data are:

Table 5-4 Monthly Data Types

Most Available (monthly)	Most Desired (monthly)
1. Roadway Closures	1. Transit Schedules
2. Construction Operations	2. Transit Fares
3. Maintenance Operations	3. Toll Pricing
4. Incidents	4. Parking Fees
5. Traffic Signal Timing Plans / Transit Fares	5. Traffic Signal Timing Plans/ Route Planning

5.2.1 Data Types by Agency Function

The following examines responses on data types, both available and desired, by the category of agency function indicated by each individual respondent. Again it is noted that a many respondents indicated more than one of the nine categories provided. Additionally, the following "Other" categories of agency functions were filled-in by individual respondents: planning organizations (4), environmental organizations (2), safety organizations (3), programming agencies (2) and operator of private toll road (1).

Considering the top five overall ranked data types overall (combining all organization functional categories), eight of the nine agency functional groupings included incident data in the most commonly available and also included incidents, roadway closures, roadway surface conditions and roadway traffic conditions among their highest ranked desired data. Operators of Airports are the ninth group omitted from the preceding consensus on data types.

5.2.1.1 Available Data

When comparing the data types reported as available among different agency functions, two groups (Disseminate Transportation Related Data and Emergency Services) have the same top ten ranked data types as the top ten available overall in 5.2 (combining all organization functional categories). Three have nine of the same top ten ranked data types (both the Operate and Maintain Public Roadways and the Law Enforcement groups replace vehicle locations with traffic signal timing plans; and, the agencies which Provide Weather Information replace traffic signal malfunctions with route planning). Three others have eight of the overall top ten ranked most available data types (Transit Operators, Operators of Public Parking Facilities and Operators of Commercial Transport). Operators of Public Airports responded with only having two of their ten most available data types the same as that of the overall respondents. Since two of the already scarce airport operator responses (3 received) are from respondents at the same facility, the Corridor-wide relevance of this latter data is not substantiated.

Aside from the obvious difference above in the data reported as available by Operators of Public Airports,

there is a significant difference between the data reported as available to Operators of Transit Services and the ten most available data types to overall respondents. Although Operators of Transit Services reported to have eight of the same ten most available data types as respondent overall, their two most available data types (transit fares and transit schedules) were not in the overall ten most available list.

5.2.1.2 Desired Data Types

When comparing the data types reported as most desired among different agency functions, three groups (Emergency Services, Law Enforcement and agencies that Provide Weather Information) have the same top ten ranked data types as the top ten desired overall in 5.2 above (combining all organization functional categories). Four agency groups have nine of the same top ten ranked desired data types (both the agencies that Operate and Maintain Public Roadways and those that Operate Public Parking replace link travel time data with traffic signal timing plans; agencies that Disseminate Transportation Related Data replace maintenance operations with route planning; and agencies that Operate Commercial Transport replace link travel time data with flight delay information). Agencies that Operate Transit Services have eight of the overall top ten ranked most desired data types (maintenance operations and link travel time data are replaced by transit schedules and transit fares).

Finally, Operators of Public Airports responded with only having one of its top four desired data types in the overall ten most desired data types (its #4 ranked weather information is ranked #8 overall). It is noted that only the top four data types from airport operators are being examined since all of the remaining data types indicated as desired by this group of three respondents are tied for fifth ranking. Recall too that two of these three respondents are from the same airport.

5.2.2 Privacy Measures

If agencies are to share data with other organizations, measures need to be taken to ensure that privacy is preserved. Of those agencies responding, 29% (22 of 75) indicated that they would require some type of measures to be taken. These privacy measures would involve the removing of private and proprietary information before its public dissemination. It is anticipated that as more agencies generate electronic data the need for privacy measures will also increase.

5.2.3 Electronic Data

Although there was a very positive response to the sharing of data, 81% (61 of 75) of respondents, only 36% (27) of the overall responding agencies (75) have data available electronically. This percentage is anticipated to increase as technology improvements are implemented and electronic data becomes more common.

5.2.4 Receiving and Distributing Data

Overall the most common method of receiving data among the respondents was by fax, with 56% of the respondents stating that they receive data by fax. By functional agency grouping, fax was the leading method of distributing data for seven of the nine groups, followed by use of a dedicated phone line/modem connections for the other two of nine groups. The GCM Internet Page was tied as the most common distribution method among two groups (one as tied with fax machines and the other tied with dedicated phone line/modem connections.

Along with the methods of receiving data, respondents also indicated how they currently distribute data to the following groups: in-house, other agencies and to the public. The most popular method of distributing information both in-house and to other agencies was by telephone. Due to the wording of the questionnaire, however, it is indeterminate how much of this distribution includes voice or electronic data. The most popular method of distributing information to the public is by press release.

5.3 DATA EXCHANGE ELEMENTS

The following summarizes the findings herein related to the varied other aspects in the exchange of data, as well as those recommendations relevant at this juncture:

- In order to efficiently and effectively share and transmit data with other agencies (i.e., TMC to TMC, TMC to VMS, etc.) a standard message format should be incorporated. This is already taking shape from the NTCIP but has not become an official standard at this time.

- Similar to the bullet item above, a standard location referencing scheme should be developed to aid in the ease of disseminating traveler data. The LRMS is currently being tested in the GCM Corridor.

- Policies and procedures must be realized and strictly enforced in order to implement shared monitoring and control of certain field devices.

- A distributed database should be maintained for accessing and sharing the traveler information. This type of database provides for the most efficient and effective transferring and sharing of data. However, investigations still need to be made into whether a relational or object oriented database structure should be used.

- Security and privacy issues of contributing agencies need to be fully understood and protected before implementation of any sharing of data or shared control of certain field devices.

- The different data types, units and format need to be pre-defined among the agencies receiving the information. This will aid in any translation process that might be needed at the Gateway.

- Data verification should be specified at all places/agencies where traveler information is received to ensure proper distribution.

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APPENDIX A

USER NEEDS QUESTIONNAIRE

CONTENTS

A.1 - LIST OF RECIPIENTS OF USER NEEDS QUESTIONNAIRE

Recipients of User Needs Questionnaire

(# in parenthesis represents multiple mailings to same agency)

AAA - Illinois
AAA - Wisconsin
Alpha School Bus Company
AMTRAK (4)
AMTRAK Engineering Department
ATC Leasing Company
Atlas Van Lines
Beverly Shores Town Council
Bulkmatic Transport Company
Burns International Harbor
Celadon
Chicago Area Transportation Study (3)
Chicago DOT (4)
Chicago DOT - Bureau of Traffic
Chicago Transit Authority (2)
Chicago Transit Authority, CITF
Citizens Committee for Clean Air
Citizens for a Better Environment
City of Brookfield - Dept. of Public Works
City of Cedarburg - Engineer
City of Chicago - Bureau of Traffic
City of Chicago - Police Department 911 Center (CAD Systems and Operations)
City of Crown Point
City of Cudahy - Department of Public Works
City of East Chicago (3)
City of Franklin
City of Franklin - Police Department
City of Gary (4)
City of Gary - Deputy Mayor (2)
City of Glendale (2)
City of Glendale - Police Department
City of Greenfield (2)
City of Greenfield - Police Department
City of Griffith - Public Works
City of Griffith - Town Council
City of Hammond (2)
City of Highland
City of Highland - Public Works
City of Hobart (2)
City of Kenosha (3)
City of La Porte (2)
City of Lake Station
City of Lowell (2)
City of Mequon - Dept. of Public Works
City of Merrillville (3)
City of Merrilville - Public Works
City of Michigan City (3)
City of Milwaukee (5)
City of Milwaukee - Dept. of City Development
City of Milwaukee - Dept. of Public Works
City of Milwaukee - Fire Department (2)
City of Milwaukee - Mayor
City of Milwaukee - Police Department (2)
City of Milwaukee - Transportation (2)
City of Naperville
City of New Berlin (2)
City of Oak Creek
City of Oak Creek - Police Department
City of Oconomowoc (2)
City of Portage (2)
City of Racine
City of Racine - Police Department
City of Racine -Transit Planner
City of South Milwaukee
City of St. Francis
City of St. John (2)
City of Valparaiso (2)
City of Waukesha (2)
City of Waukesha - Public Works
City of Wauwatosa (2)
City of Wauwatosa - Fire Department
City of West Allis
City of West Allis - Police Department
Conor Communications Co. - Director of *999.
Cook County - Superintendent of Highways
Cubic
Curry Ice and Coal, Inc.
Du-Comm
Dupage County
Dupage County Div. of Trans.
Dupage County Planning Commission
Dupage Mayors & Managers. Conf. (2)
DuPage County Highway Department
Ed Kraemer & Sons, Inc.
Elgin, Joliet & Eastern RR
Emergency Preparedness & Disaster Services
Fairway Transit, Inc.

Federal Transit Authority
Federal Transit Authority - Region 5
FHWA (6)
FHWA - Office of Motor Carriers (2)
FHWA/USDOT - Office of Motor Carriers
Gary Air Pollution Office
Gary Public Transportation Corp. (6)
Gary Regional Airport (2)
Greater Milwaukee Conv. Bureau
Greendale Police Department
Greyhound Bus Lines (2)
Hales Corners Police Department
Hammond Transit
Hammond Yellow Coach Lines
Hoosier Environmental Council (2)
Illinois Commerce Commission - Transportation Division
Illinois DOT (5)
Illinois DOT - Bureau of Electrical Operations
Illinois DOT - Bureau of Traffic
Illinois DOT - Division of Highways-Director
Illinois DOT - Division of Public Trans. (2)
Illinois DOT - Emergency Traffic Patrol
Illinois DOT - ITS Program Office
Illinois DOT - Traffic Systems Center
Illinois Emergency Management Agency
Illinois Environmental Protection Agency
Illinois Environmental Protection Agency - Air Quality Planning
Illinois Environmental Protection Agency - Office of Chemical Safety
Illinois Secretary of State - Vehicle Services
Illinois State Police (4)
Illinois State Police - District Chicago
Illinois State Toll Hwy Authority (3)
Illinois Transportation Association
Indiana Department of Emergency Mgmt. (3)
Indiana Department of Environmental Mgmt.
Indiana DOT (5)
Indiana DOT - Bureau of Rail Roads
Indiana DOT - Deputy Commissioner
Indiana DOT - Div. of Public Transportation
Indiana DOT - LaPorte District (3)
Indiana DOT - Toll Road Division
Indiana Harbor Belt Railroad Company (2)
Indiana Motor Truck Association, Inc.
Indiana State Patrol
Indiana State Police - Lowell District 13 (2)
Indiana State Police - Motor Carrier Division(2)
Jack Gray Transport, Inc.
Jacobus Oil Company
Jet Permit Service
JJ Keller
K&D
Kane County Board (2)
Kane County Division of Transportation
Kenosha County
Kenosha County Public Works
Kenosha County Sheriff (4)
Lake County Division of Transportation (2)
Lake County Highway Department (4)
LaPorte County Highway Department
League of Wisconsin Municipalities
Mayflower Transit, Inc
McCoy Group Truck
McHenry County Board
McHenry County Highway Department
Meda-Care Vans
Metra (3)
METRO Traffic
Metropolitan Transportation Association
Midwest Truckers Assn. (2)
Millis Transfer, Inc.
Milwaukee Airport
Milwaukee County (3)
Milwaukee County Public Works(2)
Milwaukee County Sheriff Department (3)
Milwaukee County Transit (3)
Morgan Drive-Away
Motor Carriers Association of Wisconsin
Motor Transportation Administration - National Safety Council
National Highway Traffic Safety Administration
New Chicago Town Council
New Transportation Alliance
North American Van Lines
North Central Region
Northeast Illinois Planning Commission
Northern Indiana Commuter Trans. District (2)
Northwest Central Dispatch
Northwest Indiana Forum - Govt. Affairs
Northwest Indiana Regional Planning Comm.(2)
Northwest Municipal Conference
Ogden Dunes Town Council
Overland Transportation System, Inc

Ozaukee County - Highways
Ozaukee County Sheriff's Department (2)
Pace (4)
Porter County
Racine County
Racine County Highway Comm. (2)
Racine County Sheriff
Racine County - Department of Public Works
Regional Transportation Authority (3)
Robert Hansen Trucking
Roehl Transport, Inc.
Rudolf Express
Schneider National Carriers, Inc.
Schneider Trucking
Shadow Broadcast Services
Skinner Transfer
South Suburban Mayors & Managers Assn. (2)
Southeastern Wisconsin Regional Planning Committee (2)
TMA of Lake-Cook
Town of Burns Harbor
Town of Cedar Lake - Public Works
Town of Chesterton (2)
Town of Hebron
Town of Kouts
Town of Munster
Town of Schererville (3)
Town of Stoughton - Public Works
TransPorte
Tri State Coach Lines
Truck Stop Operators of Wisconsin
United Parcel Service (3)
US Environmental Protection Agency, Region 5 - Air Management Division
Village of Arlington Heights
Village of Bayside
Village of Brown Deer
Village of Buffalo Grove
Village of Frankfort
Village of Germantown
Village of Greendale
Village of Hales Corners
Village of Hoffman Estates
Village of Mukwonago
Village of Orland Park
Village of Schaumburg
Village of West Milwaukee
Walworth County Emergency
Walworth County Highway Comm.
Walworth County Sheriff
Washington County Highway Department
Washington County Sheriff
Waste Management. North America
Waukesha County (3)
Waukesha Metro Transit
WBBM News Radio
West Central Municipal Conf. (2)
Wheaton Van Lines
Whitney City Hall
Will County Highway Department
Wisconsin Assn. of Haz. Mat. Responders, Inc.
Wisconsin Association of Consulting Engineers
Wisconsin Association of Mgmt. and Comm.
Wisconsin Coach Lines
Wisconsin County Planning Directors
Wisconsin Division of Tourism
Wisconsin DNR (2)
Wisconsin DOT (5)
Wisconsin DOT - District 2 (5)
Wisconsin DOT - District 2 - MONITOR
Wisconsin DOT - District 2 - Traffic Operations Center (3)
Wisconsin DOT - Division of Motor Vehicles
Wisconsin DOT - Office of Public Affairs (2)
Wisconsin DOT - State Patrol (2)
Wisconsin Economic Development Association
Wisconsin Environmental, Inc.
Wisconsin Highway Users Conference
Wisconsin State Patrol
Wisconsin State Patrol District 2 (2)
Wisconsin Tourism Federation
Wisconsin Transportation Development
Wisconsin Urban Transit Association c/o Madison Metro
Yellow Freight Systems

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A.2 -SAMPLE BLANK USER NEEDS QUESTIONNAIRE

GCM MMTIS

User Needs Questionnaire

Under the Program Plan for the Gary-Chicago-Milwaukee (GCM) Corridor, efforts are underway to design and develop a comprehensive, integrated, multi-modal traveler information system (MMTIS) which will meet the information needs of travelers and operators within the GCM Corridor. In support of this effort, the Corridor is assessing the needs of various public agencies, transit agencies, traffic reporting services, trucking firms and other transportation related companies with respect to transportation/traveler information. The focus of the following questions is to understand the types of transportation/traveler information that are currently available within the GCM Corridor and to understand your needs regarding the types of transportation/traveler information that should be exchanged within the GCM Corridor. Your responses to this survey will provide valuable information in developing an architecture for assuring the capability to exchange transportation/traveler information between agencies and to disseminate this information to the public and other interested parties.

1. Your name: _____

   Organization Name: _____

   Telephone Number: _____

2. How knowledgeable are you of the efforts of the GCM Corridor in regard to its development and purpose?
   - ☐ Very knowledgeable, understand the benefits and future capabilities of proposed systems for the Corridor.
   - ☐ Somewhat knowledgeable, I have heard of the development of systems for the Corridor.
   - ☐ This is the first time I have heard of the Corridor and know little about Intelligent Transportation Systems.

3. Has your organization discussed sharing traveler information with the GCM Corridor, specifically the MMTIS? ☐ Yes ☐ No.

4. Transportation related function of your organization:
   - ☐ Emergency services
   - ☐ Law enforcement
   - ☐ Operate transit service
   - ☐ Operate commercial transport service
   - ☐ Operate public parking facility
   - ☐ Operate public airport
   - ☐ Operate/Maintain public roadways (Municipal, DOT)
   - ☐ Disseminate transportation related data
   - ☐ Provide weather information
   - ☐ Other:_____.

5. During your operations what type(s) of transportation related data can you generate (please check all that may apply):

	Frequency of data availability?					Available electronically?		
							In the Future	
	Real-time	Hourly	Daily	Weekly	Monthly	Now	< 5 years	> 5 years
Roadway closures	☐	☐	☐	☐	☐	☐	☐	☐
Roadway traffic conditions	☐	☐	☐	☐	☐	☐	☐	☐
Roadway surface conditions	☐	☐	☐	☐	☐	☐	☐	☐
Incidents (accidents, etc.)	☐	☐	☐	☐	☐	☐	☐	☐
Construction operations	☐	☐	☐	☐	☐	☐	☐	☐
Maintenance operations	☐	☐	☐	☐	☐	☐	☐	☐
Link travel time data	☐	☐	☐	☐	☐	☐	☐	☐
Traffic signal timing plans	☐	☐	☐	☐	☐	☐	☐	☐
Traffic signal malfunctions	☐	☐	☐	☐	☐	☐	☐	☐
Alternative routes (detours for delays)	☐	☐	☐	☐	☐	☐	☐	☐
Route planning	☐	☐	☐	☐	☐	☐	☐	☐
Ridesharing/carpooling information	☐	☐	☐	☐	☐	☐	☐	☐
Transit schedules	☐	☐	☐	☐	☐	☐	☐	☐
Vehicle locations	☐	☐	☐	☐	☐	☐	☐	☐
Transit fares	☐	☐	☐	☐	☐	☐	☐	☐
Toll pricing	☐	☐	☐	☐	☐	☐	☐	☐
Itinerary planning	☐	☐	☐	☐	☐	☐	☐	☐
Parking availability	☐	☐	☐	☐	☐	☐	☐	☐
Parking fees	☐	☐	☐	☐	☐	☐	☐	☐
Scheduled flights	☐	☐	☐	☐	☐	☐	☐	☐
Flight delays	☐	☐	☐	☐	☐	☐	☐	☐
Weather conditions	☐	☐	☐	☐	☐	☐	☐	☐
Other:	☐	☐	☐	☐	☐	☐	☐	☐

6. During your operations what type(s) of transportation related data would you use if it were available (please check all that apply):

	Optimal data receipt rate?					Able to receive electronically?		
	Real-time	Hourly	Daily	Weekly	Monthly	Now	In the Future	
							< 5 years	> 5 years
Roadway closures	☐	☐	☐	☐	☐	☐	☐	☐
Roadway traffic conditions	☐	☐	☐	☐	☐	☐	☐	☐
Roadway surface conditions	☐	☐	☐	☐	☐	☐	☐	☐
Incidents (accidents, etc.)	☐	☐	☐	☐	☐	☐	☐	☐
Construction operations	☐	☐	☐	☐	☐	☐	☐	☐
Maintenance operations	☐	☐	☐	☐	☐	☐	☐	☐
Link travel time data	☐	☐	☐	☐	☐	☐	☐	☐
Traffic signal timing plans	☐	☐	☐	☐	☐	☐	☐	☐
Traffic signal malfunctions	☐	☐	☐	☐	☐	☐	☐	☐
Alternative routes (detours for delays)	☐	☐	☐	☐	☐	☐	☐	☐
Route planning	☐	☐	☐	☐	☐	☐	☐	☐
Ridesharing/carpooling information	☐	☐	☐	☐	☐	☐	☐	☐
Transit schedules	☐	☐	☐	☐	☐	☐	☐	☐
Vehicle locations	☐	☐	☐	☐	☐	☐	☐	☐
Transit fares	☐	☐	☐	☐	☐	☐	☐	☐
Toll pricing	☐	☐	☐	☐	☐	☐	☐	☐
Itinerary planning	☐	☐	☐	☐	☐	☐	☐	☐
Parking availability	☐	☐	☐	☐	☐	☐	☐	☐
Parking fees	☐	☐	☐	☐	☐	☐	☐	☐
Scheduled flights	☐	☐	☐	☐	☐	☐	☐	☐
Flight delays	☐	☐	☐	☐	☐	☐	☐	☐
Weather conditions	☐	☐	☐	☐	☐	☐	☐	☐
Other:	☐	☐	☐	☐	☐	☐	☐	☐
Other:	☐	☐	☐	☐	☐	☐	☐	☐

7. Related to Question 5, would your organization be willing to share travel related information with the GCM Corridor? ☐ Yes ☐ No
If "yes," please proceed to Question 8. If "no," please proceed to Question 10.

8. Is your information available electronically? ☐ Yes ☐ No.

9. Would the Corridor need to provide additional processing to remove any private or proprietary information from the data stream? ☐ Yes ☐ No.

10. If you were to receive any of the previously noted data from the GCM Corridor MMTIS, how would you like to receive it?
    - ☐ GCM Internet Page
    - ☐ Dedicated phone line/modem connection
    - ☐ Fax machine
    - ☐ Email
    - ☐ Pager
    - ☐ Dial-up
    - ☐ Other_____.

11. If you were to receive any of the previously noted data from the GCM Corridor MMTIS, what coverage area would be beneficial?
    - ☐ Local area (specifically, _____)
    - ☐ Regional (circle any that apply)
      Northwestern Indiana Northeastern Illinois Southeastern Wisconsin
    - ☐ Corridorwide.

12. What incident types effect your organization?
    - ☐ Internal Accidents (Within your organization's operations)
    - ☐ External Accidents (Not within your organization's operations. For example, IDOT may be interested in accidents on the Illinois Tollway because it may have an impact on operations.)
    - ☐ Roadway closures
    - ☐ Transit shut-down
    - ☐ Weather related (rain, tornado, blizzard, etc.)
    - ☐ Traffic signal malfunction
    - ☐ Other _____
    - ☐ Other _____
    - ☐ Other _____.

13. If your organization distributes transportation related data, how is this typically done:

	In-house only	To other affected agencies	To public	
Highway Advisory Radio	☐	☐	☐	
Variable Message Sign	☐	☐	☐	
In-house radio channel	☐	☐	☐	
Pager	☐	☐	☐	
Telephone	☐	☐	☐	
Fax	☐	☐	☐	
Press release	☐	☐	☐	
Internet		☐	☐	☐
Other _____	☐	☐	☐	
Other _____	☐	☐	☐	
Other _____	☐	☐	☐	

Thank you for your time and effort in responding to this questionnaire. We may be calling you shortly to discuss particular answers and participation in this project. If you have any questions in the interim, please do not hesitate to call David Weiss of De Leuw, Cather & Company at (312) 930-5102.

Please return the completed survey by April 4, 1997 to the following address (you may use the back of this page for mailing):

De Leuw, Cather & Company
Attn: David Weiss
525 W. Monroe Street, 10th Floor
Chicago, IL 60661

If you would rather fax your completed survey, you may send it to the attention of David Weiss at (312) 930-0018.

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A.3 - USER NEEDS QUESTIONNAIRE RESPONDENTS

User Needs Questionnaire Respondents

Company	*Name*	*State*
AAA Wisconsin	Stetenfeld, Ernie	WI
Bulkmatic Transport Co.	Leos, Adam	IN
CDOT - Bureau of Traffic	Ellis, John R.	IL
Chicago Area Transportation Study	Zavattero, David	IL
Chicago Fire Department	Moriarty, Francis W.	IL
Chicago Transit Authority	Baker, Ronald J.	IL
Chicago Transit Authority	Bruenig, Stephan	IL
Chicago Transit Authority	Phillips, Dave	IL
City of Gary	Oloyede, Olasupo A.	IN
City of Glendale	Maslowski, Richard	WI
City of Naperville	Ranck, Fred	IL
City of Racine	Blazek, James J.	WI
City of Racine, Belle Urban System	Glasheen, Michael J.	WI
City of Valparaiso	Butterfield, David	IN
City of Wauwatosa	Young, S. Howard	WI
City of Whiting	Botich, Dan	IN
Cook County Highway Department	Kowalski, Carl F.	IL
Du-Comm	Tuma, Richard H.	IL
DuPage County Development Dept.	Syversen, Bill	IL
DuPage County DOT	Tokarski, Chuck	IL
Dupage Mayors and Mangers Conf.	Schoedel, Carl	IL
FHWA, Office of Motor Carriers	Beaver, Dan	IL
Gary Regional Airport	Gatewood, Lavell	IN
Greendale Police Dept.	Leack, David J.	WI
Greyhound Lines Inc.	Braun, Richard	IL
Hammond Transit System	Gutowsky, Rebecca J.	IN
Illinois Dept. of Transportation	Hochmuth, Jeff	IL
Illinois Dept. of Transportation	Jonak, Ken	IL
IDOT - Emergency Traffic Patrol	Smith, Ted	IL
IDOT - District 1	McDermott, Joe	IL

Company	*Name*	*State*
IDOT - Division of Highways	Anderson, Martin E.	IL
IL Sec. of State, Comm. Farm Truck Div.	Veseling, Vince	IL
Illinois Environmental Protection Agency	O'brien, James P.	IL
Illinois State Police	Cade, Thomas	IL
Illinois State Police	Stoica, Ted L.	IL
Illinois State Toll Highway Authority	Sierakowski, Melvin R.	IL
Illinois State Tollway	MacDonald, Neal D.	IL
Indiana Dept of Environmental Management	Newland, Joyce	IN
Indiana State Police	Boruff, Guy W.	IN
Indiana State Police	Hill, John H.	IN
Indiana Dewpt. of Transportation	Heinlein, Delmae	IN
Kane County Div. of Transportation	Rickert, Thomas	IL
Kenosha County Public Works	Sipsma, Gary	WI
Kenosha Police Dept.	Gray, William V.	WI
Lake County DOT	Khawaja, Anthony N.	IL
Madison Metro Transit	Larrousse, Paul	WI
McHenry County	Magnuson, Mike	IL
Metra	McAtee, Pat	IL
Metra	Resnick, Barry	IL
Milw. County Sheriff's Dept.	Delaney, Joseph	WI
Milwaukee County (Airport, HW, Traansit)	Rutkowski, Ronald J.	WI
Milwaukee County Transit	Giugno, Michael	WI
Milwaukee Safety Commission	Witkowski, Terry L.	WI
NE IL Planning Commission	Paige, John H.	IL
NIRPC	Brown, William M.	IN
Oak Creek Police Dept.	Mitchell, Patrick	WI
Ozaukee County Sheriff's Dept.	Hermann, Edward	WI
Pace	Jarzab, James	IL
Pace	Paquet, John	IL
Regional Transportation Authority	Urbanczyk, David S.	IL

Company	*Name*	*State*
Shadow Broadcast Services	Andrew, T.J.	IL
South Suburban Mayors & Managers	Morrissy, Janice	IL
Town of Merrillville	Keilman, Thomas P.	IN
Tri-State Coach Lines, Inc.	Hunter, Larry	IN
Village of Arlington Heights	Ponsot, Thomas	IL
Village of Orland Park	Dreyer, Gregory P.	IL
Walworth County Hwy. Dept.	Coopman, Benjamin J.	WI
Walworth County Emerg. Management	Ketterhagen, Kim L.	WI
Washington County HW Dept.	Pesch, Kenneth M.	WI
Waukesha Police Department	Dussault, Wayne E.	WI
Wisconsin State Patrol District 2	Hansen, Patricia	WI
Will County Governmental League	Hanlon, Alicia	IL
Wisconsin Dept. of Tourism	Gulig, John	WI
Wisconsin Dept. of Transportation	DeCabooter, Phil	WI
Wisconsin Dept. of Transportation	Thompson, Charles H.	WI

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APPENDIX B

TABULATION OF USER NEEDS QUESTIONNAIRE QUESTIONS #5 AND #6

(on Data Availability and Data Desired)

Table of Contents

Tabulation of User Needs Questionnaire -

Data Available (#5) and Data Desired (#6)

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ta Availability - Operate and Maintain Public Roadways

	Hourly			Daily				Weekly				Monthly				Other	TOTAL	%	RANK
	<5 yrs	>5yrs	future	now	<5 yrs	>5yrs	future	now	<5 yrs	>5yrs	future	now	<5 yrs	>5yrs	future	no frequency	out of 28		
	1			1	2	1	3	1				1	1	1			24	**88.9%**	#1
	2				1		1										14	**51.9%**	#5
	1		2				1										15	**55.6%**	#4
	2				1										1		14	**51.9%**	#5
	2			2	6		3	1			1		1	1			22	**81.5%**	#2
	4			1	4		5		1				1	1			22	**81.5%**	#2
	1																6	22.2%	#11
				1	1	1							1		1		13	**48.1%**	#7
	2		1				1										12	**44.4%**	#8
	2			1	1	1		1	2				1				10	**37.0%**	#10
	1				2				1								6	22.2%	#11
					2							1					3	11.1%	#16
							1										4	14.8%	#14
																	6	22.2%	#11
	2						1										4	14.8%	#14
	1																1	3.7%	#22
						2											3	11.1%	#16
					2												2	7.4%	#21
					2		1										3	11.1%	#16
																	3	11.1%	#16
																	3	11.1%	#16
				2			1										11	**40.7%**	#9

ed Availability

					Percentage			Ranking				Under 5 years*			Overall**
					<5 yrs	>5yrs	future	now	<5 yrs	>5yrs	future	Total	%	RANK	Rank
					44%	11%	15%	#4	#1	#1	#3	17	**63%**	#1	#1
					22%	0%	4%	#1	#6	-	#10	13	**48%**	#3	#5
					26%	4%	15%	#8	#4	#4	#3	10	**37%**	#5	#4
					19%	4%	11%	#4	#8	#4	#5	10	**37%**	#5	#5
					41%	4%	22%	#7	#2	#4	#2	15	**56%**	#2	#2
					41%	7%	26%	#10	#2	#2	#1	13	**48%**	#3	#2
					7%	0%	4%	#8	#12	-	#10	5	19%	#12	#11
					11%	4%	11%	#3	#10	#4	#5	9	**33%**	#8	#7
					15%	0%	11%	#4	#9	-	#5	9	**33%**	#8	#8
					26%	4%	0%	#10	#4	#4	-	9	**33%**	#8	#10
					22%	0%	0%	-	#6	-	-	6	22%	#11	#11
					7%	0%	0%	#13	#12	-	-	3	11%	#14	#16
					0%	0%	7%	#10	-	-	#8	2	7%	#17	#14
					7%	0%	4%	#8	#12	-	#10	5	19%	#12	#11
					7%	0%	7%	-	#12	-	#8	2	7%	#17	#14
					4%	0%	0%	-	#20	-	-	1	4%	#21	#22
					4%	7%	0%	-	#20	#2	-	1	4%	#21	#16
					7%	0%	0%	-	#12	-	-	2	7%	#17	#21
					7%	0%	4%	-	#12	-	#10	2	7%	#17	#16
					7%	0%	0%	#13	#12	-	-	3	11%	#14	#16
Flight Delays	1	2	0	0	4%	7%	0%	#13	#12	-	-	3	11%	#14	#16
Weather Conditions	7	3	0	1	26%	11%	0%	4%	#1	#10	-	#10	10	**37%**	#5	#9

KEY

Percentage = % of Respondants selecting data type

Ranking= Ranked in order of most available types of data (top 10 data types are bold)

now = data type available now

< 5yr = data available in less than 5 years

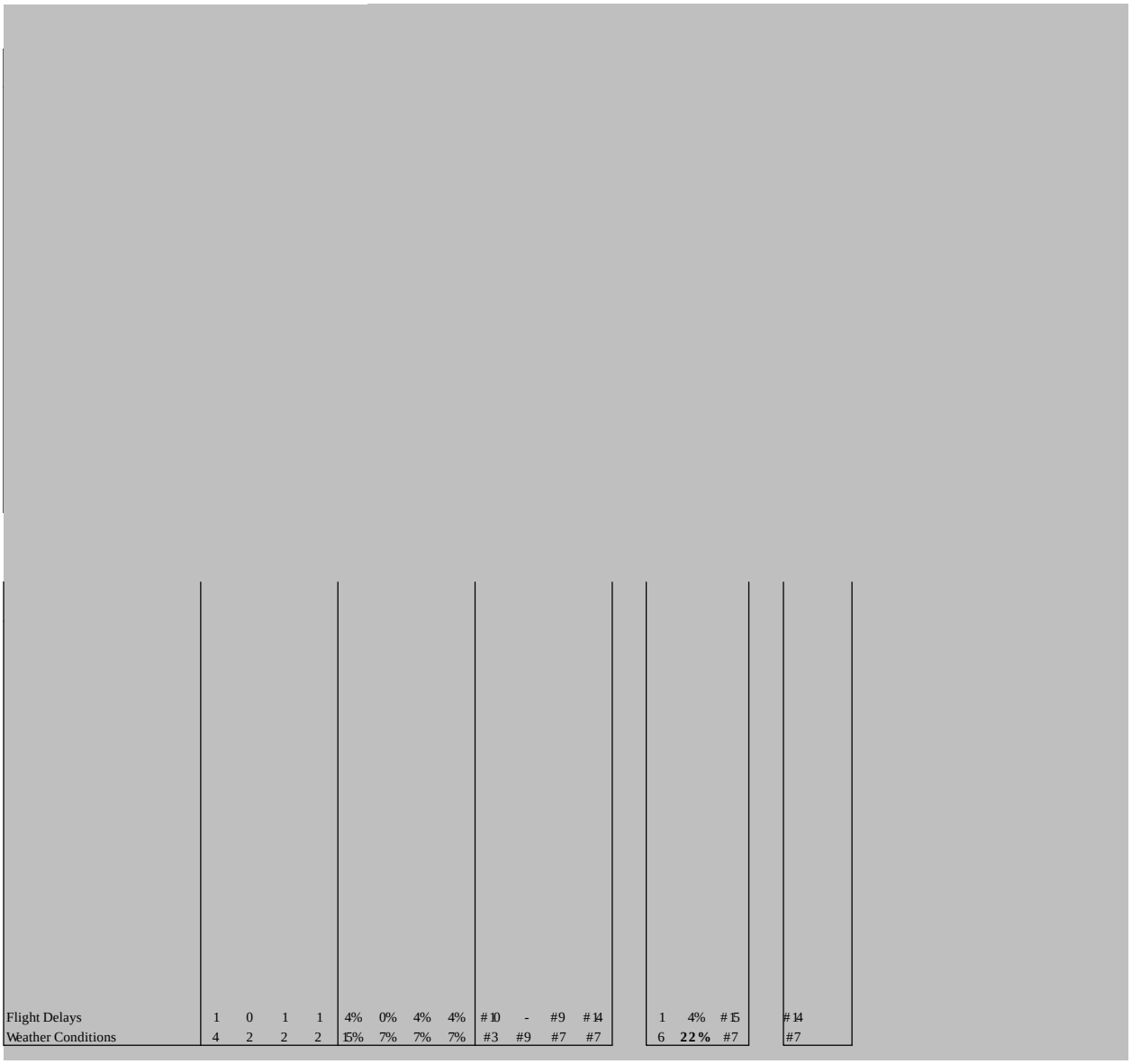
> 5yr = data available in more than 5 years

future = data available at unknown point in the future

other = no frequency specified

*= now + < 5yrs

**= now + < 5yrs + >5yrs + future



Flight Delays	1	0	1	1	4%	0%	4%	4%	#10	-	#9	#14	1	4%	#15	#14
Weather Conditions	4	2	2	2	15%	7%	7%	7%	#3	#9	#7	#7	6	**22%**	#7	#7

Table B-3 Frequency of Dat

frequency =>	**Real-time**																			
Data Type *availability =>*	now	<5 yrs	>5yrs	future	now															
Roadway Closures	3	5	1																	
Roadway Traffic Conditions	7	1	1																	
Roadway Surface Conditions	2	3	1	1	1															
Incidents	5	2	1	1																
Construction Operations	2	1	1	1																
Maintainance Operations	2	1	1	1		2			1	2	1	3		1			1			16	**61.5%**	#3
Link Travel Time Data	4	2									1							1		8	**30.8%**	#10
Traffic Signal Timing Plan	4	1									2						1			8	**30.8%**	#10
Traffic Signal Malfunctions	4	3				1					1	1								10	**38.5%**	#7
Alternative Routes	1	1	1						1	2			1	2				1		10	**38.5%**	#7
Route Planning	1	2	1						2	1				1						8	**30.8%**	#10
Ridesharing/Carpooling										2	1				1					4	15.4%	#18
Transit Schedules	2			1							2									5	19.2%	#14
Vehicle Locations	3	2	1	1														1		8	**30.8%**	#10
Transit Fares				1		2					2									5	19.2%	#14
Toll Pricing																				0	0.0%	-
Itinerary Planning		1									2									3	11.5%	#21
Parking Availability	1									2						1				4	15.4%	#18
Parking Fees										2		2				1				5	19.2%	#14
Scheduled Flights	1	3																		4	15.4%	#18
Flight Delays	2	3																		5	19.2%	#14
Weather Conditions	5	1	1		1	1			1											10	**38.5%**	#7

Data Type Totals by Projected Availability

	TOTALS				**Percentage**				**Ranking**				**Under 5 years***			**Overall****	KEY
Data Type *availability =>*	now	<5 yrs	>5yrs	future	now	<5 yrs	>5yrs	future	now	<5 yrs	>5yrs	future	Total	%	RANK	Rank	Percentage = % of Respondants selecting data type
Roadway Closures	7	6	3	2	27%	23%	12%	8%	#2	#1	#1	#5	13	**50%**	#1	#1	Ranking= Ranked in order of most available types of data (top 10 data types are bold)
Roadway Traffic Conditions	8	3	2	0	31%	12%	8%	0%	#1	#8	#3	-	11	**42%**	#2	#4	
Roadway Surface Conditions	4	4	2	2	15%	15%	8%	8%	#6	#5	#3	#5	8	**31%**	#6	#5	
Incidents	5	3	2	2	19%	12%	8%	8%	#5	#8	#3	#5	8	**31%**	#6	#5	now = data type available now
Construction Operations	6	5	2	4	23%	19%	8%	15%	#4	#3	#3	#1	11	**42%**	#2	#2	< 5yr = data available in less than 5 years
Maintainance Operations	4	6	2	4	15%	23%	8%	15%	#6	#1	#3	#1	10	**38%**	#4	#3	
Link Travel Time Data	4	2	1	1	15%	8%	4%	4%	#6	#12	#12	#11	6	**23%**	#9	#10	> 5yr = data available in more than 5 years
Traffic Signal Timing Plan	4	2	2	0	15%	8%	8%	0%	#6	#12	#3	-	6	**23%**	#9	#10	
Traffic Signal Malfunctions	4	4	1	1	15%	15%	4%	4%	#6	#5	#12	#11	8	**31%**	#6	#7	future = data available at unknown point in the future
Alternative Routes	2	4	3	1	8%	15%	12%	4%	#12	#5	#1	#11	6	**23%**	#9	#7	
Route Planning	1	5	2	0	4%	19%	8%	0%	#16	#3	#3	-	6	**23%**	#9	#10	other = no frequency specified
Ridesharing/Carpooling	0	0	2	2	0%	0%	8%	8%	-	-	#3	#5	0	0%	-	#18	*= now + < 5yrs
Transit Schedules	2	0	0	3	8%	0%	0%	12%	#12	-	-	#3	2	8%	#18	#14	**= now + < 5yrs + >5yrs + future
Vehicle Locations	3	2	1	2	12%	8%	4%	8%	#11	#12	#12	#5	5	19%	#13	#10	
Transit Fares	0	2	0	3	0%	8%	0%	12%	-	#12	-	#3	2	8%	#18	#14	
Toll Pricing	0	0	0	0	0%	0%	0%	0%	-	-	-	-	0	0%	-	-	
Itinerary Planning	0	1	2	0	0%	4%	8%	0%	-	#19	#3	-	1	4%	#20	#21	
Parking Availability	2	2	0	0	8%	8%	0%	0%	#12	#12	-	-	4	15%	#15	#18	
Parking Fees	1	2	0	2	4%	8%	0%	8%	#16	#12	-	#5	3	12%	#17	#14	
Scheduled Flights	1	3	0	0	4%	12%	0%	0%	#16	#8	-	-	4	15%	#15	#18	
Flight Delays	2	3	0	0	8%	12%	0%	0%	#12	#8	-	-	5	19%	#13	#14	
Weather Conditions	7	2	1	0	27%	8%	4%	0%	#2	#12	#12	-	9	**35%**	#5	#7	

													4	17.4%	#13
													8	**34.8%**	#6

ed Availability

Data Type *availability =>*	TOTALS				Percentage				Ranking				Under 5 years*			Overall**	KEY
	now	<5 yrs	>5yrs	future	now	<5 yrs	>5yrs	future	now	<5 yrs	>5yrs	future	Total	%	RANK	Rank	Percentage = % of Respondants selecting data type
Roadway Closures	2	7	6	4	9%	30%	26%	17%	#5	#1	#1	#2	9	**39%**	#1	#1	Ranking= Ranked in order of most available types of data (top 10 data types are bold)
Roadway Traffic Conditions	0	2	1	3	0%	9%	4%	13%	-	#7	#12	#3	2	9%	#14	#9	
Roadway Surface Conditions	0	2	1	3	0%	9%	4%	13%	-	#7	#12	#3	2	9%	#14	#9	
Incidents	5	3	3	5	22%	13%	13%	22%	#1	#6	#5	#1	8	**35%**	#2	#2	
Construction Operations	1	4	4	2	4%	17%	17%	9%	#9	#3	#2	#5	5	**22%**	#4	#3	now = data type available now
Maintainance Operations	0	5	4	2	0%	22%	17%	9%	-	#2	#2	#5	5	**22%**	#4	#3	< 5yr = data available in less than 5 years
Link Travel Time Data	2	1	1	0	9%	4%	4%	0%	#5	#15	#12	-	3	**13%**	#10	#13	
Traffic Signal Timing Plan	5	1	2	0	22%	4%	9%	0%	#1	#15	#6	-	6	**26%**	#3	#6	> 5yr = data available in more than 5 years
Traffic Signal Malfunctions	2	2	2	2	9%	9%	9%	9%	#5	#7	#6	#5	4	**17%**	#8	#6	
Alternative Routes	1	4	4	1	4%	17%	17%	4%	#9	#3	#2	#10	5	**22%**	#4	#5	future = data available at unknown point in the future
Route Planning	0	4	2	0	0%	17%	9%	0%	-	#3	#6	-	4	**17%**	#8	#9	
Ridesharing/Carpooling	0	0	2	0	0%	0%	9%	0%	-	-	#6	-	0	0%	-	#20	other = no frequency specified
Transit Schedules	2	0	0	2	9%	0%	0%	9%	#5	-	-	#5	2	9%	#14	#13	*= now + < 5yrs
Vehicle Locations	3	0	1	1	13%	0%	4%	4%	#4	-	#12	#10	3	13%	#10	#12	**= now + < 5yrs + >5yrs + future
Transit Fares	0	2	0	2	0%	9%	0%	9%	-	#7	-	#5	2	9%	#14	#13	
Toll Pricing	0	0	0	0	0%	0%	0%	0%	-	-	-	-	0	0%	-	-	
Itinerary Planning	0	0	2	0	0%	0%	9%	0%	-	-	#6	-	0	0%	-	#20	
Parking Availability	0	2	1	0	0%	9%	4%	0%	-	#7	#12	-	2	9%	#14	#18	
Parking Fees	0	2	0	1	0%	9%	0%	4%	-	#7	-	#10	2	9%	#14	#18	
Scheduled Flights	1	2	1	0	4%	9%	4%	0%	#9	#7	#12	-	3	13%	#10	#13	
Flight Delays	1	2	1	0	4%	9%	4%	0%	#9	#7	#12	-	3	13%	#10	#13	
Weather Conditions	5	0	2	1	**22%**	**0%**	**9%**	4%	#1	-	#6	#10	5	**22%**	#4	#6	

Toll Pricing							0	0.0%	-
Itinerary Planning							0	0.0%	-
Parking Availability					1		2	11.1%	#13
Parking Fees				2	1		5	**33.4%**	#6
Scheduled Flights	1						2	11.1%	#13
Flight Delays	1						2	11.1%	#13
Weather Conditions	1		1				3	**22.3%**	#10

Data Type Totals by Projected Availability

Data Type / *frequency => availability =>*	TOTALS				Percentage				Ranking				Under 5 years*			Overall**
	now	<5 yrs	>5yrs	future	now	<5 yrs	>5yrs	future	now	<5 yrs	>5yrs	future	Total	%	RANK	Rank
Roadway Closures	1	1	1	0	7%	7%	7%	0%	#6	#3	#1	-	2	**13%**	#5	#6
Roadway Traffic Conditions	0	1	0	0	0%	7%	0%	0%	-	#3	-	-	1	7%	#9	#13
Roadway Surface Conditions	0	1	0	0	0%	7%	0%	0%	-	#3	-	-	1	7%	#9	#13
Incidents	2	1	0	1	13%	7%	0%	7%	#2	#3	-	#6	3	**20%**	#3	#4
Construction Operations	0	1	0	2	0%	7%	0%	13%	-	#3	-	#5	1	7%	#9	#6
Maintainance Operations	0	1	0	3	0%	7%	0%	20%	-	#3	-	#3	1	7%	#9	#4
Link Travel Time Data	0	0	0	0	0%	0%	0%	0%	-	-	-	-	0	0%	-	-
Traffic Signal Timing Plan	2	0	0	0	13%	0%	0%	0%	#2	-	-	-	2	**13%**	#5	#10
Traffic Signal Malfunctions	2	1	0	0	13%	7%	0%	0%	#2	#3	-	-	3	**20%**	#3	#6
Alternative Routes	0	1	0	1	0%	7%	0%	7%	-	#3	-	#6	1	7%	#9	#10
Route Planning	0	0	0	0	0%	0%	0%	0%	-	-	-	-	0	0%	-	-
Ridesharing/Carpooling	0	0	0	1	0%	0%	0%	7%	-	-	-	#6	0	0%	-	#13
Transit Schedules	3	2	0	4	20%	13%	0%	27%	#1	#2	-	#2	5	**33%**	#2	#1
Vehicle Locations	2	4	0	1	13%	27%	0%	7%	#2	#1	-	#6	6	**40%**	#1	#3
Transit Fares	1	1	0	7	7%	7%	0%	47%	#6	#3	-	#1	2	**13%**	#5	#1
Toll Pricing	0	0	0	0	0%	0%	0%	0%	-		-	-	0	0%	-	-
Itinerary Planning	0	0	0	0	0%	0%	0%	0%	-	-	-	-	0	0%	-	-
Parking Availability	0	0	0	1	0%	0%	0%	7%	-	-	-	#6	0	0%	-	#13
Parking Fees	0	0	0	3	0%	0%	0%	20%	-	-	-	#3	0	0%	-	#6
Scheduled Flights	1	0	0	0	7%	0%	0%	0%	#6	-	-	-	1	7%	#9	#13
Flight Delays	1	0	0	0	7%	0%	0%	0%	#6	-	-	-	1	7%	#9	#13
Weather Conditions	1	1	0	0	7%	7%	0%	0%	#6	#3	-	-	2	**13%**	#5	#10

KEY

Percentage = % of Respondants selecting data type

Ranking= Ranked in order of most available types of data (top 10 data types are bold)

now = data type available now

< 5yr = data available in less than 5 years

> 5yr = data available in more than 5 years

future = data available at unknown point in the future

other = no frequency specified

*= now + < 5yrs

**= now + < 5yrs + >5yrs + future

Table B-6 Frequency of Data Availability - Provide Weather Information

frequency =>	Real-time				Hourly				Daily				Weekly				Monthly				Other	TOTAL	%	RANK
Data Type availability =>	now	<5 yrs	>5yrs	future	now	<5 yrs	>5yrs	future	now	<5 yrs	>5yrs	future	now	<5 yrs	>5yrs	future	now	<5 yrs	>5yrs	future	no frequency	out of 9		
Roadway Closures	2	2	1	1	1																	7	**77.8%**	#2
Roadway Traffic Conditions	4		1	1																		6	**66.7%**	#4
Roadway Surface Conditions	1	2	1	2	1					1												8	**88.9%**	#1
Incidents	4		1	2																		7	**77.8%**	#2
Construction Operations	1		1	1		2																5	**55.6%**	#7
Maintainance Operations	1		1	1		2																5	**55.6%**	#7
Link Travel Time Data	3																					3	33.3%	#11
Traffic Signal Timing Plan	2	1																				3	33.3%	#11
Traffic Signal Malfunctions	1	1																				2	22.2%	#16
Alternative Routes	1	1	1											2								5	**55.6%**	#7
Route Planning	1	2	1							2												6	**66.7%**	#4
Ridesharing/Carpooling											2											2	22.2%	#16
Transit Schedules	2																					2	22.2%	#16
Vehicle Locations	3		1																			4	44.4%	#10
Transit Fares						2																2	22.2%	#16
Toll Pricing																						0	0.0%	-
Itinerary Planning		1									2											3	33.3%	#11
Parking Availability	1									2												3	33.3%	#11
Parking Fees										2												2	22.2%	#16
Scheduled Flights		2																				2	22.2%	#16
Flight Delays	1	2																				3	33.3%	#11
Weather Conditions	4		1		1																	6	**66.7%**	#4

Data Type Totals by Projected Availability

Data Type availability =>	TOTALS				Percentage				Ranking				Under 5 years*			Overall**
	now	<5 yrs	>5yrs	future	now	<5 yrs	>5yrs	future	now	<5 yrs	>5yrs	future	Total	%	RANK	Rank
Roadway Closures	3	2	1	1	33%	22%	11%	11%	#4	#4	#3	#3	5	**56%**	#1	#2
Roadway Traffic Conditions	4	0	1	1	44%	0%	11%	11%	#2	-	#3	#3	4	**44%**	#5	#4
Roadway Surface Conditions	2	3	1	2	22%	33%	11%	22%	#7	#2	#3	#1	5	**56%**	#1	#1
Incidents	4	0	1	2	44%	0%	11%	22%	#2	-	#3	#1	4	**44%**	#5	#2
Construction Operations	1	2	1	1	11%	22%	11%	11%	#10	#4	#3	#3	3	**33%**	#8	#7
Maintainance Operations	1	2	1	1	11%	22%	11%	11%	#10	#4	#3	#3	3	**33%**	#8	#7
Link Travel Time Data	3	0	0	0	33%	0%	0%	0%	#4	-	-	-	3	**33%**	#8	#11
Traffic Signal Timing Plan	2	1	0	0	22%	11%	0%	0%	#7	#12	-	-	3	**33%**	#8	#11
Traffic Signal Malfunctions	1	1	0	0	11%	11%	0%	0%	#10	#12	-	-	2	22%	#15	#16
Alternative Routes	1	3	1	0	11%	33%	11%	0%	#10	#2	#3	-	4	**44%**	#5	#7
Route Planning	1	4	1	0	11%	44%	11%	0%	#10	#1	#3	-	5	**56%**	#1	#4
Ridesharing/Carpooling	0	0	2	0	0%	0%	22%	0%	-	-	#1	-	0	0%	-	#16
Transit Schedules	2	0	0	0	22%	0%	0%	0%	#7	-	-	-	2	22%	#15	#16
Vehicle Locations	3	0	1	0	33%	0%	11%	0%	#4	#12	#3	-	3	**33%**	#8	#10
Transit Fares	0	2	0	0	0%	22%	0%	0%	-	#4	-	-	2	22%	#15	#16
Toll Pricing	0	0	0	0	0%	0%	0%	0%	-	-	-	-	0	0%	-	-
Itinerary Planning	0	1	2	0	0%	11%	22%	0%	-	#12	#1	-	1	11%	#20	#11
Parking Availability	1	2	0	0	11%	22%	0%	0%	#10	#4	-	-	3	**33%**	#8	#11
Parking Fees	0	2	0	0	0%	22%	0%	0%	-	#4	-	-	2	22%	#15	#16
Scheduled Flights	0	2	0	0	0%	22%	0%	0%	-	#4	-	-	2	22%	#15	#16
Flight Delays	1	2	0	0	11%	22%	0%	0%	#10	#4	-	-	3	**33%**	#8	#11
Weather Conditions	5	0	1	0	**56%**	**0%**	**11%**	0%	#1	-	#3	-	5	**56%**	#1	#4

KEY

Percentage = % of Respondants selecting data type

Ranking= Ranked in order of most available types of data (top 10 data types are bold)

now = data type available now

< 5yr = data available in less than 5 years

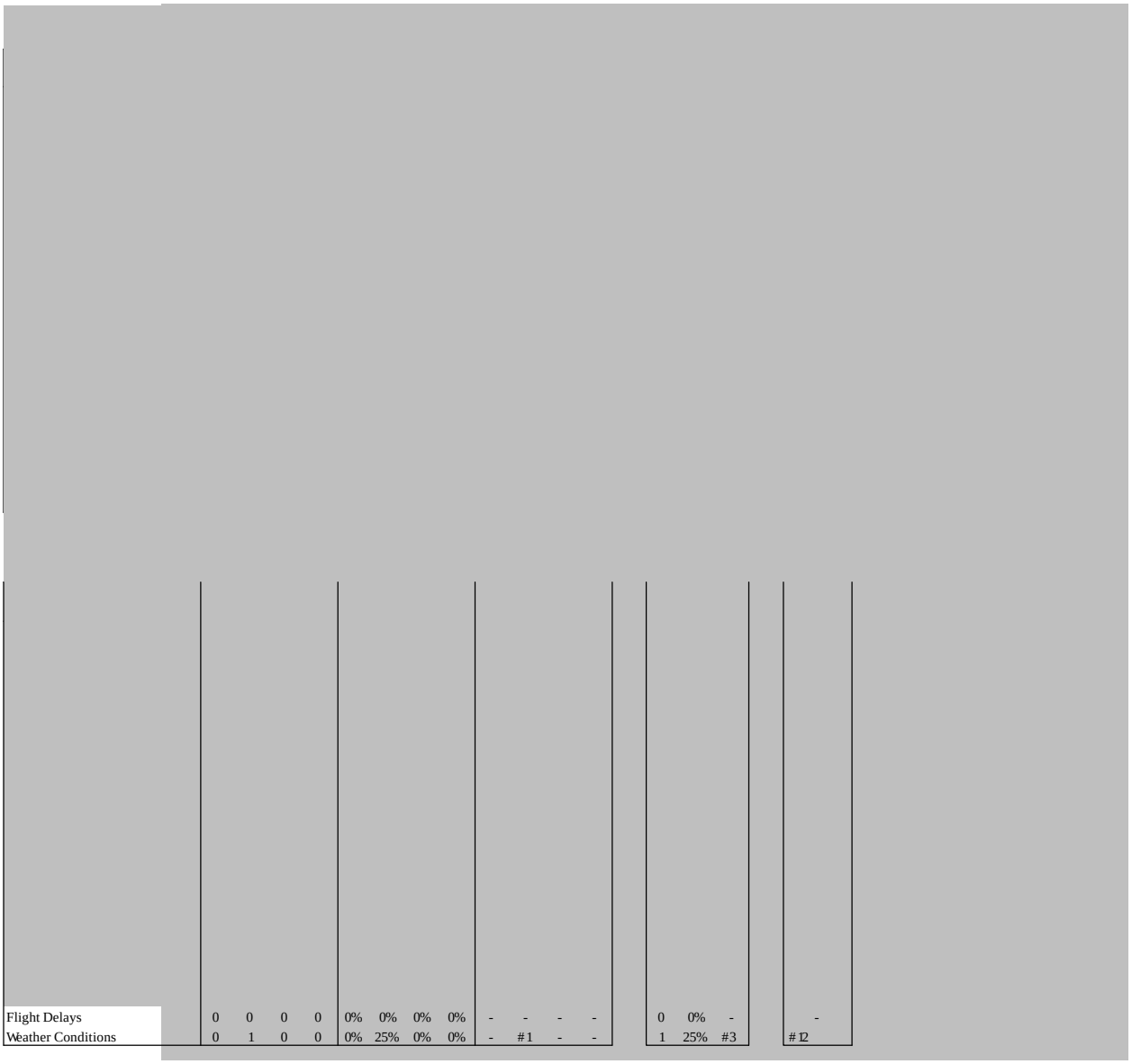
> 5yr = data available in more than 5 years

future = data available at unknown point in the future

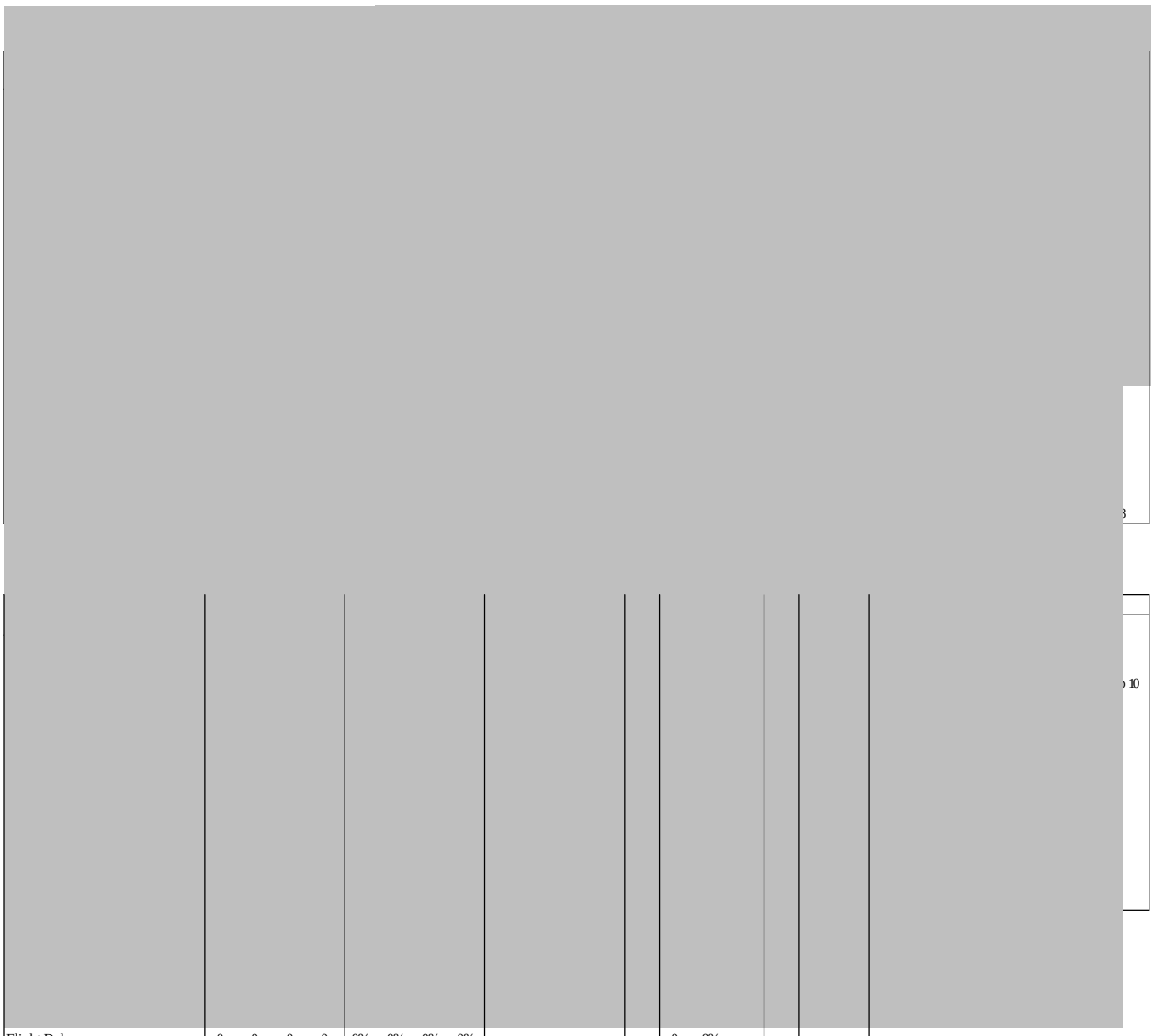
other = no frequency specified

*= now + < 5yrs

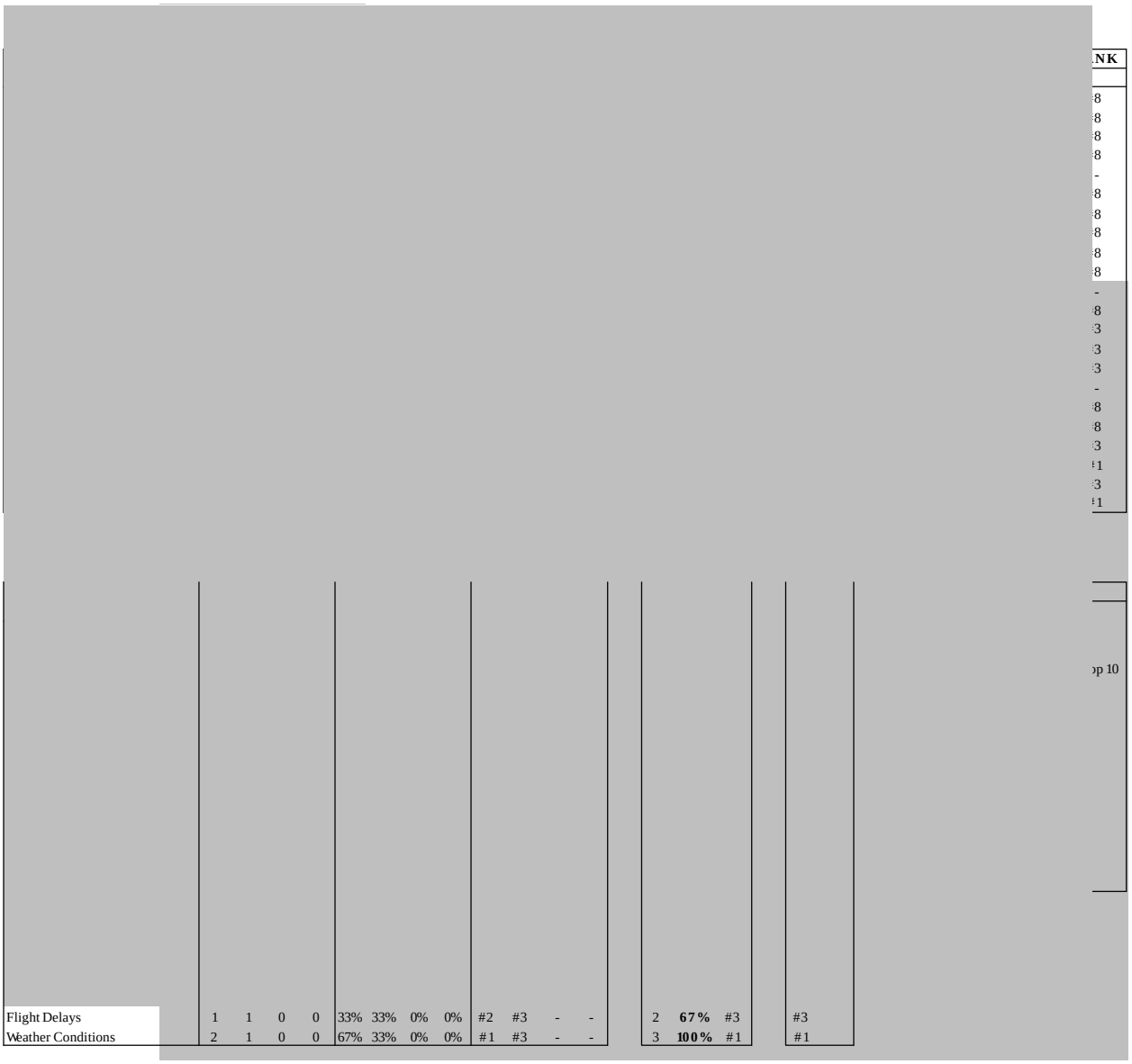
**= now + < 5yrs + >5yrs + future



Flight Delays	0	0	0	0	0%	0%	0%	0%	-	-	-	-	0	0%	-	-	
Weather Conditions	0	1	0	0	0%	25%	0%	0%	-	#1	-	-	1	25%	#3	#12	



Flight Delays	0	0	0	0	0%	0%	0%	0%	-	-	-	-	0	0%	-	-
Weather Conditions	0	0	0	1	**0%**	**0%**	**0%**	33%	-	-	-	#8	0	**0%**	-	#8



Flight Delays		1	1	0	0	33%	33%	0%	0%	#2	#3	-	-	2	**67%**	#3	#3
Weather Conditions		2	1	0	0	67%	33%	0%	0%	#1	#3	-	-	3	**100%**	#1	#1

Toll Pricing				1	
Itinerary Planning			1		
Parking Availability		2			
Parking Fees					
Scheduled Flights		1			
Flight Delays		3			
Weather Conditions	4	3	2	3	1

Data Type Totals by Project

	TOTALS				Percentage				Ranking				Under 5 years*			Overall**
Data Type availability =>	now	<5 yrs	>5yrs	future	now	<5 yrs	>5yrs	future	now	<5 yrs	>5yrs	future	Total	%	RANK	Rank
Roadway Closures	4	12	0	7	15%	44%	0%	26%	#8	#2	-	#1	16	**59%**	#2	#2
Roadway Traffic Conditions	8	7	1	7	30%	26%	4%	26%	#1	#6	#7	#1	15	**56%**	#4	#2
Roadway Surface Conditions	7	8	1	7	26%	30%	4%	26%	#2	#4	#7	#1	15	**56%**	#4	#2
Incidents	6	7	1	6	22%	26%	4%	22%	#4	#5	#7	#5	13	**48%**	#6	#6
Construction Operations	4	13	0	7	15%	48%	0%	26%	#8	#1	-	#1	17	**63%**	#1	#1
Maintainance Operations	4	12	0	5	15%	44%	0%	19%	#8	#2	-	#6	16	**59%**	#2	#5
Link Travel Time Data	5	3	0	2	19%	11%	0%	7%	#6	#12	-	#11	8	30%	#11	#11
Traffic Signal Timing Plan	6	4	1	3	22%	15%	4%	11%	#4	#7	#7	#8	10	**37%**	#8	#9
Traffic Signal Malfunctions	7	4	1	3	26%	15%	4%	11%	#2	#7	#7	#8	11	**41%**	#7	#7
Alternative Routes	1	8	2	2	4%	30%	7%	7%	#13	#4	#3	#11	9	**33%**	#9	#10
Route Planning	1	4	2	0	4%	15%	7%	0%	#13	#7	#3	-	5	19%	#12	#12
Ridesharing/Carpooling	0	1	3	3	0%	4%	11%	11%	-	#18	#1	#8	1	4%	#20	#12
Transit Schedules	2	3	0	1	7%	11%	0%	4%	#11	#12	-	#13	5	19%	#12	#15
Vehicle Locations	2	2	2	1	7%	7%	7%	4%	#11	#17	#3	#13	4	15%	#14	#12
Transit Fares	0	4	0	0	0%	15%	0%	0%	-	#7	-	-	4	15%	#14	#16
Toll Pricing	0	1	0	1	0%	4%	0%	4%	-	#18	-	#13	1	4%	#20	#22
Itinerary Planning	0	0	3	0	0%	0%	11%	0%	-	-	#1	-	0	0%	-	#20
Parking Availability	0	2	1	1	0%	7%	4%	4%	-	#17	#7	#13	2	7%	#19	#16
Parking Fees	0	3	0	1	0%	11%	0%	4%	-	#12	-	#13	3	11%	#16	#16
Scheduled Flights	0	3	0	1	0%	11%	0%	4%	-	#12	-	#13	3	11%	#16	#16
Flight Delays	0	3	0	0	0%	11%	0%	0%	-	#12	-	-	3	11%	#16	#20
Weather Conditions	5	4	2	4	19%	15%	7%	15%	#6	#7	#3	#7	9	**33%**	#9	#7

KEY

Percentage = % of Respondants selecting data type

Ranking= Ranked in order of most desired types of data (top 10 data types are bold)

now = data type desired now

< 5yr = data desired in less than 5 years

> 5yr = data desired in more than 5 years

future = data desired at unknown point in the future

other = no frequency specified

*= now + < 5yrs

**= now + < 5yrs + >5yrs + future

Data Type	*frequen availabili*
Roadway Closures	
Roadway Traffic Conditions	
Roadway Surface Condition	
Incidents	
Construction Operations	
Maintainance Operations	
Link Travel Time Data	
Traffic Signal Timing Plan	
Traffic Signal Malfunctions	
Alternative Routes	
Route Planning	
Ridesharing/Carpooling	
Transit Schedules	
Vehicle Locations	
Transit Fares	
Toll Pricing	
Itinerary Planning	
Parking Availability	
Parking Fees	
Scheduled Flights	
Flight Delays	
Weather Conditions	

Data T

Data Type	*availabili*																
Roadway Closures																	
Roadway Traffic Conditions																	
Roadway Surface Condition																	
Incidents																	
Construction Operations																	
Maintainance Operations																	
Link Travel Time Data																	
Traffic Signal Timing Plan																	
Traffic Signal Malfunctions																	
Alternative Routes																	
Route Planning																	
Ridesharing/Carpooling																	
Transit Schedules																	
Vehicle Locations																	
Transit Fares																	
Toll Pricing																	
Itinerary Planning																	
Parking Availability																	
Parking Fees																	
Scheduled Flights																	
Flight Delays		0	2	1	1	0%	7%	4%	4%	-	#13	#5	#16	2	7%	#15	#15
Weather Conditions		3	4	1	6	11%	15%	4%	22%	#7	#7	#5	#4	7	**26%**	#8	#7

							1	1		2	7.7%	#22
	2									3	11.5%	#21
	1	1			1		1	1		9	34.6%	# 13
2		1	1				2	1		7	26.9%	# 17
2		1				1				5	19.2%	# 19
										4	15.4%	#20
		1	2	1				1		13	**50.0%**	#9

ted Desirability

Data Type *availabili*					Percentage				Ranking				Under 5 years*			Overall**
						<5 yrs	>5yrs	future	now	<5 yrs	>5yrs	future	Total	%	RANK	Rank
Roadway Closures						35%	0%	15%	#3	# 1	-	#4	17	**65%**	# 1	# 1
Roadway Traffic Conditions						15%	4%	19%	# 1	#9	#6	# 1	13	**50%**	#5	#3
Roadway Surface Condition						19%	4%	19%	# 1	#7	#6	# 1	14	**54%**	#2	#2
Incidents						27%	0%	19%	#6	#3	-	# 1	14	**54%**	#2	#3
Construction Operations						35%	0%	15%	#9	# 1	-	#4	14	**54%**	#2	#5
Maintainance Operations						27%	0%	4%	# 13	#3	-	# 13	11	**42%**	#9	# 12
Link Travel Time Data						23%	0%	12%	#7	#6	-	#7	12	**46%**	#6	#7
Traffic Signal Timing Plan						12%	4%	4%	#3	# 11	#6	# 13	11	**42%**	#9	#9
Traffic Signal Malfunctions						15%	4%	8%	#3	#9	#6	#9	12	**46%**	#6	#7
Alternative Routes						27%	8%	12%	#9	#3	#3	#7	12	**46%**	#6	#6
Route Planning						19%	8%	4%	#9	#7	#3	# 13	10	38%	# 11	#9
Ridesharing/Carpooling						0%	12%	8%	# 15	-	# 1	#9	3	12%	#20	# 15
Transit Schedules						4%	0%	8%	#7	# 19	-	#9	7	27%	# 13	# 13
Vehicle Locations						8%	8%	8%	# 18	# 17	#3	#9	4	15%	# 17	# 15
Transit Fares						12%	0%	4%	# 15	# 11	-	# 13	6	23%	# 15	# 17
Toll Pricing						0%	0%	4%	#20	-	-	# 13	1	4%	#21	#22
Itinerary Planning						0%	12%	0%	-	-	# 1	-	0	0%	-	#21
Parking Availability						12%	4%	4%	# 13	# 11	#6	# 13	7	27%	# 13	# 13
Parking Fees						12%	0%	4%	# 15	# 11	-	# 13	6	23%	# 15	# 17
Scheduled Flights						8%	0%	4%	# 18	# 17	-	# 13	4	15%	# 17	# 19
Flight Delays	1	3	0	0	4%	12%	0%	0%	#20	# 11	-	-	4	15%	# 17	#20
Weather Conditions	5	3	1	4	**19%**	**12%**	**4%**	15%	#9	# 11	#6	#4	8	**31%**	# 12	#9

KEY
Percentage = % of Respondants selecting data type
Ranking= Ranked in order of most desired types of data (top 10 data types are bold)
now = data type desired now
< 5yr = data desired in less than 5 years
> 5yr = data desired in more than 5 years
future = data desired at unknown point in the future
other = no frequency specified
*= now + < 5yrs
**= now + < 5yrs + >5yrs + future

Data Type	*frequen availabili*														
Roadway Closures															
Roadway Traffic Conditions															
Roadway Surface Condition															
Incidents															
Construction Operations															
Maintainance Operations															
Link Travel Time Data															
Traffic Signal Timing Plan															
Traffic Signal Malfunctions															
Alternative Routes															
Route Planning															
Ridesharing/Carpooling															
Transit Schedules															
Vehicle Locations															
Transit Fares															
Toll Pricing															
Itinerary Planning															
Parking Availability															
Parking Fees															
Scheduled Flights															
Flight Delays															
Weather Conditions															

Data T

Data Type	*availabili*					Percentage			Ranking			Under 5 years*			Overall**	KEY
						<5 yrs	>5yrs	future	now	<5 yrs	>5yrs	future	Total	%	RANK	Rank	Percentage = % of Respondants selecting data type
Roadway Closures						43%	4%	26%	-	#1	#9	#3	**10**	**43%**	#1	#1	Ranking= Ranked in order of most desired types of data (top 10 data types are bold)
Roadway Traffic Conditions						22%	9%	35%	#2	#8	#1	#1	8	**35%**	#6	#9	now = data type desired now
Roadway Surface Condition						26%	9%	35%	#2	#6	#1	#1	9	**39%**	#4	#9	< 5yr = data desired in less than 5 years
Incidents						30%	4%	26%	#2	#4	#9	#3	**10**	**43%**	#1	#2	> 5yr = data desired in more than 5 years
Construction Operations						39%	4%	26%	#10	#2	#9	#3	**10**	**43%**	#1	#3	future = data desired at unknown point in the future
Maintainance Operations						35%	4%	26%	#10	#3	#9	#3	9	**39%**	#4	#3	other = no frequency specified
Link Travel Time Data						22%	0%	22%	#7	#8	-	#7	7	**30%**	#8	#13	*= now + < 5yrs
Traffic Signal Timing Plan						13%	0%	13%	#1	#13	-	#11	7	**30%**	#8	#6	**= now + < 5yrs + >5yrs + future
Traffic Signal Malfunctions						22%	0%	17%	#2	#8	-	#10	8	**35%**	#6	#6	
Alternative Routes						30%	9%	22%	-	#4	#1	#7	7	**30%**	#8	#5	
Route Planning						26%	9%	9%	-	#6	#1	#13	6	26%	#12	#9	
Ridesharing/Carpooling						4%	9%	4%	-	#20	#1	#14	1	4%	#20	#20	
Transit Schedules						13%	4%	0%	#7	#13	#9	-	5	22%	#13	#13	
Vehicle Locations						9%	9%	13%	#7	#18	#1	#11	4	17%	#14	#12	
Transit Fares						17%	0%	0%	-	#11	-	-	4	17%	#14	#13	
Toll Pricing						4%	0%	4%	-	#20	-	#14	1	4%	#20	-	
Itinerary Planning						0%	9%	4%	-	-	#1	#14	0	0%	-	#20	
Parking Availability						9%	9%	0%	-	#18	#1	-	2	9%	#19	#18	
Parking Fees						13%	4%	4%	-	#13	#9	#14	3	13%	#16	#18	
Scheduled Flights						13%	4%	4%	-	#13	#9	#14	3	13%	#16	#13	
Flight Delays		0	3	1	1	0%	13%	4%	-	#13	#9	#14	3	13%	#16	#13	
Weather Conditions		3	4	0	5	**13%**	**17%**	**0%**	22%	#2	#11	-	#7	7	**30%**	#8	#6

Data Type	*frequen availabili*
Roadway Closures	
Roadway Traffic Conditions	
Roadway Surface Condition	
Incidents	
Construction Operations	
Maintainance Operations	
Link Travel Time Data	
Traffic Signal Timing Plan	
Traffic Signal Malfunctions	
Alternative Routes	
Route Planning	
Ridesharing/Carpooling	
Transit Schedules	
Vehicle Locations	
Transit Fares	
Toll Pricing	
Itinerary Planning	
Parking Availability	
Parking Fees	
Scheduled Flights	
Flight Delays	
Weather Conditions	

Data T

Data Type	*availabili*					Percentage			Ranking			Under 5 years*			Overall**
						<5 yrs	>5yrs	future	now	<5 yrs	>5yrs	future	Total	%	RANK	Rank
Roadway Closures						27%	0%	13%	#1	#1	-	#5	5	**33%**	#1	#1
Roadway Traffic Conditions						13%	7%	20%	-	#5	#1	#1	2	**13%**	#7	#2
Roadway Surface Condition						13%	7%	20%	-	#5	#1	#1	2	**13%**	#7	#2
Incidents						20%	0%	13%	#1	#3	-	#5	4	**27%**	#2	#2
Construction Operations						27%	0%	7%	-	#1	-	#12	4	**27%**	#2	#6
Maintainance Operations						20%	0%	0%	-	#3	-	-	3	**20%**	#4	#12
Link Travel Time Data						13%	0%	7%	-	#5	-	#12	2	**13%**	#7	#12
Traffic Signal Timing Plan						7%	0%	7%	#1	#12	-	#12	2	**13%**	#7	#12
Traffic Signal Malfunctions						13%	0%	13%	-	#5	-	#5	2	**13%**	#7	#9
Alternative Routes						7%	7%	13%	#1	#12	#1	#5	2	**13%**	#7	#6
Route Planning						7%	7%	7%	-	#12	#1	#12	1	7%	#14	#12
Ridesharing/Carpooling						0%	0%	7%	-	-	-	#12	0	0%	-	#20
Transit Schedules						13%	0%	20%	#1	#5	-	#1	3	**20%**	#4	#2
Vehicle Locations						7%	7%	13%	-	#12	#1	#5	1	7%	#14	#9
Transit Fares						13%	0%	13%	#1	#5	-	#5	3	**20%**	#4	#6
Toll Pricing						0%	0%	7%	-	-	-	#12	0	0%	-	#20
Itinerary Planning						0%	7%	13%	-	-	#1	#5	0	0%	-	#12
Parking Availability						7%	7%	0%	-	#12	#1	-	1	7%	#14	#17
Parking Fees						0%	7%	7%	-	-	#1	#12	0	0%	-	#17
Scheduled Flights						0%	0%	0%	-	-	-	-	0	0%	-	-
Flight Delays		0	2	0	0	0%	13%	0%	0%	-	#5	-	-	2	**13%**	#7
Weather Conditions		0	1	0	3	0%	7%	0%	20%	-	#12	-	#1	1	7%	#14

KEY

Percentage = % of Respondants selecting data type

Ranking= Ranked in order of most desired types of data (top 10 data types are bold)

now = data type desired now

< 5yr = data desired in less than 5 years

> 5yr = data desired in more than 5 years

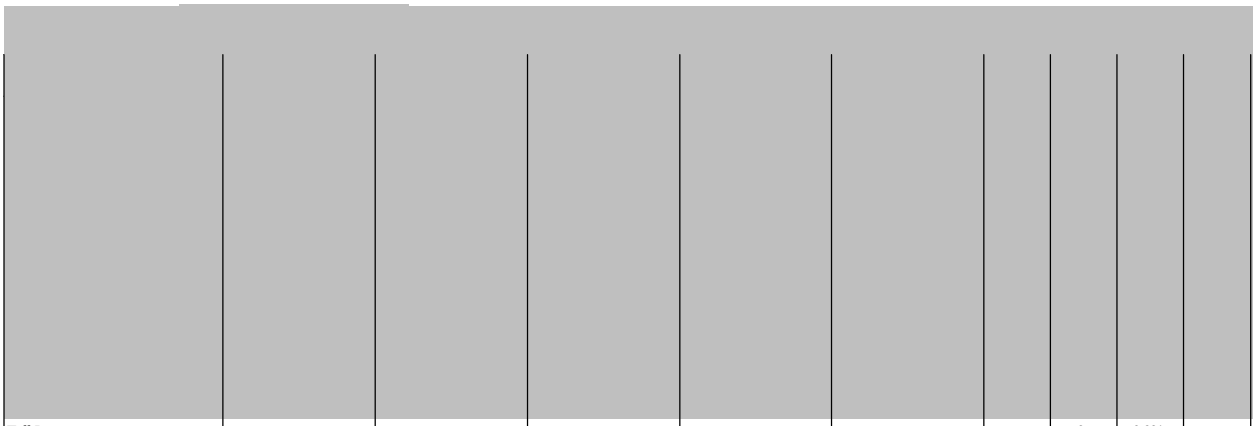
future = data desired at unknown point in the future

other = no frequency specified

*= now + < 5yrs

**= now + < 5yrs + >5yrs + future

Data Type *availability =>*	TOTALS																
	now	<5 yrs	>5yrs	future	now												
Roadway Closures	4	3	0	1	50%												
Roadway Traffic Conditions	6	1	0	1	75%												
Roadway Surface Conditions	6	1	0	1	75%												
Incidents	5	1	0	1	63%												
Construction Operations	3	2	0	1	38%												
Maintainance Operations	3	2	0	1	38%												
Link Travel Time Data	5	1	0	1	63%												
Traffic Signal Timing Plan	3	0	0	1	38%												
Traffic Signal Malfunctions	5	1	0	1	63%												
Alternative Routes	3	4	0	1	38%												
Route Planning	2	2	0	1	25%												
Ridesharing/Carpooling	0	1	2	0	0%												
Transit Schedules	3	0	0	0	38%												
Vehicle Locations	2	2	0	0	25%												
Transit Fares	0	0	0	0	0%												
Toll Pricing	0	0	0	0	0%												
Itinerary Planning	0	0	2	0	0%												
Parking Availability	1	2	0	0	13%												
Parking Fees	0	2	0	0	0%												
Scheduled Flights	1	2	0	0	13%												
Flight Delays	1	3	0	0	13%	38%	0%	0%	#15	#2	-	-	4	**50%**	#10	#12	
Weather Conditions	6	1	0	0	75%	13%	0%	0%	#1	#11	-	-	7	**88%**	#1	#5	



Toll Pricing									0	0.0%	-
Itinerary Planning									0	0.0%	-
Parking Availability		1		1					2	**50.0%**	#9
Parking Fees					1				1	25.0%	#14
Scheduled Flights									0	0.0%	-
Flight Delays	1								1	25.0%	#14
Weather Conditions		1	1						2	**50.0%**	#9

Data Type Totals by Projected Desirability

Data Type *availability =>*	TOTALS				Percentage				Ranking				Under 5 years*			Overall**
	now	<5 yrs	>5yrs	future	now	<5 yrs	>5yrs	future	now	<5 yrs	>5yrs	future	Total	%	RANK	Rank
Roadway Closures	1	1	0	2	25%	25%	0%	50%	#3	#4	-	#1	2	**50%**	#4	#1
Roadway Traffic Conditions	1	0	1	2	25%	0%	25%	50%	#3	-	#1	#1	1	25%	#7	#1
Roadway Surface Conditions	1	0	1	2	25%	0%	25%	50%	#3	-	#1	#1	1	25%	#7	#1
Incidents	1	2	0	1	25%	50%	0%	25%	#3	#1	-	#5	3	**75%**	#1	#1
Construction Operations	1	2	0	1	25%	50%	0%	25%	#3	#1	-	#5	3	**75%**	#1	#1
Maintainance Operations	1	2	0	1	25%	50%	0%	25%	#3	#1	-	#5	3	**75%**	#1	#1
Link Travel Time Data	0	0	0	1	0%	0%	0%	25%	-	-	-	#5	0	0%	-	#14
Traffic Signal Timing Plan	2	0	0	1	50%	0%	0%	25%	#1	-	-	#5	2	**50%**	#4	#8
Traffic Signal Malfunctions	2	0	0	2	50%	0%	0%	50%	#1	-	-	#1	2	**50%**	#4	#1
Alternative Routes	0	1	0	1	0%	25%	0%	25%	-	#4	-	#5	1	25%	#7	#9
Route Planning	0	0	1	0	0%	0%	25%	0%	-	-	#1	-	0	0%	-	#14
Ridesharing/Carpooling	0	0	0	0	0%	0%	0%	0%	-	-	-	-	0	0%	-	-
Transit Schedules	0	1	0	0	0%	25%	0%	0%	-	#4	-	-	1	25%	#7	#14
Vehicle Locations	0	0	1	1	0%	0%	25%	25%	-	-	#1	#5	0	0%	-	#9
Transit Fares	0	1	0	1	0%	25%	0%	25%	-	#4	-	#5	1	25%	#7	#9
Toll Pricing	0	0	0	0	0%	0%	0%	0%	-	-	-	-	0	0%	-	-
Itinerary Planning	0	0	0	0	0%	0%	0%	0%	-	-	-	-	0	0%	-	-
Parking Availability	0	0	1	1	0%	0%	25%	25%	-	-	#1	#5	0	0%	-	#9
Parking Fees	0	1	0	0	0%	25%	0%	0%	-	#4	-	-	1	25%	#7	#14
Scheduled Flights	0	0	0	0	0%	0%	0%	0%	-	-	-	-	0	0%	-	-
Flight Delays	0	1	0	0	0%	25%	0%	0%	-	#4	-	-	1	25%	#7	#14
Weather Conditions	0	1	0	1	0%	25%	0%	25%	-	#4	-	#5	1	25%	#7	#9

KEY

Percentage = % of Respondants selecting data type

Ranking= Ranked in order of most desired types of data (top 10 data types are bold)

now = data type desired now

< 5yr = data desired in less than 5 years

> 5yr = data desired in more than 5 years

future = data desired at unknown point in the future

other = no frequency specified

*= now + < 5yrs

**= now + < 5yrs + >5yrs + future

Data Type	*frequen availabili*
Roadway Closures	
Roadway Traffic Conditions	
Roadway Surface Conditior	
Incidents	
Construction Operations	
Maintainance Operations	
Link Travel Time Data	
Traffic Signal Timing Plan	
Traffic Signal Malfunctions	
A lternative Routes	
Route Planning	
Ridesharing/Carpooling	
Transit Schedules	
Vehicle Locations	
Transit Fares	
Toll Pricing	
Itinerary Planning	
Parking Availability	
Parking Fees	
Scheduled Flights	
Flight Delays	
Weather Conditions	

Data

Data Type	*availabili*																
Roadway Closures																	
Roadway Traffic Conditions																	
Roadway Surface Conditior																	
Incidents																	
Construction Operations																	
Maintainance Operations																	
Link Travel Time Data																	
Traffic Signal Timing Plan																	
Traffic Signal Malfunctions																	
A lternative Routes																	
Route Planning																	
Ridesharing/Carpooling																	
Transit Schedules																	
Vehicle Locations																	
Transit Fares																	
Toll Pricing																	
Itinerary Planning																	
Parking Availability																	
Parking Fees																	
Scheduled Flights																	
Flight Delays		0	0	0	2	0%	0%	0%	67%	-	-	-	#2	0	0%	-	#7
Weather Conditions		1	0	0	2	33%	0%	0%	67%	#1	-	-	#2	1	**33%**	#1	#1

Table B-18 Frequ

frequency =>	**Real-time**																	
Data Type *availability =>*	now	<5 yrs	>5yrs	future	now													
Roadway Closures				1														
Roadway Traffic Conditions				1														
Roadway Surface Conditions				1														
Incidents				1														
Construction Operations				1														
Maintainance Operations				1														
Link Travel Time Data																		
Traffic Signal Timing Plan																		
Traffic Signal Malfunctions				1														
Alternative Routes				1														
Route Planning																		
Ridesharing/Carpooling																		
Transit Schedules																		
Vehicle Locations				1														
Transit Fares																		
Toll Pricing																0	0.0%	-
Itinerary Planning																0	0.0%	-
Parking Availability	1			1												2	**66.7%**	#1
Parking Fees	1															1	33.3%	#5
Scheduled Flights																0	0.0%	-
Flight Delays	1	1														2	**66.7%**	#1
Weather Conditions	1			1												2	**66.7%**	#1

Data Type Totals by Projected Desirability

Data Type *availability =>*	**TOTALS**				**Percentage**				**Ranking**				**Under 5 years***			**Overall****
	now	<5 yrs	>5yrs	future	now	<5 yrs	>5yrs	future	now	<5 yrs	>5yrs	future	Total	%	RANK	Rank
Roadway Closures	0	0	0	1	0%	0%	0%	33%	-	-	-	#2	0	0%	-	#5
Roadway Traffic Conditions	0	0	0	1	0%	0%	0%	33%	-	-	-	#2	0	0%	-	#5
Roadway Surface Conditions	0	0	0	1	0%	0%	0%	33%	-	-	-	#2	0	0%	-	#5
Incidents	0	0	0	1	0%	0%	0%	33%	-	-	-	#2	0	0%	-	#5
Construction Operations	0	0	0	1	0%	0%	0%	33%	-	-	-	#2	0	0%	-	#5
Maintainance Operations	0	0	0	1	0%	0%	0%	33%	-	-	-	#2	0	0%	-	#5
Link Travel Time Data	0	0	0	0	0%	0%	0%	0%	-	-	-	-	0	0%	-	-
Traffic Signal Timing Plan	0	0	0	1	0%	0%	0%	33%	-	-	-	#2	0	0%	-	#5
Traffic Signal Malfunctions	0	0	0	1	0%	0%	0%	33%	-	-	-	#2	0	0%	-	#5
Alternative Routes	0	0	0	1	0%	0%	0%	33%	-	-	-	#2	0	0%	-	#5
Route Planning	0	0	0	0	0%	0%	0%	0%	-	-	-	-	0	0%	-	-
Ridesharing/Carpooling	0	0	0	0	0%	0%	0%	0%	-	-	-	-	0	0%	-	-
Transit Schedules	0	0	0	0	0%	0%	0%	0%	-	-	-	-	0	0%	-	-
Vehicle Locations	0	0	ERR	2	0%	0%	ERR	67%	-	-	-	#1	0	0%	-	#1
Transit Fares	0	0	0	0	0%	0%	0%	0%	-	-	-	-	0	0%	-	-
Toll Pricing	0	0	0	0	0%	0%	0%	0%	-	-	-	-	0	0%	-	-
Itinerary Planning	0	0	0	0	0%	0%	0%	0%	-	-	-	-	0	0%	-	-
Parking Availability	1	0	0	1	33%	0%	0%	33%	#1	-	-	#2	1	**33%**	#2	#1
Parking Fees	1	0	0	0	33%	0%	0%	0%	#1	-	-	-	1	**33%**	#2	#5
Scheduled Flights	0	0	0	0	0%	0%	0%	0%	-	-	-	-	0	0%	-	-
Flight Delays	1	1	0	0	33%	33%	0%	0%	#1	#1	-	-	2	**67%**	#1	#1
Weather Conditions	1	0	0	1	33%	0%	0%	33%	#1	-	-	#2	1	**33%**	#2	#1

KEY

Percentage = % of Respondants selecting data type
Ranking= Ranked in order of most desired types of data (top 10 data types are bold)
now = data type desired now
< 5yr = data desired in less than 5 years
> 5yr = data desired in more than 5 years
future = data desired at unknown point in the future
other = no frequency specified
*= now + < 5yrs
**= now + < 5yrs + >5yrs + future

APPENDIX C

DATA SOURCE INVENTORY

CONTENTS

C.1 - PARTIAL RESULTS OF DATA SOURCE INVENTORY

Table C-1 Partial Results of Data Source Inventory

Agency	Data Available	How data is transferred (Currently)	How Data will be transferred (Future)	Data Desired	Potential Interface with the Gateway
Conor Communications - *999 IPS	Incident information	Dedicated leased line to the C-TIC. No other outside connections.	Unknown	None	Dedicated line
Borman ATMS and InDOT Construction and Maintenance	Detector loops, VMS and HAR message information	Alphanumeric pages and voice telephone to response teams	Unknown	Accident data and travel time information from IDOT and WisDOT	Direct line - Client/Server type architecture
Chicago Skyway Construction & Maintenance	None	Receive updates via fax then send out via press releases	View through the Internet	Congestion and construction information on alternate expressways and downstream arterials	Unknown
Chicago 911 - Office of Emergency Communications	GEO - File database and City Map	Through the City mainframe via internal secure network	Unknown	None	Unknown
Chicago Signal System	Volume, speed, occupancy and signal failures	Through closed loop network	Unknown	Volumes, status of signal and traffic construction zones in real time	Internet real time maps
Chicago Skyway Electronic Toll Collection	Unknown at this time - Possible travel times in future	Unknown at this time	Unknown at this time	Unknown at this time	Unknown at this time

Table C-1 Partial Results of Data Source Inventory

Agency	Data Available	How data is transferred (Currently)	How Data will be transferred (Future)	Data Desired	Potential Interface with the Gateway
City of Milwaukee Traffic Signal System	None to date	---	Data would be received from the signal system via closed network	Possibly mainline and turning volumes and occupancies throughout the signal system network	Unknown
CTA Control Center	Bus travel time schedule adherence, detours and incidents along bus and rail routes	Buses are used as probes. Detour and incident information is radioed back to the center.	Unknown	Congestion information and surface conditions, incident and construction/ maintenance information	Leased line or hardwire connection
IDOT ETP GPS/AVL System	None to date	---	Undecided	Indiana & Illinois Tollway information	Unknown
IDOT Communications Center	Direction of flow of the reversible lanes on the Kennedy Expressway, HAR system, power outage information, information on flooded arterials and expressways.	Each of their systems are considered “stand alone.” The data is broadcast via radio frequencies.	Direct connection	Would like to receive all information that the C-TIC/Gateway receives via a “War Map”	Direct connection

Table C-1 Partial Results of Data Source Inventory

Agency	Data Available	How data is transferred (Currently)	How Data will be transferred (Future)	Data Desired	Potential Interface with the Gateway
IDOT Traffic Systems Center (TSC)	Loop detector data (volume and occupancy) on a one minute basis.	Various controllers send the data to the TSC where it is then sent via dedicated line to the C-TIC.	Unknown	Loop detector volume and occupancy, and incident detection algorithm output, and speed data	Unknown
IDOT Signal System	Volume and occupancy data and signal failure warnings for selected corridors	Via internal network system	Fax communication or possible Internet connection	Real time display of arterial systems	Unknown
Indiana State Police NW Dispatch	None, possibly incident information in future	Voice only telephone from Hoosier Helpers to confirm incident information	Direct connection	Connection to any InDOT system and a video feed from the Borman cameras	Direct connection or via the Internet
Indiana Tollway ETTM	Unknown at this time	---	Unknown at this time	Unknown at this time	Unknown at this time
InDOT Division of Tollroads Construction & Maintenance	Unknown at this time	---	Unknown at this time	Unknown at this time	Unknown at this time
STHA IPASS-2000 system	Volume, travel time and location along tollways	Via transponders in public vehicles to the collection computers. Then sent via leased line to the C-TIC.	Continue with the transponders and possibly the leased line.	Unknown at this time	Possibly continue with the leased line.

Table C-1 Partial Results of Data Source Inventory

Agency	Data Available	How data is transferred (Currently)	How Data will be transferred (Future)	Data Desired	Potential Interface with the Gateway
Metra	Schedule info and parking inventory	Fax or Phone (voice) and to the public via Internet.	Unknown at this time	Unknown at this time	Unknown at this time
Milwaukee County Sheriff's Department Dispatch	None at this time, will have a link to MONITOR in future	---	Unknown	Unknown	Unknown
Milwaukee County Transit System -- SmartTrack™ - Vehicle Management System	Unknown at this time	---	Unknown at this time	Unknown at this time	Unknown
MONITOR Freeway Traffic Management System	Volume, speed and occupancy, certain travel times, VMS/HAR messages and incident information on Milwaukee area freeways	Via direct links and microwave from field devices to necessary users, including dedicated line to the C-TIC.	To be investigated under CDSI project	Volume, speed, occupancy, incident and construction/ maintenance information from arterials in Milwaukee area	To be investigated under CDSI project
Northwest Central Dispatch (NWCD)	Incident information and signal malfunctions	Dedicated line to the C-TIC	---	None	Same as C-TIC.

Table C-1 Partial Results of Data Source Inventory

Agency	Data Available	How data is transferred (Currently)	How Data will be transferred (Future)	Data Desired	Potential Interface with the Gateway
Pace	None	---	Unknown	Roadway closures, roadway conditions, construction operations, traffic signal malfunctions, weather information conditions	Unknown
RTA	Itinerary routing including mode of transportation & schedules to the public	Telephone, kiosk, cable TV, Internet, etc.	Unknown, but preferably electronic	Schedules from CTA, Pace, Metra	Unknown
Scan Plus Surface Condition Analyzer Pavement and Weather Monitoring System (SSI)	Roadway surface and subsurface conditions including temperature	TCP/IP then dedicated line to the C-TIC	Unknown	Traffic volume data	Direct connection
Shadow Traffic	Expressway Travel times, incidents, road construction Arterials Incidents, construction, overall conditions	Dedicated voice lines, ISDN or dial-up teleprinter	Unknown	Existing IDOT, WisDOT travel time, volume, etc., messages on a better more consistent basis	Internet connection using existing PC's

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C.2 - DATA SOURCE INVENTORY OUTLINE

MMTIS- System and Data Source Inventory

Inventory Performed By: _____

Date: _____

System Name:

System Location:

Responsible Agency:

Name(s) of Contact(s),Phone #'s and E-mail addresses:

System Developer/Consultant:

System Description/Concept:

System Hardware Components: (include product name(s) and version number(s))

System Software: (include product name(s) and version number(s))

Network Type: (include product name(s) and version number(s))

Operating System: (include product name(s) and version number(s))

Database: (include product name(s) and version number(s))

Security Issues: (on State network, etc.)

Privacy Issues: (need to strip sensitive data, etc.)

Operating Mode: (24 hr. attended, unattended, etc.)

Location Referencing System:

Data Available:

Roadway Parameters: (Type and Frequency)

Event Information: (Type and Frequency)

Messages: Type and Frequency)

Data Desired:

Roadway Parameters: (Type and Frequency)

Event Information: (Type and Frequency)

Messages: Type and Frequency)

How to receive:

External Interfaces:

Data Users: (who, type of link/hookup)

Data Providers: (who, type of link/hookup)

Performance Data:

Potential Interface to C-TIC/Gateway:

Future Plans: