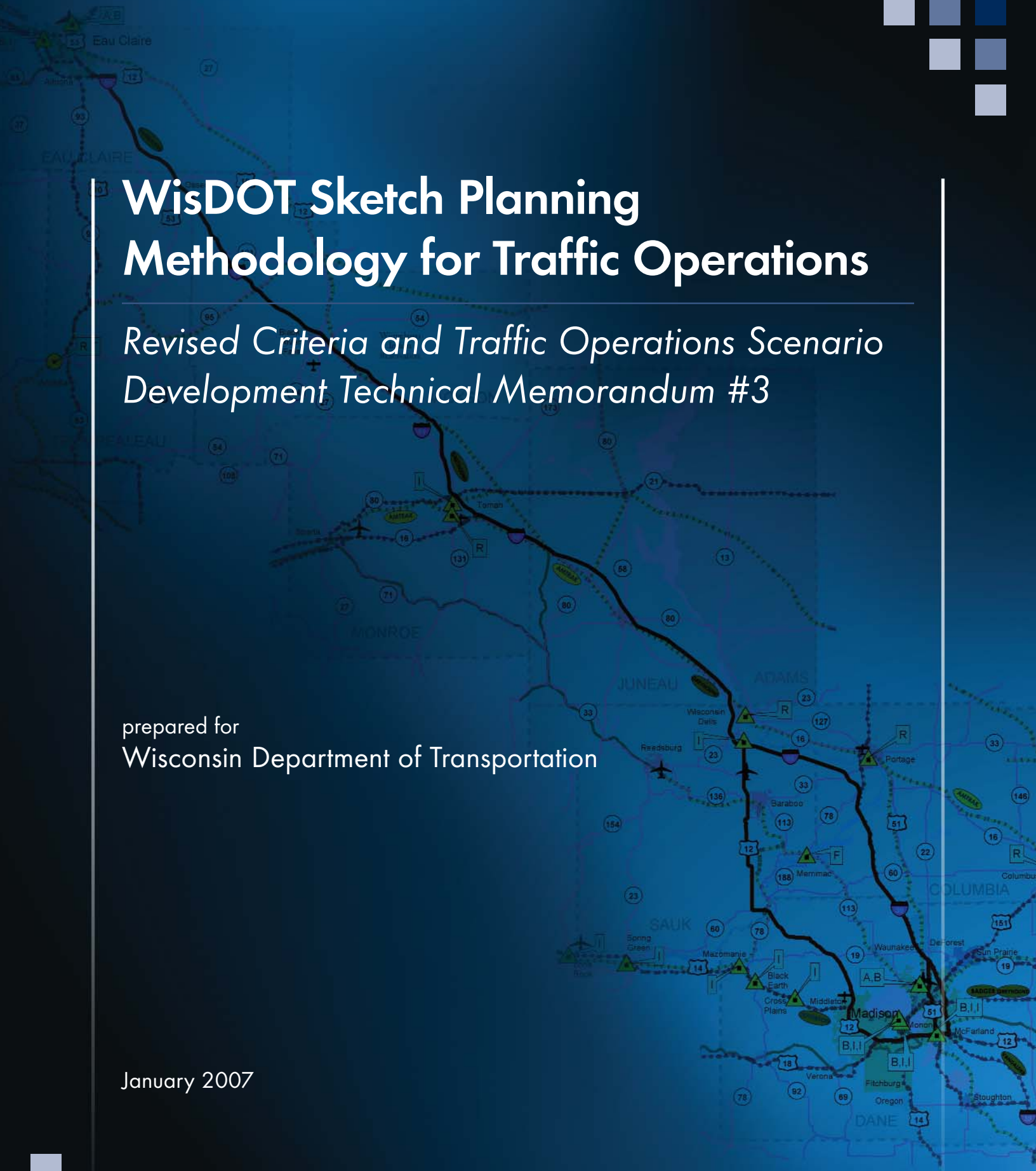
WisDOT Sketch Planning Methodology for Traffic Operations

Revised Criteria and Traffic Operations Scenario Development Technical Memorandum #3



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WisDOT Corridor Sketch Planning Methodology for Traffic Operations

Emerging Sketch Planning Methodology and Draft Criteria Technical Memorandum #3

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1.0 Introduction and Summary

The Wisconsin Department of Transportation (DOT) has initiated the Traffic Operations Corridor Sketch Planning Methodology project with the goal of developing a methodology and associated tool to enable the Bureau of Highway Operation's (BHO) Intelligent Transportation Systems (ITS) program to complement instead of compete against more traditional infrastructure projects. The sketch planning effort will develop a method for that evaluation, and will do so in a fashion that builds upon ongoing WisDOT planning and programming processes.

Wisconsin was an early adopter of ITS, participating in such key ITS deployments as Milwaukee's Monitor system, and the Gary-Chicago-Milwaukee corridor. Recently, however, the ITS program has had to competed for scarce funding against traditional highway projects and has struggled to do so. The two types of projects have been viewed as competitive, when in reality they are complementary strategies that together can improve service to the public.

The Traffic Operations Corridor Sketch Planning Methodology project encompasses four separate planning efforts that, when folded together, will comprise the overall sketch plan for statewide traffic operations:

- Corridor Planning Methodology for Traffic Operations;
- Ramp Control and Surveillance;
- Travel Warning and Information Systems; and
- Traffic Signal Systems.

This Technical Memorandum is one of a series of reports which documents the development of the Traffic Operations Corridor Sketch Planning Methodology. Major tasks of this project include developing:

- a draft of the methodology and its associated criteria;
- , a concept of operations, and
- the tool itself that will be tested through three parallel projects in three functional areas: signal systems, traveler information, and freeway operations.

The tool will also measure the impact of ITS projects on the Wisconsin backbone system, utilizing both quantitative and qualitative metrics.

A draft Traffic Operations Corridor Sketch Planning Methodology was developed during the last task and was documented in Technical Memorandum #2. A set of draft evaluation criteria were also developed as part of that task. The

next step in the development of the methodology is to refine those criteria and demonstrate how they could be applied through a scenario.

Please note, as outlined in Technical Memorandum #2, there are two methodologies which will be developed as part of this effort. The first methodology is designed to recommend appropriate sketch planning level ITS solutions/projects along a corridor. That methodology is detailed in the following sections of this report. The second is designed to rank the corridors once the ITS projects have been identified. This methodology will be developed later in Task 6 of this project.

2.0 Sketch Planning Criteria

2.1 INITIAL TRAFFIC OPERATIONS CORRIDOR SKETCH PLANNING CRITERIA

In Technical Memorandum #2, a list of 42 initial criteria were developed for the Traffic Operations Corridor Sketch Planning Methodology. This initial list of criteria were developed with the following characteristics in mind:

- Consistency with the criteria used in the Corridor Planning Methodology and other WisDOT planning efforts;
- Ability to realistically measure the effectiveness of alternatives;
- Allow operational alternatives to be compared with each other and with other types of improvements;
- Data are readily available, quality controlled and regularly updated; and
- Results can be easily summarized for presentation to decision-makers and the public.

This initial list of 42 criteria included in Technical Memorandum #2 was followed by a discussion of:

- Definition of Criteria – The criteria have generally been defined in a way that enables them to be measured, with either actual or estimated data.
- Units – Units were either specific quantitative measures, such percent heavy commercial vehicles, or thresholds, such as areas where speeds of less than 10 MPH occur.
- Rationale for Criteria – A number of the criteria were taken directly from the Corridor Planning Methodology. Consistency with this methodology is critical to permit comparison of different types of projects and strategies. Other criteria generally help to measure the effectiveness of solutions to a specific transportation problem in a segment or spot location.
- Purpose – The criteria were needed to both set priority corridors for operational improvements and to identify specific solutions. The purpose may include technology identification, (corridor) priority, or both.
- Data Availability – Availability of accurate data that are updated regularly and easily obtained is a critical concern in selecting criteria. As the project progresses there will be more analysis conducted of these data sources.

Since consistency with WisDOT Planning and Programming is a major goal of this entire effort, as a reference, the Corridor Planning Methodology criteria are listed below in Table 2.1

Table 2.1 WisDOT Corridor Planning Methodology's Criteria

Stage One Factors
Mobility
Functional Class/Corridors 2020 Designation
Year 2030 Level of Service
Truck ADT
Recreation Factor Group
Safety
Crash Rate
Crash Severity
Development Pressure
Population Projections by CVT to 2020
Land Conversion Rate by CVT from AG/Vacant to Residential, Commercial, Manufacturing, 1990-2000

The initial 42 Traffic Operations Corridor Sketch Planning Methodology criteria were focused around three major benefit categories which mirrored the WisDOT's Corridor Planning Methodology: Mobility, Safety, and Adverse Environmental Conditions with the latter replacing Development Pressure

While there was some overlap between the categories; for example adverse environmental conditions such as fog or snow could be correlated with safety measures such as crash rates and severity; its important to note that the initial list of 42 criteria were developed by intentionally casting a wide net. This was done in an effort to foster consideration of more operationally centric criteria which could be utilized as part of this emerging methodology.

Therefore the categories were mainly a method to organize a large set of criteria. As the number are narrowed categorization becomes less of a concern. The reduction of this list to a smaller, more manageable number of items is the subject of the remainder of this Section.

The initial list of 42 criteria were developed with input from Sketch Planning Team Working Group during a project meeting held on December 8, 2001 and is presented in Table 2.2. A (*) notes a more operationally centric criteria.

Table 2.2 Initial Traffic Operations Sketch Planning Criteria

Initial Traffic Operations Sketch Planning Criteria	
Mobility	Safety
Speed change	Crash Rate
Ramp closures	Hot Spots
Peak hour volume capacity volume/capacity/hour	Severity
Lane closures	Environmental Conditions
Staff response time *	Fog *
Ramp closure history	Snow/Ice *
Ramp corridor criteria	Flooding *
2020 functional class	Signalized intersection spacing *
2000 ADT	New/upgraded signal installation *
2020 ADT	Condition of existing signal *
ADT on crossing routes *	Availability of alternative routes *
2020 congestion	Route importance *
2000 HCADT or %	2000 population
Forecasted HCADT or %	Event centers *
Alternate route travel time ratio *	Event attendance vs. area *
Alternate route utilization *	Projected amount of distribution centers *
Length of alternate route *	Military access *
Proximity of alternate route *	Trauma center level 1 or 2 *
Is alternate route active or passive *	Risk
Signal jurisdiction *	Sustainability
Alternate route connection points *	Recreational factor *
	Land conversion rate *

2.2 REVISED TRAFFIC OPERATIONS SKETCH PLANNING CRITERIA

Reducing the initial list of 42 Traffic Operations Corridor Sketch Planning criteria to the most useful core criteria, began with the following goals:

- Reduce to manageable number while ensuring an operational flavor of criteria is still captured.
- Reduce to a number that makes assigning weights to each criteria meaningful.
- Ensure data are readily available for each criteria. Data should be least easily developed and replicated if they are not readily available.
- Create a number of criteria that are easily summarized.

Based on these goals, the study team reduced the number of Traffic Operations Sketch Planning criteria from 42 to ten. The updated list is presented in Table 2.3 below. A number of discussion and considerations were included in developing this updated list and a number of factors were considered when eliminating a criteria from consideration. A brief summary of those factors follows.

There was an initial discussion about whether to create a series of criteria for each functional application area, i.e. Surveillance, Traveler Information, and Signals. Under this approach criteria would be tailored for each functional area. Some of the criteria, such as ADT, would be the same across all functional areas but others, such as Signal Jurisdiction, would be specific to only one or two functions. This concept was ultimately dropped, as it was decided that having three different sets of criteria for each functional area would be too cumbersome a process. The process would not only be difficult to implement in this study, but also for future replications of this process by WisDOT staff.

Overall patterns within the criteria also began to emerge that enabled a number of related criteria to be consolidated. For example, there were three criteria all dealing with a variation of weather (Fog, Snow/Ice, and Flooding). In the final criteria, these three were rolled up into a single Weather criterion. There were also a number of traffic/event generator criteria (Event centers, Event attendance vs. area, Projected amount of distribution centers, Military access, and Trauma centers). These five criteria were consolidated into the Event/Traffic Generators criterion.

Some criteria were eliminated from consideration because there were deemed too difficult to capture even though there may have been a strong technical justification for including them. Examples are Staff Response Time and Ramp Closure History.

There were a number of Alternate Route related criteria included in the initial list. Their inclusion was driven by a desire to capture a key factor: the usefulness of traveler information to the motorist (i.e. is there alternate route which the motorist could take if they were given information on an incident ahead of them on their current route?). They were also included for the signal implementation plan. These criteria were ultimately eliminated for a number of reasons. First, many of the criteria would require significant staff assessments which would be based on qualitative interpretation of anecdotal data. The second reason was the "hot spot" nature of the criteria. The ultimate goal of this methodology is to provide planning level guidance on operational and technological deployments which could benefit a corridor. The Alternate Route criteria, such as Cross Traffic on Alternative route availability, are best suited to provide specific spot location recommendations rather than corridor-based recommendations, which are the focus of this project. As a result they were eliminated.

Overall criteria which relied on significant staff assessments for development were minimized. This was done for two reasons. First, criteria were considered more effective if quantitative data were readily available. Second, by minimizing the number of criteria based on staff assessments, the reliance on interpretation of anecdotal data could be minimized. It should be noted that not all staff assessment criteria were eliminated because some were deemed too important from an operational perspective.

There were also a large number of signal related criteria which were eliminated in the final selection. The study team recommends holding these criteria in reserve for when the Signal Implementation Plan study team resumes their work with a new project manager.

The updated, reduced list of 10 criteria is presented in Table 2.3 below.

Please note, two criteria were added that was not included in the initial 42. And they are derivatives of four already considered. The new criteria are:

- Growth rate in ADT from 2000 to 2020.
- Growth rate in HCADT from 2000 to 2020

Growth rates provide a somewhat different picture than the ADT numbers themselves and help to better incorporate development pressure into the analysis.

The Division of Transportation Investment Management (DTIM) was contacted as part of this update. DTIM manages Meta-Manager for the department. Meta-Manager is the department's transportation data archive and analysis system. DTIM was contacted to gauge data available for the criteria selected. Based on initial discussions, most of the data is available in Meta-Manager, at the 1 mile link level. Only Weather data is not captured in Meta- Manager. Once the criteria are approved, the study teams can initiate the data collection tasks.

Table 2.3 Updated Traffic Operations Sketch Planning Criteria

Traffic Operations Sketch Planning Criteria
Mobility
ADT Base Year
ADT Forecast Year
HC ADT Base Year
HC ADT Forecast Year
Peak Hour V/C – LOS
Congestion 2020 – LOS
Safety
Crash Rate
Crash Severity
Weather Index
Developmental Pressures
ADT Growth
HC ADT Growth
Event/Traffic Generators

2.3 WEIGHTING THE TRAFFIC OPERATIONS SKETCH PLANNING CRITERIA

Once the Traffic Operations Sketch Planning criteria have been finalized, a weighting exercise will be conducted with the Sketch Planning Stakeholder group. During this weighting process, the categories as well as the criteria themselves will be ranked. This weighting is done for two reasons.

The first is that it allows the criteria an extra level of calibration by reflecting WisDOT staff preferences directly in the criteria development process. The stakeholders, for example, could weight Safety as clearly the most important category and therefore give more importance to the Crash Rate and Crash Severity criteria. In extreme circumstances the weighting could have one category or criteria overshadow all others. However, this rarely happens due to the fact that most stakeholders understand the need to balance a variety of factors. If a criterion is very low in priority, that is an indicator that perhaps it shouldn't be included in the analysis. In some ways, the weighting process is a

final check of the criteria to ensure all included criteria are meaningful and realistic. The weighting process also provides an additional tie back to the WisDOT Corridor Planning Methodology which also ranks both categories and criteria.

The exercise to develop the weights will be conducted during the stakeholder meeting to be held on February 7, 2007. The results of this effort will be integrated into the final Traffic Operations Corridor Sketch Planning Methodology. Table 2.4 provides an illustrative view of what the weights could look like. (Note, the weights provided are not the final rankings and are presented for illustrative purposes only).

Table 2.4 Updated Traffic Operations Sketch Planning Criteria with Illustrative Rankings

Traffic Operations Sketch Planning Criteria	Weight
Mobility	50%
ADT Base Year	10%
ADT Forecast Year	10%
HC ADT Base Year	5%
HC ADT Forecast Year	5%
Peak Hour V/C – LOS	10%
Congestion 2020 – LOS	10%
Safety	20%
Crash Rate	7.5%
Crash Severity	7.5%
Weather Index	5%
Environmental Conditions	30%
ADT Growth	10%
HC ADT Growth	10%
Event/Traffic Generators	10%

(Note, the weights provided are not the final rankings and are presented for illustrative purposes only).

3.0 Illustrating The Results

An important step in the development of the Traffic Operations Corridor Sketch Planning Methodology is creating an effective mechanism to clearly, quickly, and effectively convey the outputs of the methodology. To begin this process, the Study Team started with the end goal in mind: Providing a clear understanding, from the BHO perspective, of the operations and ITS projects that are appropriate for all 35 Connection 2030 corridors.

In addition to this goal, integrating this effort with the existing Planning and Programming Corridor Planning Methodology remains an important goal. With this in mind an initial steps taken was to leverage as much as possible the basemap and GIS work already completed by the Corridor Planning working group and the Connection 2030 Plan. It was decided early on, that the presentation materials for the Traffic Operations Corridor Sketch Planning Methodology would use the GIS maps developed for the Connection 2030 as a basemap.

For reference, the 35 Corridors included in Connections 2030, with their termini, are listed below in Table 2.5.

For the maps to be effective, they must illustrate a number of elements. First they must illustrate where along the corridor high, medium and low levels, or densities, of ITS/Operations deployments are appropriate.

In addition the maps must delineate the ITS solutions proposed within those limits. For example, the map needs to illustrate within a given limit that an urban area requires a high level of ITS/Operations deployments. However, It must also specify what types of technologies are included i.e. cameras, sensors, or dynamic message signs. Furthermore it must illustrate this information over a variety of corridor lengths, some in excess of 200 miles.

Its important to note that the Traffic Operations Corridor Sketch Planning Methodology is not meant to provide site specific locations of ITS devices or deployments, but only provide guidance to WisDOT Region Planners and Programmers when more detailed Corridor Studies are conducted. Therefore the maps do not need to illustrate specific spot locations (i.e. a DMS sign needs to be at this specific decision point).

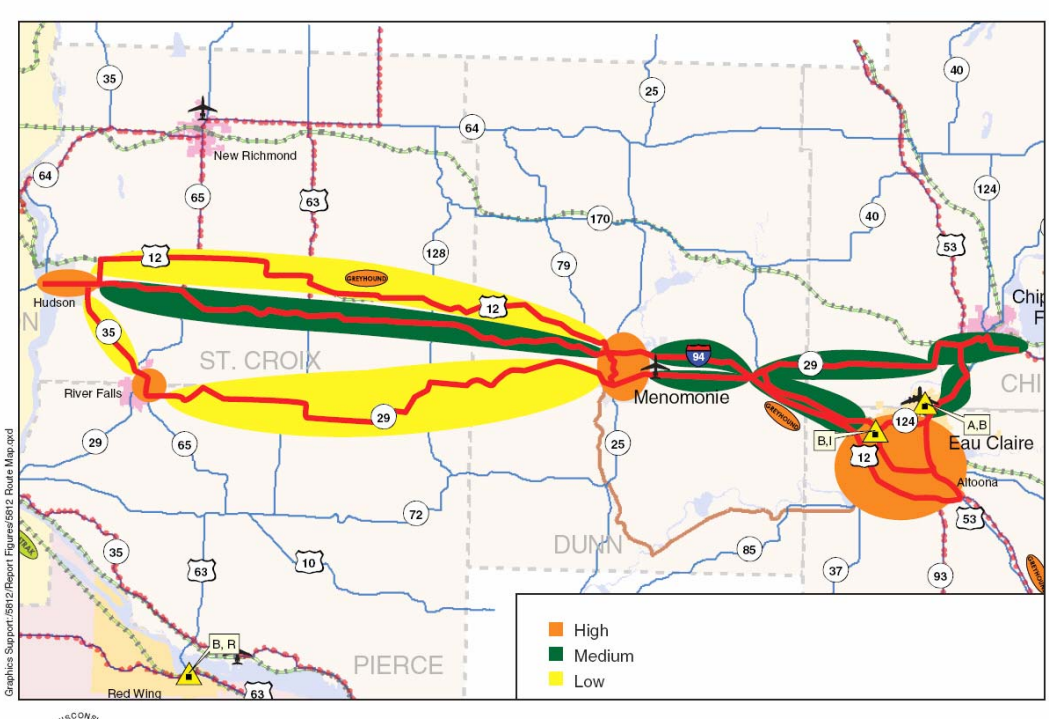
Early in the process, the SRF Consulting Study Team developed a initial concept of how the Connection 2030 maps could be used to demonstrate high, medium, and low deployments of ITS/Operations projects. This initial draft is presented in Figure 3.1 below.

Table 3.1 Connections 2030 Corridors

Corridor	End Points	Corridor	End Points
84th Division Railsplitters	Beaver Dam - Port Washington	Lake Superior	Duluth/Superior - Ironwood, Michigan
Alpine Valley	Janesville/Beloit - Milwaukee	Lake To Lake	Fox Cities to Manitowoc/Two Rivers
Badger State	Eau Claire - Madison	Lumber Country Heritage	Green Bay - Iron Mountain
Blackhawk	Madison - Beloit - Chicago	Marshfield - Rapids	Stevens Point - Abbotsford
Capitol	Milwaukee - Madison	Mississippi River	Dubuque - Twin Cities
Cheese Country	Dubuque - Janesville/Beloit Rock County	North Country	Iron Mountain - Minneapolis/St. Paul
Cornish Heritage	Dubuque - Madison	Peace Memorial	Chippewa Valley - Duluth/Superior
Coulee Country	La Crosse - Tomah	Peshtigo Fire Memorial	Green Bay - Menominee County, Michigan
Cranberry Country	Tomah - Oshkosh	Potato Country	Oshkosh - Rhinelander
Door Peninsula	Green Bay - Door County	Pow/Mia Remembrance	Abbotsford - Ashland
Fox Valley	Milwaukee - Green Bay	Rock River	Janesville/Beloit - Oshkosh
Frank Lloyd Wright	La Crosse - Madison	Southern Tier	Janesville/Beloit-Racine/Kenosha
French Fur Trade	Praire du Chien - Dodgeville	Titletown	Milwaukee - Green Bay
Geneva Lakes	Madison - Lake Geneva - Chicago	Trempealeau River	La Crosse - Eau Claire
Gopher Connection	Eau Claire - Twin Cities	Waukesha Connection	Waukesha - Washington County
Indian Head Lakes	Twin Cities - Ashland	Wild Goose	Madison - Fox River Valley
Kettle Country	Fond du Lac - Sheboygan	Wisconsin River	Madison - Ironwood, MI
		Wolf/Waupaca Rivers	Stevens Point - Fox Cities

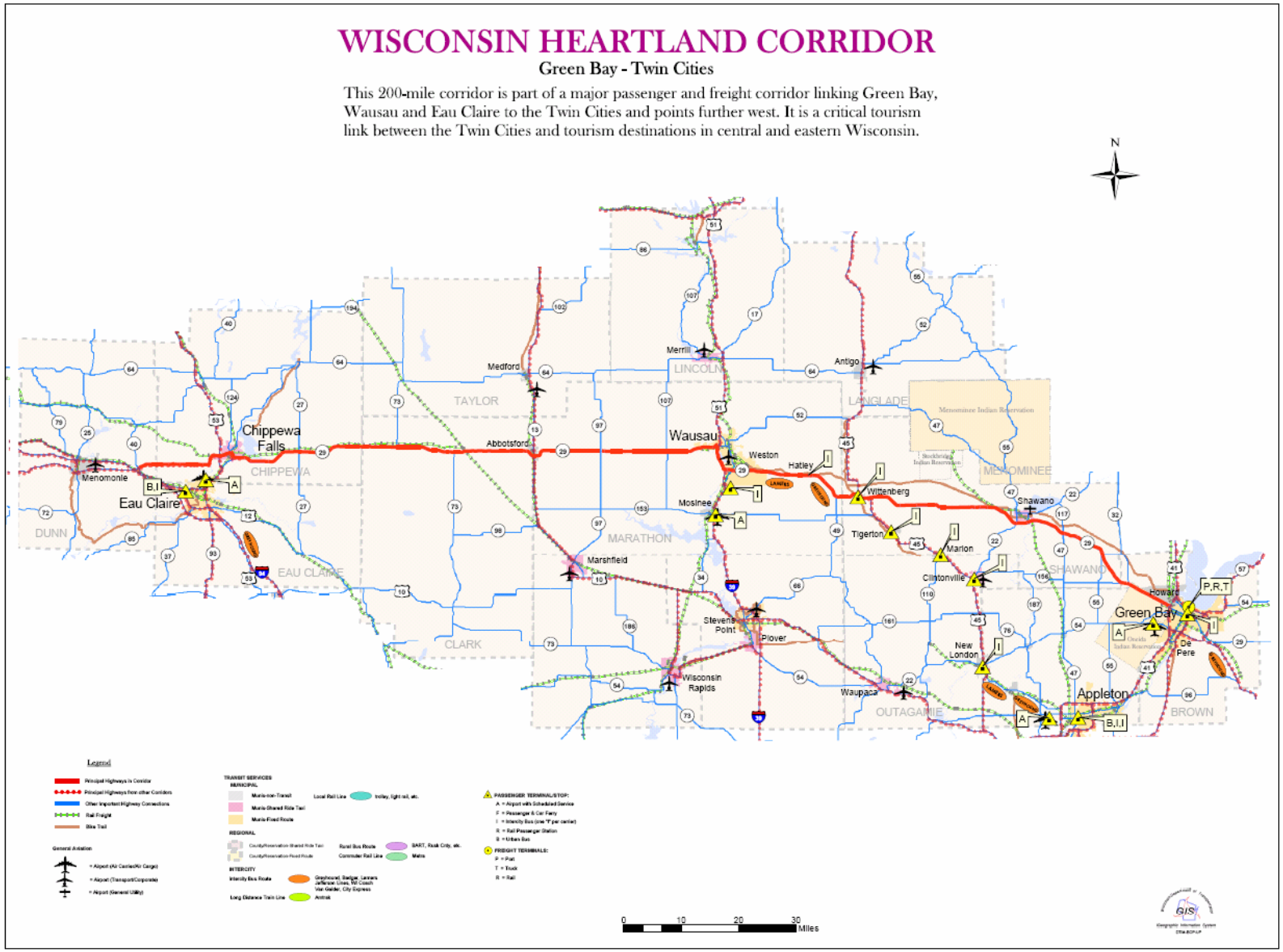
This map effectively solved the problem of showing density of deployment based on limits but still left to be resolved the issue of demonstrating the ITS/Operations projects which were appropriate within those limits. Utilizing this methodology would require multiple maps to be made, for various functions and technologies such as surveillance, and dynamic message signs. However, this approach did provide an excellent illustration metaphor which was carried forward to later drafts.

Figure 3.1 Initial Sketch Planning Illustration



To illustrate the final presentation formats, the Connections 2030 Heartland Corridor will be used. This 200 mile corridor is part of a major passenger and freight corridor linking Green Bay, Wausau and Eau Claire to the Twin Cities and points further west. It is a critical tourism link between the Twin Cities and tourism destinations in central and eastern Wisconsin. It was chosen because it offered a mix of rural and urban traffic conditions as well as a having a freight and tourism component. The Connections 2030 Corridor map is shown below in Figure 3.2.

Figure 3.2 Wisconsin Heartland Connections 2030 Corridor



Using this map as a foundation, the Traffic Operations Sketch Planning elements were then integrated to develop a map specifically for the sketch plan. It should be noted that all the data in this map is for illustrative and is not based on real data. The two main components of the map are the color coded links and the color coded sign posts.

The *color coded links* illustrate where high, medium and low densities of ITS deployments would be recommended, with red being high, yellow medium, and low density deployment green. There are red (high density) bands surrounding urban areas while in the more rural regions there are green (low density deployments) bands as well as areas with no deployments at all.

The *signposts* are the second element of this map and they are used to illustrate the types of technologies being recommended as well as what level of deployments for those specific technologies. For example, in Figure 3.3 the signpost tells us that Surveillance Detection and traffic management technologies are recommended for high deployment, but traveler information is recommended for only medium deployment. It should be noted that the 511 icon seems to repeat. This is to illustrate that 511 is a statewide system and in this example recommended for deployment throughout the state. Finally, the weather icon illustrates only specific deployments of weather stations or warning systems outside the state's already existing and largely complete RWIS system.

An example of the full map is shown in Figure 3.4. This map is in its draft stage. They will be presented at the stakeholder meeting to be held on February7, 2007. The results of this effort will be integrated into the final Traffic Operations Corridor Sketch Planning Methodology.

Figure 3.3 Sketch Planning Methodology Signpost

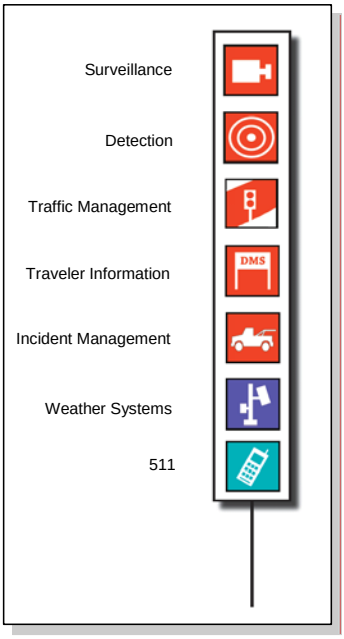
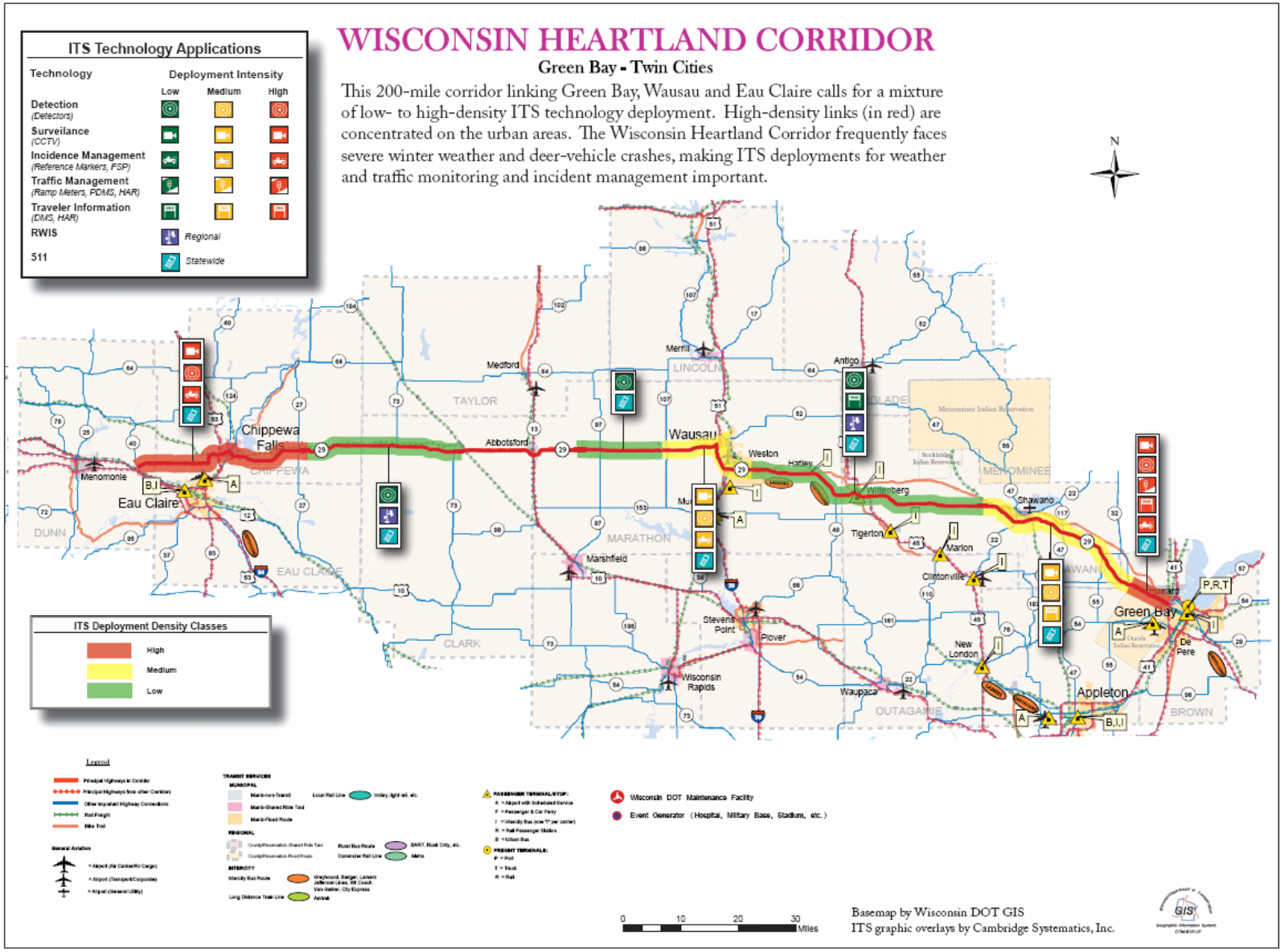


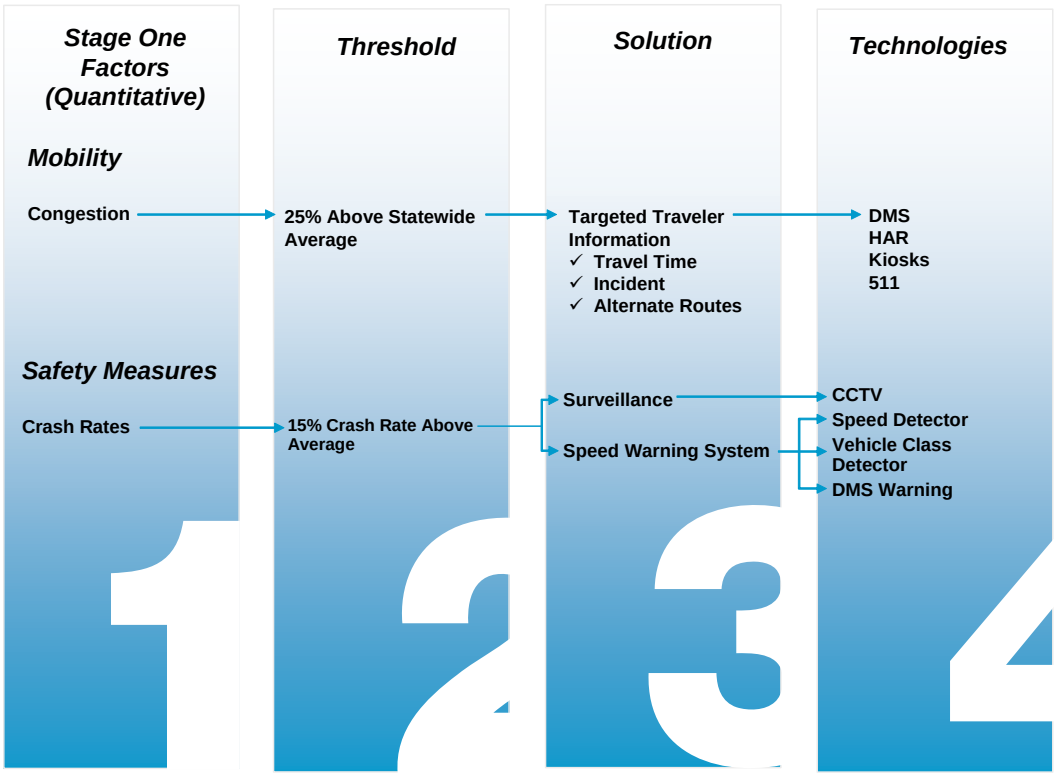
Figure 3.4 Sketch Planning Corridor Map



4.0 Sketch Plan Scenario

In Technical Memorandum #2 a framework for a Traffic Operations Corridor Sketch Planning Methodology was presented. The framework was a four step process that utilized quantitative criteria that described the current conditions in terms of mobility, safety and environmental (Step 1). Problems are then identified (Step 2) through threshold comparison and a list of potential solutions are then identified (Step 3). Once individual solutions are developed they will be packaged together into technological systems that are logical in terms of operations and geography (Step 4). For example, technologies deployed in the field such as CCTV and detectors should be coordinated to make sure that the information is made available to all who need it. This initial framework is illustrated with two criteria, Congestion and Crash Rates, in Figure 4.1 below.

Figure 4.1 Initial WisDOT Sketch Planning Corridor Methodology



This section will take this framework and expand upon it through the use of a specific scenario. It is the goal of this scenario to act as the next stage in development for the methodology and serve as a test bed, before the methodology is finalized in the next two tasks.

To demonstrate the scenario a spreadsheet technique was utilized. The methodology is designed for a logical segment of the a corridor. In order for the analysis to be useful, the segment should have relatively homogenous characteristics in terms of traffic volume, roadway capacity and abutting land use. Urban freeway corridors would generally be in the range of 5 to 15 miles, while rural corridors would be longer, probably 15 up to as much as 50 miles. Arterial corridors will probably be somewhat shorter, particularly in urban areas.

The scenario to demonstrate the methodology will study a five mile segment on the Wisconsin Heartland Corridor beginning at the boundary of the Oneida Indian Reservation at intersection of SR 29 and SR 32, and continue west on SR 29 for five miles. Note the data used in this scenario is illustrative.

The methodology is implemented as follows:

1. Three tiers are identified for most of the criteria. The exception is for HCADT where two tiers were identified. Thresholds are set for each tier as shown in Table 4.1. These will be modified as more data become available so that the middle range of the threshold reflects average or median values for the Connections 2030 corridor roadways. For most of the criteria, separate thresholds were developed for four categories; urban freeways, rural freeways, urban arterials and rural arterials.
2. "Points" are awarded based on the tier . For criteria with three tiers, 1 point is given for Tier 1 (least intensive need), 3 points for Tier 2 and 5 point for Tier 3. It should be noted that this is an initial proposal that may be modified by the Project Review committees.
3. Once points are calculated they are given weights which were established by the exercise we described earlier. Note how, these weights are based roughly on the three categories used by WisDOT planning for corridor ranking and include Mobility (50%), Safety (20%) and Development Pressure (30%). The criteria weights used in the operations analysis map to those used in the corridor analysis as shown below in Table 4.2
4. Weights are multiplied by points and a composite operations score is given to the segment. This score is then used to identify the package of operational solutions appropriate to the segment. In this initial version of the methodology, three levels of increasingly intense deployment are defined. The technologies and level of deployment vary between freeways and arterials. Rather than focusing on a large number of very specific technologies, the solutions are bundled into functional categories that are meaningful to operations personnel and/or the public. For example, both Dynamic Message Signs and Highway Advisory radio are part of an overall Traveler Information Strategy. DMS are also useful in incident management applications. Another advantage of a functional approach, over a purely technology-driven one, is that as new technologies enter the marketplace they can be more easily incorporated into the methodology.

Table 4.1 Thresholds (Step 2)

	Urban Fwy	Urban Art	Rural Fwy	Rural Art
ADT Base Year				
Tier 1	<25,000	<10,000	<15,000	<5,000
Tier 2	25,000 to 60,000	10,000 to 25,000	15,000 to 30,000	5,000 to 10,000
Tier 3	> 60,000	>25,000	>30,000	> 10,000
ADT Forecast Year				
Tier 1	<25,000	<10,000	<15,000	<5,000
Tier 2	25,000 to 60,000	10,000 to 25,000	15,000 to 30,000	5,000 to 10,000
Tier 3	> 60,000	>25,000	>30,000	> 10,000
Growth Rate				
Tier 1	<10%	<10%	<10%	<10%
Tier 2	11% to 25%	11% to 25%	11% to 25%	11% to 25%
Tier 3	> 25%	> 25%	> 25%	> 25%
HC ADT Base Year				
Tier 1	<8%	Major Truck Gen	<10%	Major Truck Gen
Tier 2	>8%	No Major Truck Gen	>10%	No Major Truck Gen
HC ADT Forecast Year				
Tier 1	<8%	Major Truck Gen	<10%	Major Truck Gen
Tier 2	>8%	No Major Truck Gen	>10%	No Major Truck Gen
Growth Rate				
Tier 1	<10%	<10%	<10%	<10%
Tier 2	11% to 25%	11% to 25%	11% to 25%	11% to 25%
Tier 3	> 25%	> 25%	> 25%	> 25%
Peak Hour V/C				
Tier 1	LOS D	LOS D	LOS D	LOS D
Tier 2	LOS E	LOS E	LOS E	LOS E
Tier 3	LOS F	LOS F	LOS F	LOS F
Congestion Forecast				
Tier 1	LOS D	LOS D	LOS D	LOS D
Tier 2	LOS E	LOS E	LOS E	LOS E
Tier 3	LOS F	LOS F	LOS F	LOS F
Crash Rate	:otal crashes per vehicle mile)			
Tier 1	<100% of statewide urban fwy average	<100% of statewide urban art average	<100% of statewide urban fwy average	<100% of statewide urban fwy average
Tier 2	100% to 200% of statewide urban fwy average	100% to 200% of statewide urban art average	100% to 200% of statewide urban fwy average	100% to 200% of statewide urban fwy average
Tier 3	> 200% of statewide urban fwy average	> 200% of statewide urban art average	> 200% of statewide urban fwy average	> 200% of statewide urban fwy average
Crash Severity (fatalities and incapacitating injuries/vehicle mile)				
Tier 1	<100% of statewide urban fwy average	<100% of statewide urban art average	<100% of statewide urban fwy average	<100% of statewide urban fwy average
Tier 2	100% to 200% of statewide urban fwy average	100% to 200% of statewide urban art average	100% to 200% of statewide urban fwy average	100% to 200% of statewide urban fwy average
Tier 3	> 200% of statewide urban fwy average	> 200% of statewide urban art average	> 200% of statewide urban fwy average	> 200% of statewide urban fwy average
Weather	Days/Yr. With over 1" inch snow or heavy fog			
Tier 1	<15	<15	<25	<25
Tier 2	15 to 25	15 to 25	25 to 35	25 to 35
Tier 3	>25	>25	>35	>35
Event Generators	Special Events (SE) with over 5,000 attendees or weekend LOS E or F			
Tier 1	< 3 SE's and < 6 weekends LOS E or F	< 3 SE's and < 6 weekends LOS E or F	< 3 SE's and < 6 weekends LOS E or F	< 3 SE's and < 6 weekends LOS E or F
Tier 2	3 to 10 SE's or 6 to 10 weekends with LOS E or F	3 to 10 SE's or 6 to 10 weekends with LOS E or F	3 to 10 SE's or 6 to 10 weekends with LOS E or F	3 to 10 SE's or 6 to 10 weekends with LOS E or F

Table 4.2 Thresholds, Weights and Scores (Step 3)

Criteria Scoring System	Three Tiers Tier 1 = 1 pt. Tier 2 = 3 pt. Tier 3 = 5 pt.	Two Tiers Tier 1 = 1 pt. Tier 2 = 4 pt.			Example **Value**	Urban Freeway **Points**	**Weight**	**Total Score**
	Urban Fwy	Urban Art	Rural Fwy	Rural Art				
ADT Base Year								
Tier 1	<25,000	<10,000	<15,000	<5,000				
Tier 2	25,000 to 60,000	10,000 to 25,000	15,000 to 30,000	5,000 to 10,000	45,000	3	10	30.0
Tier 3	> 60,000	>25,000	>30,000	> 10,000				
ADT Forecast Year								
Tier 1	<25,000	<10,000	<15,000	<5,000				
Tier 2	25,000 to 60,000	10,000 to 25,000	15,000 to 30,000	5,000 to 10,000				
Tier 3	> 60,000	>25,000	>30,000	> 10,000	65,000	5	10	50.0
Growth Rate								
Tier 1	<10%	<10%	<10%	<10%				
Tier 2	11% to 25%	11% to 25%	11% to 25%	11% to 25%				
Tier 3	> 25%	> 25%	> 25%	> 25%	0	5	10	50.0
HC ADT Base Year								
Tier 1	<8%	Major Truck Gen	<10%	Major Truck Gen				
Tier 2	>8%	No Major Truck Gen	>10%	No Major Truck Gen	0	4	5	20.0
HC ADT Forecast Year								
Tier 1	<8%	Major Truck Gen	<10%	Major Truck Gen				
Tier 2	>8%	No Major Truck Gen	>10%	No Major Truck Gen	0	4	5	20.0
Growth Rate								
Tier 1	<10%	<10%	<10%	<10%	0	1	10	10.0
Tier 2	11% to 25%	11% to 25%	11% to 25%	11% to 25%				
Tier 3	> 25%	> 25%	> 25%	> 25%				
Peak Hour V/C								
Tier 1	LOS D	LOS D	LOS D	LOS D				
Tier 2	LOS E	LOS E	LOS E	LOS E	E	3	10	30.0
Tier 3	LOS F	LOS F	LOS F	LOS F				
Congestion Forecast								
Tier 1	LOS D	LOS D	LOS D	LOS D				
Tier 2	LOS E	LOS E	LOS E	LOS E				
Tier 3	LOS F	LOS F	LOS F	LOS F	F	5	10	50.0
Crash Rate	(total crashes per vehicle mile)							
Tier 1	<100% of statewide urban fwy average	<100% of statewide urban art average	<100% of statewide urban fwy average	<100% of statewide urban fwy average				
Tier 2	100% to 200% of statewide urban fwy average	100% to 200% of statewide urban art average	100% to 200% of statewide urban fwy average	100% to 200% of statewide urban fwy average	145%	3	7.5	22.5
Tier 3	> 200% of statewide urban fwy average	> 200% of statewide urban art average	> 200% of statewide urban fwy average	> 200% of statewide urban fwy average				
Crash Severity (fatalities and incapacitating injuries/vehicle mile)								
Tier 1	<100% of statewide urban fwy average	<100% of statewide urban art average	<100% of statewide urban fwy average	<100% of statewide urban fwy average	110%	1	7.5	7.5
Tier 2	100% to 200% of statewide urban fwy average	100% to 200% of statewide urban art average	100% to 200% of statewide urban fwy average	100% to 200% of statewide urban fwy average				
Tier 3	> 200% of statewide urban fwy average	> 200% of statewide urban art average	> 200% of statewide urban fwy average	> 200% of statewide urban fwy average				
Weather	Days/Yr. With over 1" inch snow or heavy fog							
Tier 1	<15	<15	<25	<25				
Tier 2	15 to 25	15 to 25	25 to 35	25 to 35	22	3	5	15.0
Tier 3	>25	>25	>35	>35				
Event Generators	Special Events (SE) with over 5,000 attendees or weekend LOS E or F							
Tier 1	< 3 SE's and < 6 weekends LOS E or F	< 3 SE's and < 6 weekends LOS E or F	< 3 SE's and < 6 weekends LOS E or F	< 3 SE's and < 6 weekends LOS E or F				
Tier 2	3 to 10 SE's or 6 to 10 weekends with LOS E or F	3 to 10 SE's or 6 to 10 weekends with LOS E or F	3 to 10 SE's or 6 to 10 weekends with LOS E or F	3 to 10 SE's or 6 to 10 weekends with LOS E or F	X	3	10	30.0
Tier 3	> 10 SE's or > 10 weekends with LOS E or F	> 10 SE's or > 10 weekends with LOS E or F	> 10 SE's or > 10 weekends with LOS E or F	> 10 SE's or > 10 weekends with LOS E or F				
Composite Score								**335.0**

Max Score	490.0
Min Score	100.0

5. The plan selected based on composite score may not work for each segment as a "one-size fits all". A second loop through the process will be needed to identify deployments that might be required to meet a specific need or address a "hot spot" location. For example, a segment may receive an overall score that indicates medium deployment but may have exceptionally high crash rates on all or part of the segment. In this case it would be appropriate to upgrade the surveillance and incident management functions to high deployment. In many segments there will be "hot spot" problems that will be primarily related to safety. The may include dangerous curves, icing bridges or large animal crossings. The identification of these problems will require local input and the solutions will be specific to that location. An Environmental Sensor Station, for example, can be linked to an automated deicing system located on a problematic bridge. Curve warning systems can be attached to speed detectors and notify motorists through a sign that they are traveling too fast.

The sketch planning methodology uses readily available data to provide planners with a strategy for operational deployments in a corridor segment. All of the elements, including criteria, tiers, scoring and weighting can be modified easily over time based on experience. It is also important to note that there are other engineering and technical issues that will drive the ability to implement proposed solutions. Lack of power and communications, for example, may make some desired deployments too expensive.

Finally, Figure 4.2 provides a summary of the analysis at the link level and demonstrates another method for displaying the results of the analysis.

Based on feedback and comments from the stakeholder group this methodology will be modified and updated. The updated and finalized methodology will then be passed along to the other consultant teams and they will utilized the methodology to produce Infrastructure and Operations Plans for the three functional areas: Surveillance, Traveler Information and Signals.

Table 4.3 Technologies (Step 4)

Scoring Range	90 to 219	220 to 350	351 to 490
Deployment Intensity	**Low**	**Medium**	**High**
Detection			
Freeway	Mobile Probes	Mobile Probes	
	One Fixed Detector between Interchanges	One Fixed Detector between Interchanges	One Fixed Detector between Interchanges
		No more than 2 mile spacing	No more than 1 mile spacing
Arterial			Mobile Probes
	Detectors on Major Intersection Approaches	Detectors on Major Intersection Approaches	Detectors on Major Intersection Approaches
		Mid Block Detection if intersections are more than one mile apart	Mid Block Detection if intersections are more than 1/2 mile apart
Surveillance			
Freeway	Supply cameras at safety "hot spots" only	Cameras at interchanges and safety "hot spots"	100% camera coverage
	Negotiate for use of private or other public agency cameras		
Arterial	Supply cameras at safety "hot spots" only	Cameras at highest volume intersections and "hot spots"	Cameras at all major intersections and "hot spots"
	Negotiate for use of private or other public agency cameras		
Incident Management			
Freeway	Reference Markers	Reference Markers	Reference Markers
	Coordination with local PSAP's to identify closest resource	Incident management resources available on-demand for major incidents	Dedicated weekday service patrols
	Preplanned closure and detour plans	Preplanned closure and detour plans	Preplanned closure and detour plans
			Trailblazer signs on freeway and alternate routes activated for emergency detours
Arterial	Coordination with local PSAP's to identify closest resource	Incident management resources available on-demand for major incidents	Incident management resources available on-demand for major incidents
			Preplanned closure and detour plans
Traffic Management			
Freeway	Portable DMS and/or HAR for major incidents/closures	Ramp metering in specific segments where cost-effective	Ramp Metering
Arterial	Update signal timing on regular basis	Closed loop systems in corridors where cost-effective	Signal coordination on corridor basis through closed loop or adaptive systems
Traveler Information			
Freeway	Portable DMS and/or HAR used for construction, major incidents and special events	Fixed DMS and/or HAR at major interchanges/decision points	Fixed DMS at major interchanges and every 5-10 miles along freeway - DMS report travel times to major decision points
	511 Reports in case of major incidents, construction or special events	Regular 511 Reports including incidents and general traffic conditions	Detailed 511 reports including regular updates on major freeways
Arterial	Portable DMS and/or HAR used for construction, major incidents and special events	Portable DMS and/or HAR used for construction, major incidents and special events	Fixed DMS and/or HAR at major intersection/decision points or safety "hot spots"
	511 Reports in case of major incidents, construction or special events	511 Reports in case of major incidents, construction or special events	Regular 511 Reports including incidents and general traffic conditions

Figure 4.2 Scenario Results