Metropolitan Area ITS Implementation Plan

FINAL

ITS Deployment Analysis and Recommendations

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1.0 INTRODUCTION

1.1 Background

Several Intelligent Transportation Systems (ITS) projects have been undertaken in the Albuquerque Metropolitan Area that provide a solid foundation for the regions' ITS program. These include a new centrally-controlled traffic signal system being installed in the City of Albuquerque, the Advanced Metropolitan Traffic Management System (AMTMS) being designed on Interstate 40 and Interstate 25, deployment of smart corridors in Bernalillo County, and a new traffic signal system in the City of Rio Rancho.

In an effort to provide coordinated solutions to addressing transportation issues in the region, the Mid-Region Council of Governments (MRCOG) in cooperation with local, regional, state and federal ITS partners, has undertaken the "Metropolitan Area ITS Implementation Plan" study. The purpose of the study is to establish a comprehensive, phased plan for future ITS deployment so that agencies can coordinate ITS deployment, in order to maximize technology investments and so they can begin to mainstream ITS projects with other construction projects, resulting in overall cost savings.

The plan is intended to help technical managers and policy makers to understand the benefits of specific ITS projects in both technical and political terms in advance of requests for funding. This will help them by providing a basis for evaluating ITS projects in the context of competing interests. While the benefits of ITS have been well advertised from other regions, ITS implementation in this region is very much dependent on generating reliable estimates of the benefits that can be achieved through the implementation of ITS in the Albuquerque Metropolitan Area. The ITS Implementation Plan will be based on estimates of the benefits that can be anticipated from its deployment.

1.2 Document Overview

This report is organized into four key sections:

Section 1 – Introduction

This section provides a brief overview of the state of ITS in the MRCOG region, the purpose of the project, a summary of ITS needs in the region, and major project activities.

Section 2 – Analysis of Roadway Network

Section 2 contains a description of the methodology used to prioritize arterial and freeway segments, including the criteria, how they were weighted, and the resultant prioritization results.

Section 3 – Menu of Potential ITS Functions and Elements

Section 3 contains ITS elements that could be considered for deployment on the arterial and freeway system in the MRCOG region.

Section 4 –ITS Deployment Plan

Section 4 recommends an incremental, phased plan for build-out of the Region's ITS. Specific corridors and elements recommended for deployment on those corridors are presented as well as regional projects.

1.3 Project Overview

The primary purpose of the Metropolitan Area ITS Implementation Plan is to develop a regionally-coordinated, phased deployment for ITS elements in the MRCOG region. The focus of the project study is to develop a financially feasible implementation plan. The implementation plan provides recommendations for how to best leverage and phase ITS deployments to achieve a strong return on the investment of the infrastructure.

The deployment of ITS within the project area was determined based on existing and future overall needs within the project area. The following overall needs were identified for the project:

- Develop a structured plan to deploy ITS within the project area;
- Optimize the use of existing infrastructure in the deployment of ITS;
- Prioritize ITS deployment in the project area;
- Develop short-term, financially feasible ITS deployment packages; and
- Recommend ITS functions that should be considered for long-term deployment.

Major project activities are:

- Develop a phased plan for ITS implementation, including both corridor-based and system-wide projects;
- Perform a cost-benefit analysis making use of the IDAS model to establish regional benefits from the proposed deployment program and, through an iterative planning process, adjust the Implementation Plan to reflect any necessary changes to balance the cost-benefit expectations;
- Produce an ITS deployment capital improvement program for the region;
- Provide an executive summary document of the findings of the project geared towards policy makers; and
- Provide, throughout the process, input to update the MRCOG "*Draft Intelligent Transportation System Long Range Map"* to reflect the results of the study.

2.0 ANALYSIS OF ROADWAY NETWORK

The objective of the analysis was to prioritize roadway segments to determine where ITS can provide the greatest benefits in the Albuquerque region in a phased deployment plan.

2.1 Methodology

Data available from MRCOG was used to prioritize the roadways with the potential for ITS deployment. A meeting was held with MRCOG staff and the ITS Subcommittee. The purpose of the meeting was to:

- Discuss roadways for inclusion in the analysis;

- Identify the priorities of the regions' transportation agencies, and
- Discuss potential data sources to assist in the prioritization process.

Following data collection and discussion sessions, a four-part prioritization process was followed.

- First, the roadways to be included in the ITS Roadway Analysis Network were identified;
- Second, prioritization criteria were developed;
- Third, a criterion weighting factor based on the importance of the criteria to key agencies was identified; and
- Fourth, each segment of the ITS Roadway Analysis Network was ranked based on each criterion.

From the analysis, a hierarchy of prioritized roadways consisting of freeway and major arterial segments was developed.

2.2 ITS Roadway Analysis Network

The ITS Roadway Analysis Network consists of major arterials and freeways in the MRCOG region that were analyzed for prioritization and potential inclusion in the ITS Deployment Plan. Roadways were initially selected for inclusion in the analysis network based upon the MRCOG *"Draft Intelligent Transportation Systems Long Range Map – Albuquerque Urban Area"* dated 11/06/2002. The following categories of roadways on the map were selected by the MRCOG ITS Subcommittee to be included in the ITS Roadway Analysis Network:

- Class 1 ITS Roadways (Freeways);
- Class 2 ITS Roadways (Arterials);
- Class 3 ITS Roadways (Arterials);
- Several Class 4 ITS Roadways (Arterials):
  - Broadway (NM 47) between I-25 and Central Avenue;
  - Golf Course Road between Montano Road and Southern Boulevard;
  - Louisiana Blvd between Menaul Blvd and Montgomery Boulevard;
  - Candelaria Road between San Mateo Boulevard/Osuna Road and Tramway Boulevard; and
  - Menaul Boulevard between Eubank Boulevard and Tramway Boulevard.

After the network was identified, some roadways were broken into smaller segments for the analysis. The segmentation was based primarily on common existing and future operational characteristics of the road. Roadways that extended over large geographic areas were segmented so that a more finite analysis could be conducted on specific sections of the corridor that share operational characteristics. For example, a roadway might be broken into two segments where the traffic volumes and/or accidents within each segment are fairly consistent.

The ITS Roadway Analysis Network is shown in **Figure 1**. A list of individual segments included in the ITS Roadway Analysis Network is shown in **Appendix A**.

Figure 1: ITS Analysis Network

2.3 Prioritization Analysis Criteria

The criteria selected by the ITS Subcommittee for use in prioritizing freeway and arterial segments in the Albuquerque Metropolitan Area for ITS implementation are:

- Volume/capacity ratios for 2005, 2010 and 2025;
- Provides a connection to a freeways;
- Acts as an alternate route to a freeway(s);
- Significant to interjurisdictional travel;
- High accident rate;
- Adverse weather impacts;
- Provides access across the Rio Grande River;
- Major transit route;
- Limited access route;
- Existing/funded ITS Infrastructure; and
- Provides access to major destinations.

The following are summary descriptions of the data used in the analysis:

Volume/Capacity Ratios for 2005, 2010, and 2025

Volume/capacity (v/c) ratio data for the years 2005, 2010, and 2025 was available in GIS format for the roadways in the project area. This information was contained within a roadway shapefile layer that utilized the MRCOG standard segmentation. These segments were aggregated to form the corridor and freeway segments that were analyzed.

Provides a Connection to a Freeway

Maps were reviewed to identify roadways that provide direct access to freeways.

Acts as an Alternate Route to a Freeway(s)

Freeway alternate routes were identified by the ITS Subcommittee.

Significant to Interjurisdictional Travel

Roadways that contribute significantly towards interjurisdictional travel were identified by the ITS Subcommittee.

High Accident Rate

Accident point data was available for various areas of the region for 1998, 1999 and 2000. A comparison of the data for the three years showed it to be fairly consistent from year-to-year with regard to quantity of accidents per segment. Only the 1999 data was complete over the entire project area; thus, only 1999 data was used to determine the aggregated accident rates per one hundred million vehicle miles of travel.

Adverse Weather Impacts

The ITS Subcommittee identified the roadway segments in the project area that experience impacts by adverse weather conditions.

Provides Access Across the Rio Grande River

Maps were reviewed to select routes that provide access across the Rio Grande River. The ITS Subcommittee subsequently confirmed these selected roadways.

Major Transit Route

The ITS Subcommittee identified arterials that currently serve as major transit routes, or will serve as major transit routes in the future.

Limited Access Route

GIS maps were reviewed to identify routes with limited access.

Existing/Funded ITS Infrastructure

The agencies in the area made available information on existing and programmed (funded) ITS infrastructure.

Provides Access to Major Destinations

The ITS Subcommittee identified roadways that provide access to major employment and recreational destinations within the region.

2.4 Weighting Factors

A weighting factor was assigned to each criterion. The weighting factor was determined by MRCOG and the ITS Subcommittee based upon the importance of each criterion to the region.

Weighting factors for each criterion are independent ranging from 1 to 5; with a score of 5 given to a very important criterion and a score of 1 given to one of low importance. **Table 1** and **Table 2** show the resultant criteria weighting factors for freeways and arterials, respectively.

Table 1: Freeway Segment Criteria and Weighting Factors

Prioritization Criteria	Weighting Factors (1 – 5)
Volume/capacity ratios for 2005	5
Volume/capacity ratios for 2010	4
Volume/capacity ratios for 2025	1
High accident rate	5
Adverse weather impacts	3
Provides access across the Rio Grande River	3
Major transit route	2
Existing/funded ITS infrastructure	4
Provides access to major destinations	3

Table 2: Arterial Roadway Prioritization Analysis Criteria and Weighting Factors

Prioritization Criteria	Weighting Factors (1 – 5)
Volume/capacity ratios for 2005	5
Volume/capacity ratios for 2010	3
Volume/capacity ratios for 2025	1
Provides a connection to a freeway	3
Acts as an alternate route to a freeway(s)	5
Significant to interjurisdictional travel	4
High accident rate	5
Adverse weather impacts	2
Provides access across the Rio Grande River	3
Major transit route	3
Limited access	4
Existing/funded ITS Infrastructure	4
Provides access to major destinations	4

2.5 Analysis Scoring Guidelines

Each segment in the ITS Roadway Analysis Network was assigned a score based on how it met each criterion. The analysis scoring guidelines described in **Table 3** and **Table 4** established a framework to ensure that each roadway was scored on the same basis. **Table 3** and **Table 4** present the analysis scoring guidelines for freeways and arterials, respectively.

Table 3: Freeway Analysis Scoring Guidelines

Criteria	Ranking Guidelines
Volume/Capacity Ratios (v/c)	
1.01 and above	5
0.86-1.00	4
0.71-0.85	3
0.51-0.70	2
0.01-0.5	1
High Accident Rate (accidents per 100 million VMT)	
90 and above	5
45-89	3
0-44	1
Adverse Weather Impacts	
Adverse Weather Impact – Level 1	5
Adverse Weather Impact – Level 2	3
Insignificant Weather Impact	0
Provides Access across the Rio Grande River	
Provides access	5
If not	0
Existing/Funded ITS Infrastructure	
Existing or programmed (funded) communications that can be used for future projects on roadway	5
Existing or programmed (funded) communications conduit and/or ITS infrastructure on roadway	4
Existing or programmed (funded) ITS infrastructure on roadway	3
No infrastructure	0
Provides Access to Major Destinations	
Provides access to 3 or more major destinations	5

Table 3: Freeway Analysis Scoring Guidelines (continued)

Criteria	Ranking Guidelines
Provides access to 2 major destinations	3
Provides access to 1 major destination	1
Does not provide access to major destinations	0

Table 4: Arterial Analysis Scoring Guidelines

Criteria	Ranking Guidelines
Volume/Capacity Ratios (v/c)	
1.01 and above	5
0.86-1.00	4
0.71-0.85	3
0.51-0.70	2
0.01-0.5	1
Provides a Connection to a Freeway(s)	
If connected to a freeway	5
If no freeway connections	0
Acts as an Alternate Route to a Freeway(s)	
Parallel to a freeway and within a distance of up to one mile	5
Parallel to a freeway and greater than one mile away	1
Does not serve as an alternate route to a freeway	0
Significant to Interjurisdictional Travel	
Traverses 3 or more jurisdictions	5
Traverses 2 jurisdictions	3
Does not serve interjurisdictional travel	0
High Accident Rate (accidents per 100 million VMT)	
90 and above	5
45 – 89	3
0 – 44	1
Adverse Weather Impacts	
Adverse Weather Impact – Level 1	5
Adverse Weather Impact – Level 2	3
Insignificant Weather Impact	0

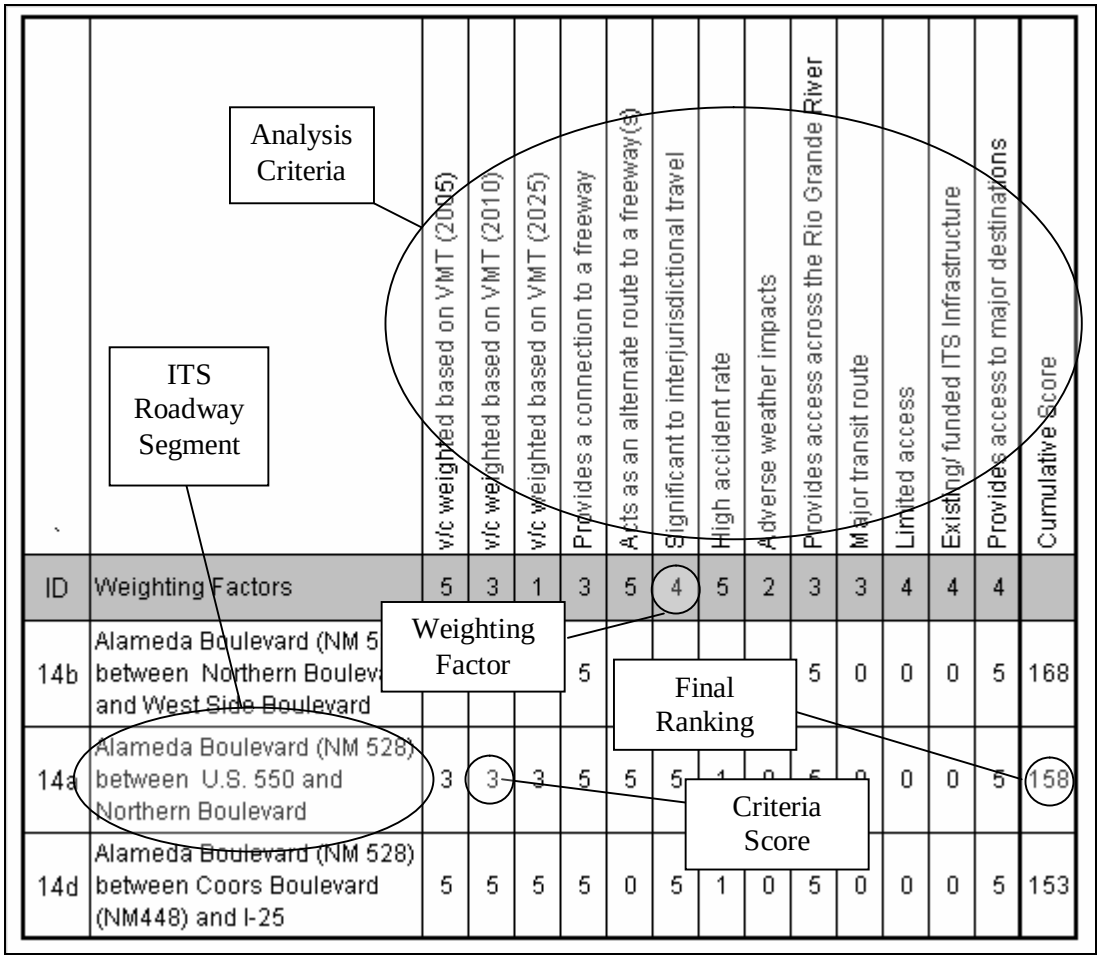
Table 4: Arterial Analysis Scoring Guidelines (continued)

Criteria	Ranking Guidelines
Provides Access across the Rio Grande River	
Provides access	5
If not	0
Major Transit Route	
As identified by the ITS subcommittee	5
If not	0
Limited Access Route	
As identified in the long range plan	5
If not	0
Existing/Funded ITS Infrastructure	
Existing or programmed (funded) communications that can be used for future projects on roadway	5
Existing or programmed (funded) communications conduit and/or ITS infrastructure on roadway	4
Existing or programmed (funded) ITS infrastructure on roadway	3
No infrastructure	0
Provides Access to Major Destinations	
Provides access to 3 or more major destinations	5
Provides access to 2 major destinations	3
Provides access to 1 major destination	1
Does not provide access to major destinations	0

2.6 ITS Roadway Analysis Results

A matrix containing each of the segments in the ITS Roadway Analysis Network, the analysis criteria, and the weighting factors was developed. A criteria score was assigned to each roadway segment using the criteria score analysis guidelines. The weighting factor was applied to each score, and the weighted criteria scores were summed to calculate the final ranking. Freeways and arterials were analyzed separately. A sample portion of the matrix is shown in **Table 5**. The full matrix is included in **Appendix B**.

Table 5: Sample ITS Roadway Analysis Matrix



ID	Weighting Factors	v/c weighted based on VMT (2005)	v/c weighted based on VMT (2010)	v/c weighted based on VMT (2025)	Provides a connection to a freeway	Acts as an alternate route to a freeway(s)	Significant to interjurisdictional travel	High accident rate	Adverse weather impacts	Provides access across the Rio Grande River	Major transit route	Limited access	Existing/ funded ITS Infrastructure	Provides access to major destinations	Cumulative Score
		5	3	1	3	5	4	5	2	3	3	4	4	4	
14b	Alameda Boulevard (NM 5 between Northern Boulev and West Side Boulevard				5					5	0	0	0	5	168
14a	Alameda Boulevard (NM 528) between U.S. 550 and Northern Boulevard	3	3	3	5	5	5	1	0	5	0	0	0	5	158
14d	Alameda Boulevard (NM 528) between Coors Boulevard (NM448) and I-25	5	5	5	5	0	5	1	0	5	0	0	0	5	153

The results of the matrix analysis are shown in **Table 6** and **Table 7**. **Table 6** shows the results of the freeway analysis, while **Table 7** shows the results of the arterial analysis.

Table 6: Freeway Segment Ranking Results

Roadway Name	Final Ranking
I-40 EB Between Tramway Boulevard (NM 556) and Unser Boulevard	106
I-40 WB Between Tramway Boulevard (NM 556) and Unser Boulevard	106
I-25 SB Between Alameda Boulevard (NM 528) and Rio Bravo Boulevard (NM 500)	106
I-25 NB Between Alameda Boulevard (NM 528) and Rio Bravo Boulevard (NM 500)	100
I-40 EB East of Tramway Boulevard (NM 556)	61
I-25 SB South of Rio Bravo Boulevard (NM 500)	49
I-40 WB East of Tramway Boulevard (NM 556)	41
I-25 NB South of Rio Bravo Boulevard (NM 500)	40
I-40 EB West of Unser Boulevard (NM 345)	25
I-40 WB West of Unser Boulevard (NM 345)	25
I-25 NB North of Alameda Boulevard (NM 528)	25
I-25 SB North of Alameda Boulevard (NM 528)	25

As seen in **Table 6**, the freeway segments that have the highest scores all fall within the Albuquerque urban area and include the following:

- I-40 EB and WB between Tramway Boulevard and Unser Boulevard; and
- I-25 NB and SB between Alameda Blvd (NM 528) and Rio Bravo Boulevard.

Table 7: Arterial Segment Ranking Results

Roadway Name	Final Ranking
Alameda Boulevard (NM 528) between Northern Boulevard and West Side Boulevard	168
Alameda Boulevard (NM 528) between U.S. 550 and Northern Boulevard	158
Alameda Boulevard (NM 528) between Coors Boulevard (NM448) and I-25	153
Alameda Boulevard (NM 528) between West Side Boulevard and Coors Boulevard (NM448)	133
Central Avenue between Paseo del Volcan and Coors Boulevard	119
Bridge Boulevard/Avenida Cesar Chavez between Isleta Boulevard and Broadway (NM 47)	114
Central Avenue between Coors Boulevard and I-25	113
Coors Boulevard (NM 448) between Central Avenue and Montano Road	106
Coors Boulevard (NM 448) between Montano Road and Alameda Boulevard	103
U.S. 550 between Alameda Boulevard (NM 528) and I-25	103
Paseo del Norte between Coors Boulevard and Edith Boulevard	101
Paseo del Norte between Edith Boulevard and Pennsylvania Street	98
Coors Boulevard (NM 448) between Rio Bravo Boulevard (NM 500) and Central Avenue	92
Avenida Cesar Chavez between Broadway (NM 47) and I-25	91
Montano Road between Unser Boulevard (NM345) and I-25	90
Bridge Boulevard/Tower Road between Coors Boulevard and Isleta Boulevard	87
Gibson Boulevard between San Mateo Boulevard and Pennsylvania Street	86
Paseo del Norte between Pennsylvania and Tramway Boulevard (NM 556)	86
Montgomery Boulevard between I-25 and Carlisle Boulevard	84
Unser Boulevard (NM 345) between Gun Club Road and U.S. 550	80
Lomas Boulevard between Carlisle Boulevard and Wyoming Boulevard	79
Juan Tabo Boulevard (Gibson Boulevard/Southern Boulevard) between Gibson Boulevard and I-40	78
U.S. 550 between Unser Boulevard and Alameda Boulevard (NM 528)	75
Montgomery Boulevard between Carlisle Boulevard and Wyoming Boulevard	74
Candelaria Boulevard between Carlisle Boulevard and San Mateo Boulevard	74

Table 7: Arterial Segment Ranking Results (continued)

Roadway Name	Final Ranking
Paseo del Norte between west and Coors Boulevard	74
Osuna Road/San Mateo Boulevard between Montgomery Boulevard and Indian School Road	74
Sen. Dennis Chavez Boulevard/Rio Bravo Boulevard (NM 500) between Paseo del Volcan and Special Event Area	74
Alameda Boulevard between I-25 and Pennsylvania Street	74
2nd Street (NM 47) between Candelaria Road and 4th Street	72
Central Avenue between I-25 and Washington Street	72
Gibson Boulevard between Broadway (NM 47) and San Mateo Boulevard	72
Central Avenue between Eubank Boulevard and Tramway Boulevard (NM 556) Road	71
Broadway (NM 47) between I-25 and Central Avenue	71
Paseo del Volcan/King Boulevard between I-40 and U.S. 550	69
Juan Tabo Boulevard s/o I-40	68
Cesar Chavez Boulevard between I-25 and University Boulevard	68
Tramway Boulevard (NM 556) between I-40 and Modeso Avenue	66
Central Avenue between Washington Street and Louisiana Boulevard	65
Zuni Road/Coal Avenue/Lead Avenue between 4th Street and Central Avenue	65
Central Avenue between Louisiana Boulevard and Eubank Road	65
Montgomery Boulevard between Wyoming Boulevard and Eubank Boulevard	64
Gibson Boulevard between Pennsylvania Street and Juan Tabo Boulevard	63
Montgomery Boulevard between Eubank Boulevard and Tramway Boulevard (NM 556)	63
Lomas Boulevard between Eubank Boulevard and Tramway Road (NM 556)	62
Roy Avenue (NM 556)/Tramway Road (NM 556) between NM 313 (2nd Street extension) and Modeso Avenue	62
Osuna Road/San Mateo Boulevard between 2nd Street (NM 47) and Montgomery Boulevard	61
Golf Course Road/Taylor Ranch Road between Montano Road and Southern Boulevard	60
Louisiana Boulevard between Gibson Boulevard and Menaul Boulevard	59
Lomas Boulevard between Central Avenue and Carlisle Boulevard	59

Table 7: Arterial Segment Ranking Results (continued)

Roadway Name	Final Ranking
Lomas Boulevard between Wyoming Boulevard and Eubank Boulevard	59
Isleta Boulevard between Rio Bravo Boulevard (NM 500) and Bridge Boulevard	58
Wyoming Boulevard between Gibson Boulevard and Tramway Road (NM556)	58
Eubank Boulevard south to Tramway Road (NM 556)	56
Louisiana Boulevard between Menaul Boulevard and Montgomery Boulevard	55
Dr. Martin Luther King Jr. Avenue/Tijeras Avenue between 12th Street and I-25	55
San Mateo Boulevard between Gibson Boulevard and Indian School Road	54
Menaul Boulevard between Wyoming Boulevard and Eubank Boulevard	54
Menaul Boulevard between Carlisle Boulevard and Wyoming Boulevard	51
Juan Tabo Boulevard between I-40 and Eubank Boulevard	51
Candelaria Boulevard between 12th Street and Carlisle Boulevard	51
Sunport Boulevard between I-25 and Albuquerque International Airport	49
Menaul Boulevard between Eubank Boulevard and Tramway Boulevard (NM 556)	48
Candelaria Boulevard between San Mateo Boulevard Wyoming Boulevard	47
Menaul Boulevard between 12th Street and Carlisle Boulevard	41
98th Street between Paseo del Volcan and Sen. Dennis Chavez Boulevard	41
Paseo Del Volcan between Sen. Dennis Chavez Boulevard and Upper Street	38
Alameda Boulevard between Pennsylvania Street and Eubank Boulevard	38
Arenal Boulevard between Unser Boulevard (NM 345) and Coors Boulevard (NM448)	35
Candelaria Boulevard between Wyoming Boulevard and Eubank Boulevard	33
2nd Street (NM 47) between Bridge Boulevard and Candelaria Road	32
Central Avenue west of Paseo Del Volcan	32
Coors Boulevard (NM 448) between Coors Boulevard and Alameda Boulevard (NM 528)	31
Atrisco Drive w/o Unser Boulevard (NM 345)	26
Ellison Drive between Golf Course Road and Alameda Boulevard (NM 528)	25

Table 7: Arterial Segment Ranking Results (continued)

Roadway Name	Final Ranking
Coors Boulevard (NM 45) between I-25 and Sen. Dennis Chavez Boulevard/Rio Bravo Boulevard (NM 500)	23
McMahon Boulevard between Rainbow Boulevard and Golf Course Road	21
Americas Parkway/Arvada Avenue/Winrock Loop	19
Candelaria Road between Eubank Boulevard and Tramway Boulevard (NM 556)	19
Westside Boulevard between Rainbow Boulevard and Alameda Boulevard (NM 528)	18
Southern Boulevard between Paseo del Volcan and Alameda Boulevard (NM 528)	16
Idalia Road between Rainbow Boulevard and Alameda Boulevard (NM 528)	16
Rainbow Boulevard between Paseo del Volcan and Westside Boulevard	16
Gibson West w/o Unser Boulevard (NM 348)	13
Northern Boulevard between Paseo del Volcan and Alameda Boulevard (NM 528)	13
Rainbow Boulevard between Irving Boulevard and Paseo del Norte	13
118th Street between Paseo del Volcan and Middle Street	10
Between Lower Street and I-40	10
Progress Blvd between Rainbow Boulevard and Chayote Road/Paseo del Volcan	7

3.0 MENU OF POTENTIAL ITS FUNCTIONS AND ELEMENTS

This section identifies ITS functions and elements that could be considered for deployment on the arterial and freeway system in the MRCOG region.

3.1 Correlation with Regional Architecture

Section 5206(e) of the TEA-21, Public Law 105-178, 112 Stat. 457, requires ITS projects funded from the highway trust fund to conform to the regional ITS architecture and the National ITS Architecture. The National ITS Architecture defines services that could be performed to satisfy the regions' needs, and how the various transportation systems might connect to share information. These services are grouped into market packages. Market packages represent services tailored to fit real-world transportation problems and needs. The market packages collect together one or more equipment packages that must work together to provide the transportation service. Equipment packages are the "implementable packages", or field elements, that are required to implement the particular transportation service (*National ITS Architecture, version 4.0. http://itsarch.iteris.com/itsarch/html/mp/mpindex.htm*).

In order to identify appropriate ITS devices and field elements that should be considered for deployment on Albuquerque area roadways, and to ensure that these field elements are in conformance to the National ITS Architecture, a three-step process was followed:

- Step 1: Select applicable high priority market packages from the regional architecture;
- Step 2: Identify equipment packages for each high priority market package; and
- Step 3: Identify specific ITS field elements for each equipment package.

Step 1: Select applicable high priority market packages from the regional architecture

The regional ITS architecture for the Albuquerque Metropolitan Area (AMPA) Version 2 identified high-priority market packages for deployment on Albuquerque area roadways.

The high priority market packages were categorized as either existing or planned. The regional ITS architecture defined existing market packages as those that already exist in the Albuquerque area, although the interfaces may be "legacy", and may not conform to the National ITS Architecture or related standards. Planned market packages are those that do not exist, but for which funds have been programmed, or there is reasonable stakeholder consensus for the project that can lead to future funding.

The existing market packages identified in the regional ITS architecture included:

- Network Surveillance;
- Transit Vehicle Tracking;
- Demand Response Transit Operations;
- Broadcast Traveler Information;
- Interactive Traveler Information;
- Traffic Information Dissemination; and
- Surface Street Control.

The planned market packages include:

- § Transit Fixed-Route Operations;
- § Transit Vehicle Tracking;
- § Transit Passenger and Fare Management;
- § Transit Security;
- § Transit Maintenance;
- § ITS Planning;
- § Transit Traveler Information;
- § Emergency Routing;
- § Emergency Response;
- § Probe Surveillance;
- § Broadcast Traveler Information;
- § Regional Traffic Control;
- § Parking Facility Management;
- § Incident Management System;
- § Road Weather Information System; and
- § Road Weather Information System (Road Weather Data Collection and Weather Information Processing and Distribution).

Step 2: Identify equipment packages for each high priority market package

Market packages are composed of "equipment packages." Equipment packages group similar processes, or functions, into an "implementable" package. The equipment packages containing roadway ITS elements were identified for each of the high priority market packages. These are shown in **Table 8**. Equipment packages for two additional market packages have also been included here as additional potential solutions to current transportation issues. These are the Freeway Control and Advanced Railroad Grade Crossings market packages. The Freeway Control market package allows for communications and roadside equipment to support ramp control, lane controls, and interchange control for freeways. The Advanced Railroad Grade Crossings Market Package manages highway traffic at highway-rail intersections.

Table 8 shows the high priority market packages and the associated roadside equipment packages that could be deployed in order to implement the market package. Existing roadside equipment packages and those for which projects are funded for deployment in the Albuquerque area are shown in brackets [example].

Table 8: High Priority Market Packages and Associated Roadway Equipment Packages

National ITS Architecture Market Package	Associated Roadway Equipment Packages from National ITS Architecture
Network Surveillance	**Roadway Basic Surveillance** – This provides the capabilities to monitor traffic flow at major intersections and on main highways for urban areas and to monitor road conditions using fixed equipment such as loop detectors and wireline communication.
Transit Vehicle Tracking	No roadway equipment packages identified. Equipment packages relate to vehicle on-board equipment.
Demand Response Transit Operations	No roadway equipment packages identified. Equipment packages relate to vehicle on-board equipment.

Table 8: High Priority Market Packages and Associated Roadway Equipment Packages (continued)

National ITS Architecture Market Package	Associated Roadway Equipment Packages from National ITS Architecture
Interactive Traveler Information	No roadway equipment packages identified. Equipment packages relate to vehicle on-board equipment, central equipment and dissemination equipment.
Traffic Information Dissemination	**Roadway Traffic Information Dissemination –** Provides the roadside elements of traffic information dissemination including DMS, HAR, and talking pedestrian signs. [AMTMS DMS, District 3 Highway Advisory Radios, 511, CARS]
Surface Street Control	**Roadway Signal Control** – Provides the capabilities to control traffic signals at major intersections and on main highways for urban areas. **Roadway Equipment Coordination –** Provides direct communications and coordination between field equipment, such as between remote sensors and field devices (e.g., Dynamic Message Signs) and coordination between the field devices themselves (e.g., coordination between traffic controllers that are controlling adjacent intersections.) [City interconnect]
Transit Fixed-Route Operations	No roadway equipment packages identified. Equipment packages relate to vehicle on-board equipment.
Transit Passenger and Fare Management	**Remote Transit Fare Management** – Provides the capability for the traveler to use a common fare medium for all applicable surface transportation services, and to pay without stopping. This may be implemented as a payment instrument reader at a kiosk. [COA Transit Kiosks]. The market package can be implemented with the use of on-board devices.
Transit Security	**Secure Area Monitoring –** Provides the capability to monitor the safety of travelers at transit stations, rest areas, tourist centers, park and ride lots, and other locations frequented by travelers. It collects surveillance images and data and relays this information back to the appropriate center.
Transit Maintenance	No roadway equipment packages identified. Equipment packages relate to on-board vehicles equipment and facility equipment
ITS Planning	Not a current market package of National ITS Architecture version 4.0.
Transit Traveler Information	**Remote Transit Information Services –** Furnishes transit users with real-time travel-related information at transit stops, multi-modal transfer points, and other public transportation areas. This also supports general annunciation and/or display of imminent arrival information and other information of general interest to transit users. [COA Transit Kiosks, 511, CARS]
Emergency Routing (for Emergency Vehicle Signal Preemption, and Transit Signal Priority)	**Roadside Signal Priority** – Provides the capability to receive vehicle signal priority requests and control roadside signals accordingly [Bernalillo County Preemption System and Smart Corridor Assets, Downtown/NE Heights Traffic Signal Control Equipment, Rio Rancho Traffic Signal]
Probe Surveillance	No roadway equipment packages identified. Equipment packages relate to vehicle on-board equipment.
Broadcast Traveler Information	**Remote Basic Information Reception –** Provides the capability for travelers to receive formatted traffic advisories including accurate traveling information concerning available travel options and their availability, and congestion information [COA Transit Kiosks]
Regional Traffic Control	No roadway equipment packages identified**. TMC Regional Traffic Control** equipment package relates to facility and center equipment and provides capabilities for analyzing, controlling, and optimizing area-wide traffic flow. These capabilities provide for wide area integration of a network signal system with control of freeway. These capabilities are best provided using a Traffic Management Center (TMC) to manage freeway ramp meters and traffic signals and software to process traffic information and implement traffic management measures

Table 8: High Priority Market Packages and Associated Roadway Equipment Packages (continued)

National ITS Architecture Market Package	Associated Roadway Equipment Packages from National ITS Architecture
Parking Facility Management	No roadway equipment packages identified – elements are specific to parking structure facilities
Incident Management System	**Roadway Incident Detection –** Provides incident detection capability to reside at the roadside. [AMTMS Video, Data Collection, Smart Corridor Assets, Downtown/NE Heights Traffic Signal Control Equipment, Rio Rancho Traffic Signal]
Road Weather Information System (Version 4.0 of the National ITS Architecture separates this into: Road Weather Data Collection and Weather Information Processing and Distribution	**Roadway Environmental Monitoring –** Measures environmental conditions and communicates the collected information back to a center where it can be monitored and analyzed [Smart Corridor Assets, NMSHTD, RWIS]
Freeway Control	**Roadway Freeway Control –** Ramp meters, DMS and other freeway control effects which will control traffic on freeways [NMSHTD AMTMS portable/fixed DMS]
Advanced Railroad Grade Crossings	**Advanced Rail Crossing** – Manages highway traffic at highway-rail intersections (HRIs). Active warning systems (e.g., flashing lights and gates) are supported as well as provision of information to traffic information dissemination devices (DMS, CMS).

Step 3: Identify specific ITS field elements for each equipment package

The third and final step to identify ITS Functional Field Elements that can be considered for deployment on roadways in the Albuquerque region was to identify specific types of ITS field devices for each equipment package. This resulted in a Menu of ITS Elements, as explained in **Section 3.2**.

3.2 Menu of Potential ITS Elements

This section presents a menu of potential ITS elements. The purpose of the menu is to illustrate some of the various ITS applications that can be considered for deployment in the Albuquerque metropolitan area.

The menu of potential ITS elements that can be considered for deployment in the Albuquerque metropolitan area is shown in **Table 9.** The first column of **Table 9** lists the equipment packages from the National ITS Architecture as identified in **Table 8**. The second column lists specific roadside ITS field elements that comprise the equipment package. The third column of **Table 9** provides additional detail and explanation of the purpose of the ITS field element.

The ITS elements listed are independent of specific technologies or products. For example, an ITS element is identified as video surveillance. While this element will likely include a CCTV camera, the type of camera, specifications, and pole mount have not been specified. By identifying an element without specific technologies, the element will remain flexible and allow for changes in technology.

A more detailed description of the ITS elements follows the table in **Sections 3.2.1 through 3.2.21**.

Table 9: Menu of Potential ITS Elements

Associated Equipment Packages from National ITS Architecture	ITS Elements for Deployment	Purpose
Roadway Basic Surveillance	Vehicle Detection	§ Monitor traffic speed, volume, and occupancy § Identify congestion § Identify incidents based on speed, volume and/or occupancy
	Video Surveillance	§ Monitor Traffic Flow § Identify Congestion § Identify, verify and determine appropriate response for incidents § Shared use of video by multiple agencies (emergency services, parking management, special events) is possible
Roadway Traffic Information Dissemination	Dynamic Message Signs	§ Unlimited number of messages § Provides traveler information and alternate routing information to motorists
	Changeable Message Signs	§ Preprogrammed messages in controller § Provides traveler information and alternate routing information to motorists
	Trailblazer Signs	§ Modular sign can include static, changeable, and extinguishable single message arrows (on or off only) § Provides detour route signing for motorists
	Highway Advisory Radio	§ Capable of conveying detailed and elaborate messages § Provides broadcast traveler information to motorists and allows a large geographic coverage area
Roadway Signal Control	Modern Traffic Signal Controllers	§ Allows signal timing plans to be implemented from a workstation § Allows operators to adjust traffic signal timing to respond to incidents
Roadway Equipment Coordination	Traffic Signal Interconnect	§ Provides capability to remotely change timing plans and coordinate signal modules
	Road barriers (when used in conjunction with Flood detection system)	§ Used to restrict motorist access to roadways during flooding incidents
Remote Transit Fare Management	Fare Payment Kiosks at Transit Stops	§ Allows transit users to use a traveler card or other electronic payment device for fare payment
Secure Area Monitoring	Video Surveillance	§ Identify, verify and determine appropriate response for incidents at transit centers and other public transportation facilities
Remote Transit Information Services	Traveler Information Devices at Transit Stops	§ Provides transit agency ability to update passengers at transit stations/stops on arrival times of transit vehicles § May include kiosks or dynamic message displays at transit stations
Roadside Signal Priority	Transit Priority Capability	§ Provides traffic signal with capability to give priority to buses
	Emergency Vehicle Signal Preemption	§ Provides emergency vehicles with capability to preempt normal traffic signal cycle

Table 9: Menu of Potential ITS Elements (continued)

Associated Equipment Packages from National ITS Architecture	ITS Elements for Deployment	Purpose
Remote Basic Information Reception	Traveler Information Devices at Public Locations	§ Provides travelers with traffic advisories and information concerning travel options and their availability, and information concerning congestion § May include kiosks or dynamic message displays at transit stations
Roadway Incident Detection	Video Surveillance	§ Enables network surveillance to be used for incident detection
Roadway Environmental Monitoring	Road Weather Information Systems	§ Identify severe weather conditions, such as fog, heavy rain, or high winds § Creates history of weather patterns and effects on roadway to establish predictability
	Pavement Sensors	§ "Hockey-puck" sized sensors installed into the pavement to measure pavement surface and subsurface temperatures, and provide road conditions
	Flood Detection Systems	§ Identify potential and existing flood conditions at low-water crossings § Allows needed closures to be identified and increases safety for motorists
Roadway Freeway Control	Freeway Ramp Metering and Control	§ Used to manage demand on freeways during peak congestion periods
Advanced Rail Crossing	Rail Crossing/Traffic Signal Coordination	§ Detects vehicles trapped inside closing gate § Provides traffic signal coordination capability with highway-rail intersections § Provides information (DMS, CMS) to motorists prior to arrival at highway-rail intersection

3.2.1 Vehicle Detection

Vehicle detection sensors (intrusive or non-intrusive) enable traffic managers to monitor traffic and road conditions, identify incidents, and collect data for traffic strategy development and long range planning. Deployment of vehicle detection elements is the first step to achieving a traffic surveillance functionality. Video surveillance (described in **Section 3.2.2**) can be added during later implementation stages to enhance the function. The collected data can also be analyzed and made available to users of travel information systems.

3.2.2 Video Surveillance

Video surveillance enables traffic managers to monitor traffic and road conditions and identify and verify incidents. The addition of video surveillance to a corridor allows system operators to visually identify and monitor traffic conditions, and observe the effect of changes made to the traffic management system on traffic conditions.

Video surveillance requires a type of high bandwidth communication in order to provide full-motion video. If compressed or still-frame video is acceptable, then a low bandwidth communication system is adequate. Cameras can include pan-tilt-zoom (PTZ) capability or can be fixed-mounted to reduce capital and maintenance costs.

3.2.3 Dynamic Message Signs

Dynamic message signs (DMS) can be used to provide information to travelers while en-route. DMS allow operators to input any text message on a sign for traffic management and traveler information purposes. DMS are flexible in terms of the available messages. The message content is only limited by the size of the DMS and speed of travel on the adjacent roadway. Thus, DMS can be used for a variety of advisories. DMS can be designed for arterial as well as freeway applications. Arterials applications would be smaller, and can even incorporate finishes (e.g., wood) to meet local aesthetic standards.

Communications to DMS can be accomplished through the use of low bandwidth communications, such as a telephone line.

3.2.4 Changeable Message Signs

Changeable message signs (CMS) can be used to provide information to travelers while en-route. CMS require that the sign be preprogrammed at the controller and allows a limited number of messages for potential use.

Communications to CMS elements can be accomplished through the use of low bandwidth communications, such as a telephone line.

3.2.5 Trailblazer Sign

Trailblazer signs can be used to provide information to travelers while en-route. Trailblazer signs can be modular, comprised of static, changeable and extinguishable (e.g., a set of directional arrows to be displayed or turned off).

CMS are lower in capital cost than DMS but do not offer the flexibility in terms of the messages. CMS can be considered in locations where specific message content needs are anticipated.

Trailblazers are a specific type of CMS that are generally used to direct travelers who are unfamiliar with the route to the location of major transportation facilities or major traffic generators (special events, recreational facilities). The signs can also be used to direct traffic towards transportation facilities that serve as alternate routes during incidents, congestion, or other events, such as for the river crossings. They are generally installed on primary roadways that provide the most direct route to the alternate route. The signs are modular, and would generally include the following components:

- a static freeway shield or traffic generator name or logo to identify the purpose of the sign;
- an arrow or a series of arrows that can be turned on or off to direct traffic in a particular direction; and
- potentially a module for display of messages (changeable or dynamic).

3.2.6 Highway Advisory Radio

Highway Advisory Radio (HAR) can be used to provide information to travelers while en-route. HAR broadcasts driver advisories over a large area and can be received by any driver with a radio. Communications to the HAR element can be accomplished through the use of low bandwidth communications, such as a telephone line.

3.2.7 Modern Traffic Signal Controllers

Modern traffic signal controllers can be used to run advanced traffic control strategies and to interface with other ITS applications such as dynamic message signs, changeable message signs, emergency vehicle signal preemption and transit priority systems, video surveillance devices, video detection devices, weather information systems, ramp meters, and highway-rail intersections equipment.

Modern traffic signal controllers also allow for communication between intersections enabling signal timing plan synchronization along a corridor.

If communication is established between the traffic signal controller and the central traffic control system, traffic signals can be monitored from the traffic management center. System operators are able to actively manage traffic and respond to incidents by remotely inputting signal timing plans from the traffic management center in response to incidents, lane closures, special events, and recurring congestion.

3.2.8 Traffic Signal Interconnect

Traffic signal interconnect allows groups of traffic signals to be simultaneously programmed and to consistently operate in synchronization. Traffic signal interconnect may consist of hardwire (copper or fiber) or wireless applications (e.g. Spread Spectrum Radio). Interconnect can be established between the field controller and the central control system, allowing traffic signal timing plans to be uploaded to the intersections remotely.

3.2.9 Road Barriers

Road barriers can be used to close roads due to severe flooding or other recurring incidents. They should be deployed in conjunction with video surveillance and a flood warning system or other detection system. When using road barriers, it is also important to deploy field elements that will provide travel information to the motorists that will be impacted by the road barrier. Dynamic or changeable signs could provide information as to the reason for the closure, and provide alternate route information. Trailblazer signs could provide directional information to alternate routes.

3.2.10 Fare Payment Kiosks at Transit Stops

Fare payment kiosks located at transit stops provide the capability for travelers to use a traveler card or other electronic payment device to pay for all applicable transportation services, to pay without stopping, to have payment media automatically identified as void or valid, and to have eligibility verified. In addition, the kiosks can be multi-purpose, including the provision of transit and travel information to users.

3.2.11 Secure Area Monitoring

Video surveillance of transit stations, rest areas, tourist centers, park and ride lots and other areas increases the safety of travelers. Video surveillance images are collected and relayed back to the transit control center. Security related information is also transmitted to emergency dispatch centers when an emergency is identified that requires an external response.

Video surveillance requires a type of high bandwidth communication in order to provide full-motion video. If compressed or still-frame video is acceptable, then a low bandwidth communication system is adequate. Cameras can include pan-tilt-zoom capability or can be fix-mounted to reduce capital and maintenance costs.

3.2.12 Traveler Information Devices at Transit Stops

Land-based traveler information devices could include kiosks, dynamic message displays, or any other type of infrastructure that can be located at a transit station or stop and provide information to transit users en-route.

In order to effectively deploy these elements, system operators must be able to supply accurate and real-time information to the traveler information devices. This requires equipment on buses to track schedule adherence as well as a facility where data can be processed and sent to the traveler information devices.

3.2.13 Transit Priority Capability

Transit signal priority is a strategy used to provide preference to transit vehicles at traffic signals in order to reduce travel time for transit users. Transit priority requires a transponder located on a transit vehicle to alert a traffic signal controller that the transit vehicle is approaching. To ensure the effectiveness of transit priority, an automatic vehicle location system, such as global positioning satellites (GPS), or another technology, should be in place in order to determine if transit vehicles are behind schedule and require priority at signals.

3.2.14 Emergency Vehicle Signal Preemption

Emergency vehicle signal preemption is used at intersections for emergency vehicles to reduce emergency response time and to reduce the number of accidents involving emergency vehicles at intersections. Emergency vehicle preemption also can increase the area that emergency vehicles can cover in required response times, resulting in cost-savings to the municipality.

Deployment of emergency vehicle signal preemption requires an emitter located on the emergency vehicle to send a signal to a detector mounted above the traffic signal. Following a request for preemption from an emergency vehicle, a green light is provided to the approaching emergency vehicle. All other directions, including pedestrian phases, are red. Once the vehicle passes through the intersection, the traffic signal transitions back into normal operations.

3.2.15 Traveler Information Devices at Public Facilities

Traveler information devices at public facilities (transit stops, rest areas, park and ride lots) and major trip generators (malls, major employment centers) can be used to provide traffic advisories and information concerning available travel options. Devices could include kiosks, dynamic message displays, or any other type of infrastructure that can be located at a public facility to provide travel information.

3.2.16 Video Surveillance (Roadway Incident Detection)

This is similar to the surveillance used for traffic monitoring. In addition to detecting traffic congestion, video surveillance can be used to identify and verify incidents on the roadway and allow system operators to monitor traffic conditions and pedestrian activities.

3.2.17 Road Weather Information Systems

Road Weather Information Systems (RWIS) may be used to identify weather conditions that have the potential to impact traffic such as fog, heavy rain, icing, and high winds. RWIS can operate using low bandwidth communications.

3.2.18 Pavement Sensors

Pavement sensors can be installed on roadways to provide information concerning pavement surface and subsurface temperatures. The sensors can also report the condition of the road: moisture, ice, or snow. Sensors also provide a report of the chemical concentrations present on the roadway, enabling the more efficient use of resources. The "hockey-puck" sized road sensors are installed in the roadway with a cable running from the sensor to the roadside processing unit.

3.2.19 Flood Detection Systems

Flood detection systems may be used to detect rising water on low-lying roadways. A typical flood detection system includes a warning light on the sign that advises travelers not to proceed due to rising water. Flood detection systems can operate using low bandwidth communications. When flooding is detected, a signal may be sent to operations and maintenance divisions so that they may respond accordingly. In addition, a system operator may post messages on DMS or activate trailblazer signs that direct motorists to alternate routes.

3.2.20 Freeway Ramp Control

Entrance ramp meters control the number of vehicles entering the freeway to help to reduce congestion on freeways. Ramp metering benefits travelers on the mainline by controlling entering traffic and providing impetus for entering traffic to divert to another location. Ramp metering is intended primarily to maintain uninterrupted flow and improve safety at on-ramp merge points and secondarily to provide for traffic diversion. Ramp-metering systems have been shown to result in higher freeway speeds, less delay to freeway users, high freeway-service volumes, safe merging operations, and reduced fuel consumption and emissions. (*Traffic Control Systems Operations, Installation, Management and Maintenance, ITE 2000*).

When deciding to implement ramp metering, it is important to ensure that the following conditions are satisfied (*Traffic Control Systems Operations, Installation, Management and Maintenance, ITE 2000*).

Diversion – Because ramp meters do not create additional capacity on the freeway, it is important that alternative routes and arterial capacity are available. If extra capacity is not available, congestion will occur elsewhere, even though entrance ramp control may help to reduce congestion on the freeway.

Storage – Adequate storage must exist at metered entrance ramps, so that waiting vehicles will not negatively impact the non-freeway traffic. Ramp traffic should not be allowed to back up and block arterial streets and frontage roads.

Traffic patterns and trip length – If most trips are regional in nature and only a small percentage of localized traffic exists, then little diversion will take place.

Public acceptance – Although ramp metering may provide benefits to the system as a whole, it is difficult to relate these benefits to individual freeway users. In announcing the beginning of an entrance ramp control system, it is important to inform the public about the reasons for initiating the system and the potential benefits of the system.

A ramp metering system would consist of ramp metering signals, local controllers, and potentially advance ramp control warning signs that could include flashing lettering or beacons. In addition, a more advanced system could consist of check-in detectors to measure demand, check-out detectors to ensure single-vehicle entry, queue detectors to prevent traffic from blocking frontage roads or surface streets, and merge detectors to measure the presence of vehicles in the primary merging area of the ramp and freeway mainlines.

3.2.21 Rail Crossing/Traffic Signal Coordination

Rail Crossing/Traffic Signal Coordination enables traffic signal and wayside rail equipment to work in response to, or in anticipation of, approaching trains.

Connectivity can be established between crossing gates and upstream traffic signal systems. This will enable alternate signal timing strategies to be implemented that prevent vehicles from entering the highway-rail intersection. For example, when the rail crossing is activated (gates are lowered) the upstream traffic signal may limit the amount of through traffic that can proceed to the rail crossing, ensuring that intersections are not blocked as the train passes.

Additional information about the arriving train can also be disseminated on dynamic message signs, prior to the arrival of the driver at the highway-rail intersection. Information may include the train's direction of travel, estimated time of arrival, and estimated duration of closure.

Trapped vehicle detectors can be installed where needed. This would provide immediate notification to the wayside rail and traffic management equipment so that an appropriate response can be implemented.

4.0 DRAFT ITS DEPLOYMENT PLAN

The ITS roadway segment final rankings, as explained in **Section 2**, were used to identify the roadways for inclusion in the Draft ITS Deployment Plan.

Following the preliminary identification of the roadways for inclusion in the ITS Deployment Plan based on the roadway segment final rankings, additional factors were considered such as maintaining connectivity, assessing the financial feasibility of implementing the resulting ITS Plan, and optimizing the use of planned and programmed ITS infrastructure. Consideration was also given as to where the deployment of ITS infrastructure will have the biggest impact to

resolve congestion and transportation safety issues. The ITS Subcommittee provided input to the ITS Plan direction and development.

Recommendations are made for corridor-based and for system-wide deployment of ITS. System-wide deployment recommendations are for ITS elements, systems, and solutions that should be deployed on a regional basis, such as traveler information. Also contained within this section is a brief description of the roadways included in the Draft ITS Deployment Plan, and the types of devices that should be deployed. Finally, recommendations for long-term ITS deployment are made.

4.1 System-wide Recommendations

The Draft ITS Deployment Plan is focused on corridor-based projects (see section 4.2) and several ITS system-wide deployments. For example, traveler information systems are not effective unless deployed on a regional, system-wide basis. System-wide deployment of such ITS applications increases the overall efficiency of the surface transportation system. Specifically, stakeholders in the Albuquerque metropolitan area should consider system-wide deployment of the following ITS applications:

Traveler Information – Stakeholders should continue to deploy the infrastructure required to support a comprehensive traveler information system. Infrastructure elements may include arterial and freeway vehicle detection devices to detect real-time traffic conditions.

Information from transit, parking, incident and weather services should be collected and information broadly disseminated through multiple media such as radio, internet, television, and telephone (511) services. The provision of real-time information to existing websites and travel information services should be a high priority.

Portable Traveler Information Dissemination Devices – The region should continue to use portable traveler information dissemination devices (portable changeable or dynamic message signs) during construction and special events, both on freeways and arterials

Communications Infrastructure – Center-to-field and field-to-field (interconnect) communications should be deployed as necessary to support the ITS project applications intended for deployment within the region. Additionally, the region should continue to deploy center-to-center communications between transit management, incident management, emergency management and traffic management agencies to improve regional coordination and to support the collection of travel information. A communication master plan should be developed to analyze the current specific communication needs of the agencies related to traffic signal interconnect, center-to-center connections, and ITS field element communication.

Region-wide Signal Synchronization – The region should continue to deploy the hardware and software necessary to enable signal coordination and synchronization across jurisdictional boundaries. The Cities of Albuquerque and Rio Rancho are installing new signal systems and other jurisdictions should consider deploying traffic signal systems that are interoperable with the City's.

Joint Operation Center – Preliminary planning should begin for the implementation of a joint-use facility that would provide the foundation for an integrated deployment of ITS throughout the region. The facility would provide for the needs of transportation and public safety/emergency management personnel. The joint-use facility may serve the regions' needs for transportation management system operations, data collection and processing, and integrated incident and

emergency management. Primary partners could include the City of Albuquerque, Bernalillo County, NMSHTD, with communication links provided for coordination with other agencies, such as the City of Rio Rancho, the Emergency Operation Center (EOC) and maintenance departments of various agencies. The NMSHTD AMTMS TMC, currently in the planning phases, is a potential facility whose scope could be expanded to include this joint functionality.

4.2 Deployment Corridors

The roadways included in the ITS Deployment Plan are those where corridor-based ITS deployment is recommended over the next ten years.

ITS deployment on the roadways should be done in multiple stages. The objective of early stage deployments should be to establish a region-wide infrastructure such as a communications backbone and a network of surveillance and detection elements at critical points in the transportation system. Later stages should consist of the build-out of early-stage deployments. For example, an early stage deployment may consist of widely-spaced detectors and surveillance cameras at several critical locations. Additional cameras and detectors would then supplement that initial stage deployment during later stages to provide continuous corridor coverage.

The ITS Deployment Plan is separated into 16 corridor-based deployment packages, as shown in **Figure 2**. A corridor-based deployment facilitates the staged approach to ITS deployment, helps to mainstream ITS projects into other construction projects, and maximizes the effectiveness of the deployed elements. Each corridor is described as a deployment package for use in further defining the ITS Deployment Plan in terms of cost-benefit and in developing the capital improvement plan for these projects. Packages are numbered for ease of reference. They are not listed in any order or priority in the following descriptions.

Figure 2: ITS Deployment Plan Corridors

The following sections contain a short description of each of the 16 deployment corridors.

Urban Interstate Highways

The urban interstate highways deployment corridor consists of the sections of I-25 between Paseo del Norte and Rio Bravo Boulevard (NM 500), and I-40 between Unser Boulevard and Tramway Boulevard.

The limits of the urban interstate deployment corridor are aligned with the planned limits of Phase A of the NMSHTD AMTMS project.

Recommended ITS Elements	
Stage 1	Stage 2
§ Dynamic Message Signs	§ Freeway Ramp Metering and Control
§ Vehicle Detection	
§ Video Surveillance	
§ Pavement Sensor (on bridge)	
§ Communications Cable	
§ Modern Traffic Signal Controllers (frontage roads)	
§ Traffic Signal Coordination (frontage roads)	

Extended Interstate Highways

The extended area interstate deployment package includes the remainder of the Interstates 25 and 40 that are not included within the current limits of the AMTMS project but are within the MRCOG region.

Recommended ITS Elements	
Stage 1	Stage 2
§ Video Surveillance	§ Video Surveillance
§ Road Weather Information System	§ Dynamic Message Signs
§ Vehicle Detection	

Coors Boulevard

Coors Boulevard is a major north-south arterial through the western part of the project area. The corridor begins at Rio Bravo Boulevard and extends north approximately 12 miles, to Alameda Boulevard.

Recommended ITS Elements	
Stage 1	Stage 2
§ Video Surveillance	§ Modern Traffic Signal Controllers
§ Traffic Signal Interconnect	§ Traffic Signal Coordination
§ Vehicle Detection	§ Dynamic Message Signs
§ Trailblazer Signs	§ Trailblazer Signs
§ Pavement Sensors (on bridge)	

Alameda Boulevard

Alameda Boulevard is a major north-south arterial in the northwest section of the project area and is one of three Rio Grande River crossings in the northeast section of the project area. It links the Cities of Corrales and Rio Rancho to I-25 and to the City of Albuquerque. The section of Alameda Boulevard that is included in this package begins at I-25, continues west to Coors Boulevard, and terminates at U.S. 550 in the north part of the region.

Recommended ITS Elements	
Stage 1	Stage 2
§ Video Surveillance	§ Vehicle Detection
§ Pavement Sensors (on bridge)	§ Video Surveillance
§ Vehicle Detection	§ Traffic Signal Coordination
	§ Dynamic Message Signs
	§ Modern Traffic Signal Controllers

2nd Street

This deployment package consists of a 10-mile section of 2nd Street beginning at Bridge Boulevard and extending north to 4th Street. 2nd Street provides a north-south alternate to I-25.

Recommended ITS Elements	
Stage 1	Stage 2
§ Video Surveillance	None identified
§ Traffic Signal Interconnect	
§ Vehicle Detection	
§ Traffic Signal Coordination	
§ Modern Traffic Signal Controllers	

Gibson Boulevard

Gibson Boulevard starts at Broadway and continues east to Juan Tabo Boulevard. It provides access to the Albuquerque International Airport and Kirtland Air Force Base.

Recommended ITS Elements	
Stage 1	Stage 2
§ Video Surveillance	§ Vehicle Detection
	§ Traffic Signal Coordination
	§ Modern Traffic Signal Controllers
	§ Dynamic Message Signs (for deployment on Sunport and Avenida Cesar Chavez)

Central Avenue

Central Avenue is a major east-west facility through the region and serves as a primary alternate for I-40. It crosses the Rio Grande River and traverses downtown Albuquerque. The section of Central Avenue that is included in this package starts at I-40 west of downtown, continues

through downtown Albuquerque, crosses I-25 and continues until joining I-40 in the east part of the region.

Recommended ITS Elements	
Stage 1	Stage 2
§ Video Surveillance	§ Video Surveillance
§ Pavement Sensors (on bridge)	§ Vehicle Detection
	§ Traffic Signal Coordination
	§ Modern Traffic Signal Controllers

Montano Boulevard/Montgomery Boulevard

This deployment corridor consists of Montano Boulevard beginning at the intersection of Montano and Unser Boulevard in the west, and traversing east to provide access to I-25. The package continues east on Montgomery Boulevard terminates at Wyoming Boulevard. This corridor is particularly significant because it crosses the Rio Grande River, providing access to I-25 from the west.

Recommended ITS Elements	
Stage 1	Stage 2
§ Video Surveillance	§ Dynamic Message Signs
§ Vehicle Detection	
§ Pavement Sensors (on bridge)	

Paseo del Norte

This 10-mile segment of Paseo del Norte begins at Coors Boulevard and extends east, across the Rio Grande River, to I-25. The corridor continues east to Tramway Blvd west of I-25.

Paseo del Norte provides access to I-25 from the east and the west. Paseo del Norte is especially significant from the west, because it is one of three corridors that cross the Rio Grande River in the northwest quadrant of the region. In addition, the corridor is limited access in certain segments.

Recommended ITS Elements	
Stage 1	Stage 2
§ Traffic Signal Interconnect	§ Dynamic Message Signs
§ Pavement Sensors (on bridge)	
§ Vehicle Detection	

Bridge Boulevard

This segment of Bridge Boulevard begins at Unser Boulevard, in the southwest quadrant, and continues east to I-25. This corridor provides access to I-25 and crosses the Rio Grande River. This corridor is projected to have particularly high volume to capacity ratios in 2005, 2010, and 2025.

Recommended ITS Elements	
Stage 1	Stage 2
§ Pavement Sensors (on bridge)	§ Vehicle Detection § Traffic Signal Coordination § Modern Traffic Signal Controllers

Senator Dennis Chavez/Rio Bravo Boulevard

This Corridor begins at Coors Boulevard in the southwest quadrant of the city, extends east, crossing the Rio Grande River, and providing access to I-25.

Recommended ITS Elements	
Stage 1	Stage 2
§ Pavement Sensors (on bridge)	§ Video Surveillance § Vehicle Detection § Traffic Signal Coordination § Modern Traffic Signal Controllers

Louisiana Boulevard

Louisiana Boulevard is a major arterial in the east section of the project area. This high-volume corridor passes through the up-town district of Albuquerque. The corridor begins at Central Avenue and extends north to Menaul.

Recommended ITS Elements	
Stage 1	Stage 2
§ Video Surveillance	§ Vehicle Detection

Wyoming Boulevard

The Wyoming Boulevard deployment corridor begins at I-40, and then extends south to the Sandia Lab gates located just south of the Gibson Boulevard extension.

Recommended ITS Elements	
Stage 1	Stage 2
None Identified	§ Video Surveillance

Unser Boulevard

The Unser Boulevard corridor, located in the northeast quadrant of the study area, begins at Interstate 40 and extends north to Southern Boulevard. Unser is a major limited access north/south arterial that provides access to I-40.

Recommended ITS Elements	
Stage 1	Stage 2
None identified	§ Video Surveillance § Vehicle Detection § Modern Traffic Signal Controllers § Traffic Signal Coordination § Dynamic Message Signs

U.S. 550

US 550, located in the northwest quadrant of the project area, is a high-volume corridor that provides access across the Rio Grande River.

Recommended ITS Elements	
Stage 1	Stage 2
§ Road Weather Information System § Video Surveillance	§ Vehicle Detection

Lomas Boulevard

The Lomas Boulevard corridor extends from I-40/Wyoming Boulevard west to join Central Avenue. This provides a major alternate to Interstate 40.

Recommended ITS Elements	
Stage 1	Stage 2
§ Video Surveillance	§ Video Surveillance § Vehicle Detection § Traffic Signal Coordination § Modern Traffic Signal Controllers § Dynamic Message Signs

Tramway Boulevard

The section of Tramway Boulevard that is included in this package starts at I-40 and continues to I-25 in the north. Although the east-west section in the north is not a high priority, it is included in the corridor because of the functionality that the corridor plays within the region. It is also the most easterly arterial within the project area.

Recommended ITS Elements	
Stage 1 § Video Surveillance § Traffic Signal Interconnect § Road Weather Information System § Pavement Sensors (on Tramway and several nearby north-south arterials)	Stage 2 § Vehicle Detection

4.3 Description of Long-Term Deployment

Long-term deployment focuses on solutions to consider for the 10 to 25 year time frame. The map of long-term corridors is shown in **Figure 3.** Because of the rapidly evolving nature of technology, specific technology recommendations are not made for long-term corridors. In the long-term, continued build-out of the Deployment Corridors (section 4.2) should be a high-priority. The infilling of Deployment Corridors with additional surveillance and detection devices should be sustained until continuous coverage is achieved.

Additionally, long-term deployment focuses on incorporating ITS projects into construction projects on the deployment corridors and the additional roadways depicted in **Figure 3**. Specifically, the following should be part of any construction, reconstruction, or development project in the region:

§ Installation of conduit to provide for future deployment of communications; and
§ Deployment of low-cost detection devices to collect traffic volume and speed data. Data could be used for planning purposes. Data may also be used for input to travel information services.

Figure 3: Roadways to Consider for System-wide Deployment

APPENDIX A

Roadway Name

118th between Lower Street and I-40

118th Street between Paseo del Volcan and Middel Street

2nd Street (NM 47) between Candelaria Road and 4th Street

98th Street between Paseo del Volcan and Sen. Dennis Chavez Boulevard

Alameda Boulevard between I-25 and Pennsylvania Street

Alameda Boulevard between Pennsylvania Street and Eubank Boulevard

Americas Parkway/Arvada Avenue/Winrock Loop

Arenal Boulevard between Unser Boulevard (NM 345) and Coors Boulevard (NM448)

Atrisco Drive w/o Unser Boulevard (NM 345)

Broadway (NM 47) between I-25 and Central Avenue

Candelaria Boulevard between Carlisle Boulevard and San Mateo Boulevard

Candelaria Boulevard between San Mateo Boulevard Wyoming Boulevard

Candelaria Boulevard between Wyoming Boulevard and Eubank Boulevard

Candelaria Boulevard between 12th Street and Carlisle Boulevard

Candelaria Road between Eubank Boulevard and Tramway Boulevard (NM 556)

Cesar Chavez Boulevard between I-25 and University Boulevard

Coors Boulevard (NM 45) between I-25 and Sen. Dennis Chavez Boulevard/Rio Bravo

Coors Boulevard (NM 448) between Montano Road and Alameda Boulevard

Dr. Martin Luther King Jr. Avenue/Tijeras Avenue between 12th Street and I-25

Ellison Drive between Golf Course Road and Alameda Boulevard (NM 528)

Eubank Boulevard south to Tramway Road (NM 556)

Eubank Boulevard south to Tramway Road (NM 556)

Eubank Boulevard south to Tramway Road (NM 556)

Eubank Boulevard south to Tramway Road (NM 556)

Gibson West w/o Unser Boulevard (NM 348)

Golf Course Road/Taylor Ranch Road betweeen Montano Road and Southern Boulevard

I-25 NB North of Alameda Boulevard (NM 528)

I-25 NB South of Rio Bravo Boulevard (NM 500)

I-25 SB North of Alameda Boulevard (NM 528)

I-25 SB South of Rio Bravo Boulevard (NM 500)

I-40 EB East of Tramway Boulevard (NM 556)

I-40 EB West of Unser Boulevard (NM 345)

I-40 WB East of Tramway Boulevard (NM 556)

I-40 WB West of Unser Boulevard (NM 345)

Idalia Road between Rainbow Boulevard and Alameda Boulevard (NM 528)

Roadway Name

Isleta Boulevard between Rio Bravo Boulevard (NM 500) and Bridge Boulevard

Juan Tabo Boulevard between I-40 and Eubank Boulevard

Lomas Boulevard between Eubank Boulevard and Tramway Road (NM 556)

Lomas Boulevard between Wyoming Boulevard and Eubank Boulevard

Louisiana Boulevard between Menaul Boulevard and Montgomery Boulevard

Louisiana Boulevard between Gibson Boulevard and Menaul Boulevard

McMahon Boulevard between Rainbow Boulevard and Golf Course Road

Menaul Boulevard between 12th Street and Carlisle Boulevard

Menaul Boulevard between Carlisle Boulevard and Wyoming Boulevard

Menaul Boulevard between Eubank Boulevard and Tramway Boulevard (NM 556)

Menaul Boulevard between Wyoming Boulevard and Eubank Boulevard

Montgomery Boulevard between Wyoming Boulevard and Eubank Boulevard

Montgomery Boulevard between Eubank Boulevard and Tramway Boulevard (NM 556)

Northern Boulevard between Paseo del Volcan and Alameda Boulevard (NM 528)

Osuna Road/San Mateo Boulevard between 2nd Street (NM 47) and Montgomery Boulevard

Osuna Road/San Mateo Boulevard between Montgomery Boulevard and Indian School Road

Paseo del Norte between west and Coors Boulevard

Paseo Del Volcan between Sen. Dennis Chavez Boulevard and Upper Street

Paseo del Volcan/King Boulevard between I-40 and U.S. 550

Progress Boulevard between Rainbow Boulevard and Chayote Road/Paseo del Volcan

Rainbow Boulevard between Irving Boulevard and Paseo del Norte

Rainbow Boulevard between Paseo del Volcan and Westside Boulevard

Roy Avenue (NM 556)/Tramway Road (NM 556) between NM 313 (2nd Street extension) a

San Mateo Boulevard between Gibson Boulevard and Indian School Road

Sen. Dennis Chavez Boulevard/Rio Bravo Boulevard (NM 500) between Paseo del Volcan

Southern Boulevard between Paseo del Volcan and Alameda Boulevard (NM 528)

Sunport Boulevard between I-25 and Albuquerque International Airport

Tramway Boulevard (NM 556) between I-40 and Modeso Avenue

U.S. 550 between Unser Boulevard and Alameda Boulevard (NM 528)

Unser Boulevard (NM 345) between Gun Club Road and U.S. 550

Unser Boulevard (NM 345) between Gun Club Road and U.S. 550

Unser Boulevard (NM 345) between Gun Club Road and U.S. 550

Westside Boulevard between Rainbow Boulevard and Alameda Boulevard (NM 528)

Wyoming Boulevard between Gibson Boulevard and Tramway Road (NM556)

Wyoming Boulevard between Gibson Boulevard and Tramway Road (NM556)

Zuni Road/Coal Avenue/Lead Avenue between 4th Street and Central Avenue