Greater Yellowstone Rural ITS Priority Corridor Project

Task 9. Preliminary Project Identification and Evaluation

Prepared for

MONTANA DEPARTMENT OF TRANSPORTATION

and

U.S. DEPARTMENT OF TRANSPORTATION,
FEDERAL HIGHWAY ADMINISTRATION

In Cooperation with

IDAHO TRANSPORTATION DEPARTMENT,

WYOMING DEPARTMENT OF TRANSPORTATION,

and

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IMPLEMENTATION STATEMENT

This study is sponsored by the Montana Department of Transportation in cooperation with the U.S. Department of Transportation, Federal Highway Administration. The major objectives of this document are to summarize the process used to select "early winner" projects and to define those projects. Recommendations from this study will help to lay the groundwork for the construction of these early winners. In addition, results will support future tasks that will ultimately develop a corridor ITS plan.

DISCLAIMER

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ACKNOWLEDGMENTS

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INTRODUCTION

This report summarizes the research of *Task 9, Preliminary Project Identification and Evaluation*, for the Greater Yellowstone Rural Intelligent Transportation Systems Priority Corridor (GYRITS Corridor). Specifically, this document (1) details the early winner project selection process, (2) defines the projects (3) provides estimates of purchase, installation and maintenance costs and discusses potential project objectives and potential benefits, and (4) provides an outline for measuring benefits after system implementation.

Report Organization

The *Introduction* provides some background information on the entire project and this document, in particular. *Project Prioritization* details how early winner projects were selected. *Prioritized Project Summaries* describe the early winner projects in greater detail. Finally, the *Evaluation* outlines a proposed evaluation plan by which the effectiveness of the various intelligent transportation systems (ITS) projects will be measured.

Description of the Corridor

The Greater Yellowstone Rural Intelligent Transportation System Priority Corridor is a 200-mile long, 100-mile wide, heavily utilized rural transportation corridor between Bozeman, Montana and Idaho Falls, Idaho (Figure 1). This corridor includes:

- three states: Montana, Idaho and Wyoming;
- two national parks: Yellowstone (YNP) and Grand Teton GTNP; and
- a variety of transportation facilities ranging from Interstate freeway to low-volume, two-lane rural highways.

Primary transportation facilities include:

- Interstate 90/15 from Bozeman, Montana to Idaho Falls, Idaho through Butte, Montana;
- U.S. Highway 191/20 from Bozeman, Montana to Idaho Falls, Idaho; and
- U.S. Highway 89/26 from Livingston, Montana through Jackson, Wyoming to Idaho Falls, Idaho.

Additionally, highways added to the corridor at the March 1998 Steering Committee meeting include:

- Highway 212 from Red Lodge, Montana, through Cooke City, Montana and into Yellowstone National Park;
- Highway 14 from Cody, Wyoming, through the east entrance of Yellowstone National Park and into the Park interior; and
- Highway 31 from Swan Valley Idaho, over Teton Pass to Jackson, Wyoming.

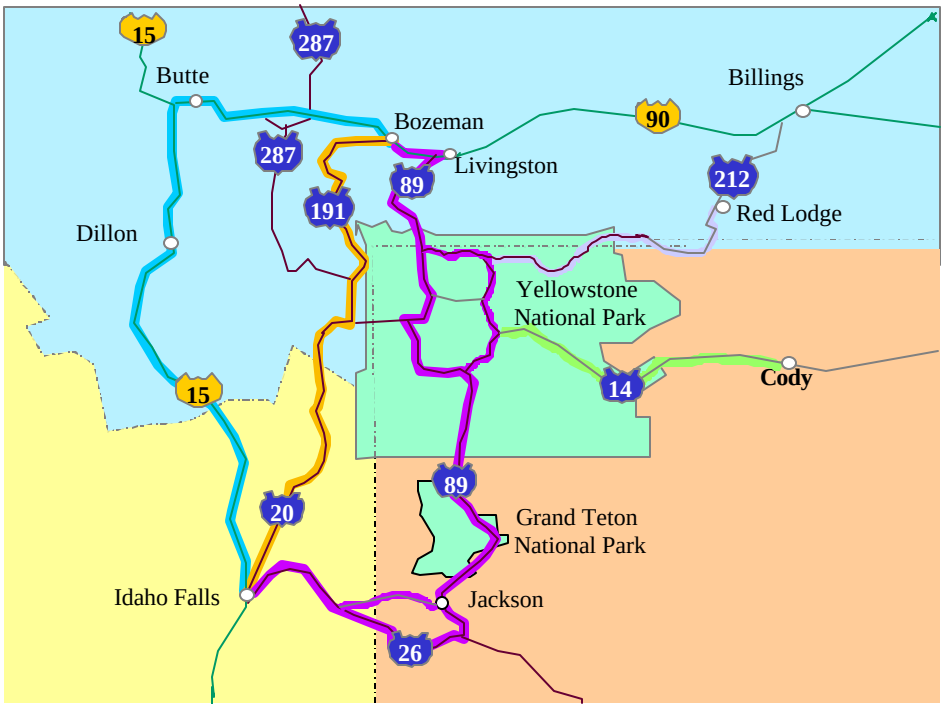

Figure 1: Study Area

These routes represent vital transportation links for the economy and well-being of the three-state area of Montana, Wyoming and Idaho. They also serve the recreational and resource needs of a growing number of individuals seeking to utilize the Greater Yellowstone ecosystem and Grand Teton National Park. The national importance of the corridor is further emphasized by its function as the connector for the trucking industry between the upper Midwest markets along Interstate 90 and the Intermountain and Southwest markets accessible by Interstate 15.

PROJECT PRIORITIZATION

This section details the early winner project selection process shown in Figure 2. Early winner projects were determined by (1) identifying all feasible ITS infrastructure elements and locations, (2) ranking of these elements and locations by the partner agencies, (3) identifying projects based on these rankings, and (4) prioritizing this list of projects by the steering committee. Portions of this effort will be used to assist with development of the strategic plan (Tasks 11 through 13).

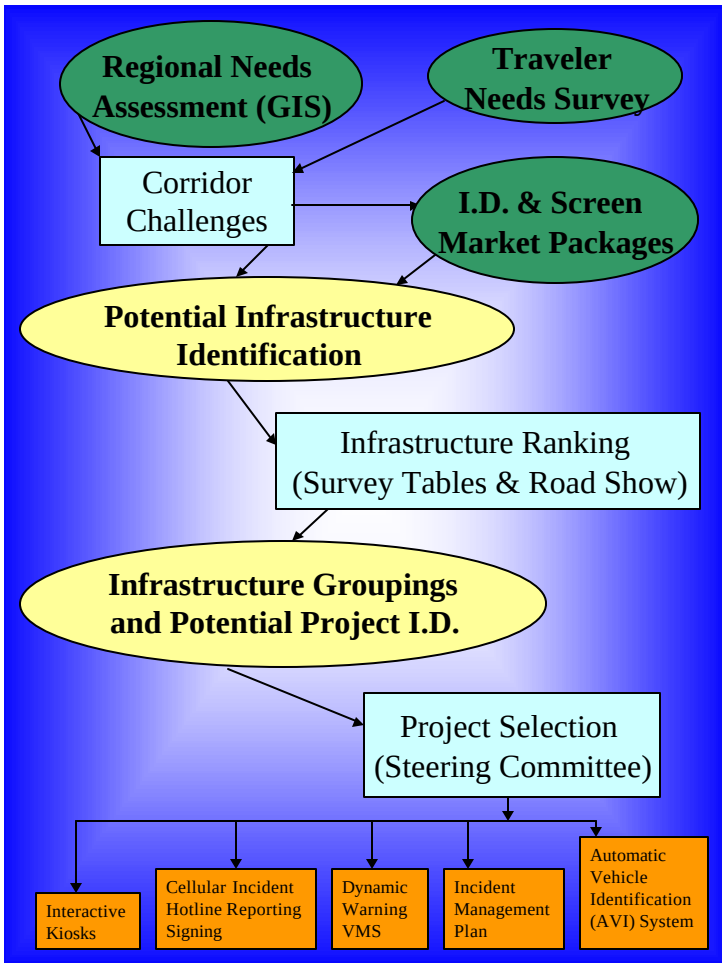

Figure 2: Early Winner Selection Process

Infrastructure Identification Process

A document was developed entitled *Greater Yellowstone Rural ITS Priority Corridor Project Infrastructure* (Appendix A). which detailed potential ITS infrastructure elements within the corridor. For each element, this report gave:

- a description;
- a list of objectives (potential benefits);
- location selection criteria; and
- a map of potential locations.

Potential infrastructure elements were identified based on previous tasks. *Task 6, Identify and Screen Market Packages*, provided a comprehensive list of potential ITS projects. *Task 3, ITS Related Inventory and Regional Needs Assessment*, helped narrow this list of ITS projects based on the qualitative and quantitative challenges identified within the corridor.

Infrastructure Ranking

The above-mentioned *Infrastructure* document was mailed to all partner on March 2, 1998, along with three ranking tables, each listing all the potential infrastructure elements (Appendix B). The first table queried project partners as to which agencies they felt should be responsible for owning, operating, and maintaining the infrastructure element. With the second table, project partners ranked infrastructure elements as short-term, medium-term, or long-term projects. Those identified as short-term were considered potential early winners. The third provided project partners with the opportunity to suggest other potential locations for each of the infrastructure elements. Between March 8 and March 20, 1998 WTI staff met personally with a majority of the project partners. During these meetings, an overview of the GYRITS project was given, the results of the regional needs assessment were presented, and an open discussion was facilitated about the *Infrastructure* document and the ranking tables. Due to time and travel constraints, personal contacts with all partner agencies were not feasible; however, an opportunity to provide input was given to all agencies through telephone and mail correspondence. The table values were collected and averaged, giving an equal weight to each state and each partner agency (Appendix B).

Project Identification

Based on the ranking tables' results and input from the partner agencies, the infrastructure elements were prioritized and grouped into logical projects. Infrastructure elements were selected if they received an average rating of less than 2 (1=short-term, 2=medium-term and 3=long-term). Additional elements were added if, based on meetings with partner agencies, they were identified as a major priority to an agency. Based on these results, a document was developed entitled *Greater Yellowstone Rural ITS Priority Corridor Projects* (Appendix C). This document grouped the infrastructure elements into projects and focus areas. For each project, this document contained (1) project title, (2) project description, (3) potential project benefits, (4) project partners, and (5) project limits (recommended implementation sites).

Project Selection Process

Project selection criteria were developed as part of the business plan and approved by the Steering Committee. A project ranking form was developed based on these criteria (Figure 3).

At the March 1998 Steering Committee meeting in West Yellowstone, every committee member completed a selection criteria ranking form for each project identified in the *Projects* document. These results were tabulated and an average score was determined for each project (Table 1). After discussion and evaluation of preliminary cost estimates, (Appendix D) a motion was made to move forward with the five projects receiving the highest scores. In descending order of priority, these projects include:

1. Interactive Touch Screen Kiosks;
2. Cellular Incident Hotline Reporting Signing;
3. Dynamic Warning Variable Message Signs;
4. Incident Management Plan and Hazardous Materials Tracking; and
5. AVI/Smart Card at Park entrances.

The motion stipulated that the number of dynamic warning variable message sign sites may be reduced

Greater Yellowstone Rural ITS Priority Corridor Project Selection Criteria

Project Ranking Form

Date: _____

Project Title: _____

Agency Representative: _____

	Points (0-10)	Weighted Value
1. Value and sustainability of results and efforts (30%) This is the most important criterion because it rates the value and usefulness of the project. Weighted 30% **No Value 0----------5----------10 Highly Valuable**		
2. Sustainability to the Greater Yellowstone Region (20%) This criterion is meant to determine whether or not this is an appropriate project for the Greater Yellowstone Rural ITS Priority Corridor Project based on its goals, objectives and consistency with group needs. Weighted 20% **Not Sustainable 0----------5----------10 Very Sustainable**		
3. Project feasibility (15%) Can this project be implemented and completed? Weighted 15% **Not Feasible 0----------5---------- 10 Highly Feasible**		
4. Timeliness of project (15%) To what degree is the proposed project timely to the Greater Yellowstone coalition? Is it appropriate at this time? Weighted 15% **Not Appropriate 0----------5----------10 Very Appropriate**		
5. Cost realism (10%) Does the anticipated cost for the proposed project seem reasonable and appropriate? **Weighted 10%** **Not Reasonable 0----------5----------10 Very Reasonable**		
6. National recognition (10%) Does the project "showcase" solutions that may attract increased public or private sector funding from national sponsors? **Weighted 10%** **Not Nat'l in Scope 0----------5----------10 Nat'l in Scope**		
SubTotal		
Total		_____

to keep project costs within budget limits. The motion was passed unanimously.

Figure 3: Project Ranking Form

Table 1: Project Ranking Results

	Value and Sustainability		Sustainability to GY Region		Project Feasbility		Project Timeliness		Cost Realism		National Recognition		Totals	
Project	Sum of Entries	Weighted Average	Sum of Entries	Weighted Average	Sum of Entries	Weighted Average	Sum of Entries	Weighted Average	Sum of Entries	Weighted Average	Sum of Entries	Weighted Average	Sum of Entries	Weighted Average
Traveler Safety and Security														
Cellular Incident Hotline Reporting Signing	95	2.375	98	1.633	107	1.338	100	1.250	102	0.850	69	0.575	571	8.021
●Dynamic Warning Variable Message Signs	97	2.425	100	1.667	86	1.075	89	1.113	93	0.775	89	0.742	554	7.796
●Animal-Vehicle Collision Warning System	78	1.950	82	1.367	73	0.913	77	0.963	79	0.658	84	0.700	473	6.550
●Pre-Trip Information on Road Closures	83	2.075	78	1.300	86	1.075	81	1.013	45	0.375	76	0.633	449	6.471
●Portable Mayday Notification System	63	1.575	70	1.167	69	0.863	69	0.863	28	0.233	77	0.642	376	5.342
●Enhanced Emergency – 911 Service	70	1.750	85	1.417	76	0.950	74	0.925	28	0.233	67	0.558	400	5.833
Weather Information and Roadway Management														
●RWIS-Activated Pager System	88	2.200	91	1.517	90	1.125	83	1.038	84	0.700	66	0.550	502	7.129
●Safe Passage	82	2.050	80	1.333	78	0.975	74	0.925	48	0.400	72	0.600	434	6.283
●Probe Vehicle Instrumentation	57	1.425	67	1.117	68	0.850	61	0.763	31	0.258	66	0.550	350	4.963
●New RWIS Sites	81	2.025	89	1.483	87	1.088	77	0.963	60	0.500	61	0.508	455	6.567
Travel and Tourism Information and Services														
●Interactive Kiosks	92	2.300	93	1.550	105	1.313	97	1.213	101	0.842	98	0.817	586	8.033
Commercial Vehicle Operations														
●Electronic Pre-clearance/AVI	70	1.750	75	1.250	80	1.000	76	0.950	51	0.425	83	0.692	435	6.067
YNP/GTNP Demand Mgmt and Net. Surveillance														
●AVI/Smart Card	94	2.350	96	1.600	98	1.225	92	1.150	72	0.600	89	0.742	541	7.667
●Parking Management System	62	1.550	66	1.100	67	0.838	59	0.738	40	0.333	55	0.458	349	5.017
●Transit Shuttle Service to YNP	49	1.225	48	0.800	55	0.688	48	0.600	24	0.200	51	0.425	275	3.938
●Transit Shuttle Service; Jackson, Wyoming	46	1.150	43	0.717	53	0.663	43	0.538	25	0.208	48	0.400	258	3.675
●Network Monitoring	77	1.925	77	1.283	67	0.838	81	1.013	50	0.417	64	0.533	416	6.008
Regional Management and Coordination														
●Incident Mgmt. Plan and Haz. Materials Track	95	2.375	95	1.583	93	1.163	92	1.150	97	0.808	84	0.700	556	7.779
●Regional Server	94	2.350	97	1.617	88	1.100	89	1.113	71	0.592	86	0.717	525	7.488
●Rural Emergency Management Center	73	1.825	70	1.167	66	0.825	71	0.888	41	0.342	67	0.558	388	5.604
●Rural Coordinate Addressing	60	1.500	67	1.117	66	0.825	65	0.813	47	0.392	59	0.492	364	5.138

PRIORITIZED PROJECT SUMMARIES

This section is intended to give more detail on the five projects selected for implementation at the March 1998 Steering Committee meeting. For each project, this section supplies (1) a description, (2) potential locations, (3) project partners and roles, (4) a rough cost estimate, and (5) project objectives and possible benefits. The evaluation of these projects is discussed separately in the *Evaluation* section of this report. This document does not obligate agencies or finalize locations, but, rather, is intended as a starting point for discussion purposes. The projects and agency roles ultimately will be negotiated and approved in a multi-state memorandum of understanding.

The task of evaluating projects for possible implementation is a difficult, but necessary one, given the budget and manpower limitations typically faced by State Departments of Transportation. Understandably, those responsible for such decisions often search for economic measures (e.g., cost/benefit ratios) to serve as the basis and justification for their recommendation. The project selection process, detailed previously in this report, used to determine the early winners relied on estimated costs and ranking by the steering committee.

In the present study, estimates of the implementation costs associated with the early winner projects were relatively easy to obtain. Actual costs may vary somewhat over time, across equipment suppliers, and so forth. However, the purchase, installation, and maintenance costs for the proposed systems should remain within a reasonable range of the original estimates. During project implementation, accurate and complete documentation of expenses can be expected.

Conversely, attempts to estimate potential economic benefits of each project proved extremely difficult. For example, the intended benefits of the touch screen kiosks include providing weather and road information to users of the system and improving the quality of tourists' visits. Similarly, the objective of the incident management plan is to improve coordination of agencies' responses to hazardous materials spills. Qualitative assessments of such factors can be made through the use of interviews or surveys, but it may

never be possible to meaningfully translate subjective measures of effectiveness into dollar figures. This inability to quantify various benefits does not preclude the possibility of a meaningful evaluation of the projects. Rather, it simply emphasizes the need to identify appropriate measures of effectiveness and applicable data sources for evaluation purposes. The ultimate goal of the evaluation will be to determine if, and to what extent, each project accomplished its intended objective(s), regardless of whether or not its success can be measures in terms of economic benefits.

Touch Screen Information Kiosks

Touch screen interactive kiosks will be placed at strategic locations where travelers stop in the GYRITS area. These kiosks will have a video "grabber" screen to entice travelers to use the system to access information on events, points of interest, services and real-time road and weather conditions. The system will be based on the Montana Tourism and Recreation Initiative Kiosk system.

Proposed Project Locations

Kiosks will initially be installed at locations in Montana and in Yellowstone and Grand Teton National Parks, with future locations in gateway communities in Idaho and Wyoming. Kiosks will be housed in indoor locations that experience a substantial amount of tourist traffic and have attendants willing to assist with the project. Potential locations are listed in Table 2.

Table 2: Touch Screen Information Kiosk Locations

State	Locations	Type of Facility
Montana	Dillon	Visitor Information Center
	Bozeman	Airport
	Bridger Bowl	Ski Area/Resort
	Freely	Rest Area
Idaho	Island Park, Targhee National Forest	Visitor Information Center
	Idaho Falls	East Idaho Visitor Information Center
	Highway 26, East of Idaho Falls	Rest Area
Wyoming	Jackson	Visitor Information Center
National Parks	Old Faithful, Yellowstone National Park	Visitor Information Center
	Moose, Grand Teton Park	Visitor Information Center

Proposed Agency Roles

Travel Montana will be the lead agency in constructing, installing and maintaining the kiosks with WTI coordinating the effort. Specific partner roles are detailed below.

- **Travel Montana:** Travel Montana will coordinate obtaining and retrofitting the kiosk units, customizing and upgrading the software, installing a dedicated phone line at each location, developing "grabber" screen video, collecting and inputting data and images for Montana and Yellowstone National Park, and installing and maintaining the units.
- **Idaho and Wyoming Departments of Tourism:** The respective Departments of Tourism will coordinate the collection and input of data and images for the gateway communities in their respective states. Travel Montana will provide a database entry system for this information.
- **Western Transportation Institute:** The WTI will coordinate funding, location selection and finalization of appropriate agreements with location facility owners.

Estimated Project Costs and Potential Benefits

Costs of the kiosk system are detailed in Table 3. These costs are based on information provided by Travel Montana for the 22 kiosks planned for installation. The estimated cost to the GYRITS project will amount to approximately $120,000. Travel Montana is matching a sizeable amount of financial resources (32 percent), as well as making considerable donations of both manpower and equipment as shown in Table 3. The Idaho and Wyoming Departments of Tourism will donate staff time to collect data and images for properties in the gateway communities of their respective states.

Table 3: Cost Breakdown for Kiosks

Task	GYRITS Funded	Travel MT Funded	Yellowstone/ Grand Teton	ID/WY Dept of Tourism
Kiosk Units		Donated		
Retrofit Hardware	$88,800			
Upgrade Software		$25,000		
Customize Software	$13,000	$13,000		
Installation of Dedicated Phone Lines		Donated		
Phone Line Charges (3 yr.)	$18,000			
"Grabber" Screen Development		Donated		
Montana and Yellowstone Data and Images		Donated	Coordinate w/ Travel MT	
ID/WY Data and Images				Donated
Kiosk Installation and Maintenance		Donated		
Total	$119,800	$38,000		

Objectives of touch screen kiosks as previously identified in the GYRITS Business Plan include:

- providing sustainable traveler information systems that disseminate credible and accurate "real-time" information;
- providing systems that advise regional transportation system users of weather conditions;
- providing systems that advise unfamiliar motorists of tourist attractions, services, construction and weather;
- increasing public awareness of public transportation alternatives to and within the Parks;
- improving accessibility to services and tourist areas through expanded information availability;
- improving identification of goods, services, and opportunities in regional communities (i.e. en-route information, transportation service information, etc.); and
- providing a mechanism by which the tourism industry, transportation and transit services can work more closely together.

By improving the identification of goods and services, tourists may be more apt to extend their stay in the area, which would potentially generate more tourist dollars spent in the communities. The extent to which economic indicators can be incorporated into the evaluation is unknown at this time.

By providing regional information on road closures and weather conditions through the kiosks, it is conceivable that travelers could change their travel behavior to avoid problem areas. Theoretically, such changes in travel behavior could result in a reduction in weather-related crashes due to travelers avoiding severe weather areas, reduced traveler delay caused by road closures, or reduced traveler delay caused by construction zones. Estimates of either potential or actual changes in travel plans resulting from information obtained at kiosks may be obtained via user surveys, but such subjective assessments would be difficult to quantify in terms of economic benefits.

Incident Reporting Hotline Signing

Static signs will be placed at strategic locations in advance of areas where there are relatively high emergency response times and where cellular telephone coverage exists. These static signs will display information on existing phone numbers for reporting incidents, such as 911, *ISP, #HELP, 1-800-525-5555.

Proposed Project Locations

Potential locations were selected based on areas of existing cellular coverage and areas having higher than average notification time, as reported in *Task 3: ITS Related Inventory - Regional Needs Assessment*. The major challenge area identified is Interstate 15 between Idaho Falls and the Montana/Idaho Border. Recommended, potential sign locations include:

- Interstate 15 in the southbound direction just south of the Montana/Idaho Border (m.p. 194);
- Interstate 15 in the southbound direction just south of Dubois (m.p. 165); and
- Interstate 15 in the northbound direction just north of Dubois (m.p. 169).

No emergency notification times were available for Montana until 1998. Locations in Montana may be identified and targeted for hotline signing in future phases as relevant data are accumulated and evaluated.

Proposed Agency Roles

It is anticipated that this project can be done as a maintenance activity in order to a mitigate some of the administrative difficulties encountered with construction projects. Proposed project partner agency responsibilities are detailed below.

- **Idaho Transportation Department, Maintenance:** ITD will supply maintenance crews for sign installation and coordinate sign purchase.

- **Western Transportation Institute:** WTI will coordinate financial reimbursement of ITD Maintenance efforts and assist with sign purchase.

Estimated Costs and Potential Benefits

Costs are expected to be approximately $4000 per sign to be absorbed by the GYRITS Project. This will include the costs of the sign and installation costs by a maintenance crew. As described in the GYRITS Business Plan, incident reporting hotline signing is intended to:

- provide systems that enhance road users' ability to request assistance in emergency situations;
- reduce emergency response times.

By providing better information on existing incident hotlines to drivers and other road users, benefits may be realized by the potential reduction of notification and response times to incidents. It is generally acknowledged that the faster critical care can be administered, the better the chances are for crash-involved occupants to survive. Specifically, researchers have used the term "golden hour"(2) to refer to that period of time following a crash in which, if critical care is administered, some injuries may be treated or conditions redressed that would save a life or reduce the severity of an injury. Obviously, there will always be non-survivable crashes, which cannot be prevented by improvements in response time. Likewise, many kinds of injuries sustained in crashes will not be significantly affected by variations in emergency response time. It is unlikely that sufficient injury data can be collected at the proposed project sites to meaningfully assess a change in injury severity that could be attributes to incident reporting hotline signing. Moreover, the injury classification scheme (incapacitating, evident, or possible injury) used on traffic accident report forms does not provide sufficient detail to be able to detect shifts within injury severity levels. Detailed examination of hospital records or other attempts to document the affect of elapsed time between a crash and the administration of emergency medical care are beyond the scope of this study.

Dynamic Warning Variable Message Sign

Dynamic Warning VMSs will utilize real-time conditions information collected by sensors in order to give immediate warnings at spot locations. For the early winner projects, the advisory will consist of warning of safe speeds in advance of curves and downgrades. This technology may or may not utilize pavement sensors and weigh-in-motion to assist in determining safe speed advisories.

Proposed Project Locations

Locations were determined based on the safety problems identified in *Task 3 ITS Related Inventory: Regional Needs Assessment*. The locations experienced crashes that involved icy/slippery roads and the driver reportedly driving too fast for conditions. These locations fall in the general areas of major mountain passes and canyons, including Gallatin Canyon, Snake River Canyon, Homestake Pass, Bozeman Pass and Monida Pass. Potential locations for the variable message signs are provided in Table 4, although the exact locations may be adjusted based on the recommendations and experience of local DOT maintenance personnel. Additionally, these locations might be prioritized in order to reduce the number of locations to meet funding constraints. To assist in prioritization, Table 4 also includes (1) the number of crashes with "speed too fast for conditions" as a contributing factor, split by severity (F-fatal, I-injury, P-property damage only), (2) average annual daily traffic (AADT), (3) a crash severity rate per million vehicle miles traveled, weighted by severity (fatal=8, injury=3, p.d.o.=1) and (4) total cost of these types of crashes ($2,600,000 for fatal, $66,000[1] for injury, and $2000 for property damage only (3)). Caution should be used when prioritizing these locations strictly on the basis of crash severity rates or crash costs, especially considering the segments are of different lengths.

[1] Crash breakdown for injuries (i.e., incapacitating, evident, possible) were only available for some states. An average cost of $66,000 per injury was used based on the proportions of injury types, for those records available and the costs given from this source for each injury type.

Table 4: Dynamic Variable Message Sign Warning Locations

State	Highway	Milepost	Severity F	Severity I	Severity P	AADT	Crash Rate	Crash Cost
Montana	191 (Gallatin Canyon)	9.9 - 10.1	1	5	7	1,760	38.9	$2,944,000
		47.1 - 47.7	0	3	2	2,600	4.8	$202,000
	I-90 (Homestake Pass)	232.2 - 232.8	0	5	6	6,060	4.0	$342,000
		233.2 - 233.5	1	2	1	6,060	4.5	$2,734,000
		236.2 - 237.8	0	9	15	6,130	3.5	$624,000
	I-90 (Bozeman Pass)	315.0 - 315.7	0	2	17	8,350	2.8	$166,000
		316.8 - 317.2	0	5	6	8,350	3.8	$342,000
		317.5 - 317.8	0	6	2	8,350	4.4	$400,000
		321.3 - 321.7	0	1	6	8,350	1.6	$78,000
Idaho	I-15 (Monida Pass)	180.0 - 181.5	0	1	7	2,070	2.6	$80,000
		189.0 - 190.5	0	2	3	2,100	2.3	$138,000
Wyoming	89 (Snake River Canyon)	127.0 - 127.9	0	11	5	2,590	12.2	$736,000
		Average Location	**0.2**	**4.3**	**6.4**	**5,231**	**7.1**	**$732,167**

Proposed Agency Roles

Pre-construction roles have not yet been determined. Specific pre-construction roles will be negotiated with each individual State Department of Transportation. Suggested roles are detailed below.

- **MT/WY/ID Departments of Transportation:** May assist with the pre-construction duties such as developing plans, specifications and estimates, developing environmental impact statements, preparing the bid package, letting the project, and monitoring construction activities. Additionally, State Departments of Transportation may be required to maintain the systems.
- **Western Transportation Institute:** WTI will coordinate pre-construction efforts. Where State Departments of Transportation are unwilling or unable to complete pre-construction activities WTI will complete them in-house or hire a consultant, as appropriate, within available funding limits.

Estimated Costs and Potential Benefits

It is anticipated that construction costs will be approximately $110,000 per site. Although costs depend on specific system configurations these costs are comparable to costs of similar deployments in Colorado and California (4,5). The pre-construction costs will vary depending on the specific role assumed by each

State Department of Transportation.

Based on the objectives from the GYRITS Business Plan, dynamic warning variable message signs are designed to:

- disseminate credible and accurate "real-time" information;
- advise unfamiliar motorists of alignment, speed conditions, and weather; and
- reduce exposure to unsafe situations through motorist aid devices.

The warnings provided on the variable message signs will alert travelers to potentially hazardous conditions at spot locations. Ideally, drivers will reduce their speeds in response to these advisories of hazardous conditions. Spot speed studies conducted before and after the installation of the variable message signs will be used to determine the effectiveness of the signs at reducing vehicle speeds. Traffic accident reports will be analyzed, as well, to assess changes in such factors as crash frequency, severity, contributing factors, weather conditions, and first harmful event. Given the inherent instability of accident data, it is imperative that data be collected for a sufficient period of time after the variable message signs are installed in order to meaningfully interpret any trends in the data. This is particularly true if a simple before/after analysis (i.e., without comparison sites) is used in the evaluation.

Incident Management Plan and Hazardous Materials Tracking

This task would involve developing an incident management plan and/or hazardous materials tracking plan for the entire corridor or regional areas of the corridor. The hazardous materials tracking would have areawide coverage or be tested in a smaller area. The goal would be twofold: (1) alleviate some of the discrepancies between different hazardous materials databases; and (2) provide for a faster, more informed notification to Hazmat Teams when a spill occurs. The goal of the incident management plan would be to provide a coordinated response to incidents, thus reducing the negative impacts of those incidents.

Proposed Project Locations

Both the incident management plan and hazardous materials tracking would involve a corridor-wide effort. The incident management plan will focus on road closures that occur in the locations listed in Table 5.

Table 5: Road Closure Locations

State/NP	Location
Montana	Bozeman Pass: Interstate 90 between Bozeman and Livingston
	Interstate 90 from west Livingston interchange to east Livingston interchange
	Gallatin Canyon: Highway 191 from Four Corners to West Yellowstone
	Monida Pass: Interstate 15 at Idaho Border
	Homestake Pass: Interstate 90 east of Butte
Idaho	Interstate 15 between Idaho Falls and Roberts
	Monida Pass: Interstate 15 between Dubois and Montana State Line
	Highway 20 between Ashton and West Yellowstone, MT
	Highway 26 between Swan Valley or Palisade and Alpine Junction, WY
Wyoming	Highway 89 between Alpine Junction and Hoback Junction
	Highway 89 between Hoback Junction and Jackson
	Teton Pass: Highway 22 west of Jackson
Grand Teton	Highway 89 north of Moose
Yellowstone	Entirely closed to rubber tire vehicles in winter

Proposed Agency Roles

- **Western Transportation Institute:** As WTI has incident management expertise in-house, some or all of this work may be performed by WTI. A work plan will be determined by the Steering Committee.
- **All Involved Partner Agencies:** Agencies will make available to the researcher existing incident management plans and be available for input into these plans.

Estimated Costs and Potential Benefits

Project cost will vary depending on the magnitude of the effort. Based on staff experience, it is anticipated that this effort will cost $100,000 depending on the scope of the project.

Based on the objectives from the GYRITS Business Plan this project will help to:

- coordinate public fleet responses to unsafe conditions (weather, incidents, detour routes) to provide for improved regional movement;
- reduce emergency response times;
- provide improved methods for commercial vehicle monitoring, and hazardous material identification;
- collect, process and share data between local, state, and federal agencies to increase efficiency and resources utilization;
- improve communication system capabilities to provide for increased coordination of services (i.e. radio, wire-line/wireless); and
- reduce hazardous material incident response.

Quantifiable potential benefits could be based on a reduction in response times to road closures and hazardous materials spills. However, with other factors involved and the small data set, it is difficult to determine what portion of a change in response times is actually due to an incident management plan. Additionally, as discussed previously in this report, it is unlikely that sufficient data would be available to document or evaluate the benefit of reduced response times on a reduction in injury severity. Potential benefits could include: (1) improved coordination between agencies based on interviews with such agencies and (2) reduced impact of road closures based on case studies.

Automated Vehicle Identification (AVI) / Smart Card

An AVI System will be installed at two of the Yellowstone National Park entrance gates (Cooke City and Gardiner) for transit users, employees, concessionaires and local residents who are impacted by tourist congestion. Future phases may include a Yellowstone National Park gate in West Yellowstone or other entrances and gates in Grand Teton National Park at Moran and Moose. It is our hope to create an electronic pass that will be a prototype in Yellowstone National Park and then expanded to other Parks.

Proposed Agency Roles

- **Yellowstone National Park:** Yellowstone National Park with the assistance of WTI will develop the pre-construction documents. As this will probably be a design-build contract, the pre-construction documents will be minimal. Yellowstone National Park will facilitate the operations of the system and the disbursement of the windshield tags.
- **Western Transportation Institute:** WTI will facilitate funding and assist Yellowstone National Park, as needed.
- **Design-Build Contractor:** A contractor will be selected to design and build the system. Their duties will be further defined in a request for proposal.

Estimated Costs and Potential Benefits

It is anticipated that the design-build cost of each site will be $150,000 based on a previous estimate determined by Amtech Corporation (7). Yellowstone National Park will supply resources for staffing the operations of the system. An extra fee may be assessed to each purchaser of an electronic in order to offset some of the costs for the windshield transponder tags.

The following objectives for the AVI system were reported in the GYRITS Business Plan:

- to increase awareness of public transportation alternatives to and within the Parks; and
- encourage and provide incentives for increased transit utilization.

Potential benefits of the AVI system include reduced delay at park gates and reduced staffing requirements at those same entrances.

Table 6 provides data on the number of vehicles and persons entering the entire Park in a year. Of the vehicles entering the park, 14% enter through the north entrance and 6% enter through the northeast entrance (8).

Table 6: 1991 Vehicles/Visitors Entering Yellowstone National Park (8)

Mode of Transportation	Vehicles Entering	Visitors Entering
Automobile (5%)	810,824	2,432,472
Recreational Vehicles (5%)	100,147	300,441
Bus (100%)	4,754	99,794
Private Oversnow Vehicle (0%)	61,735	73,857
Snowcoach (0%)	1,264	11,174
Non-Recreational (all types, 100%)	31,113	37,319
Other (on foot)	0	2,676

At this time, quantifying potential benefits based on reduced delay times at park gates is difficult because of the lack of information on current delay times, peak hour traffic volumes, and potential market penetration. It can be assumed that an AVI system may reduce the staffing requirements at the park gates because of fewer vehicles requiring staff time to check passes, sell passes and provide park information. However, there may actually be a shift in staffing, as the AVI system will require staff time. It is difficult to say at this point what overall affect this system will have on staff requirements at park gates.

Variable Message Signs

The Steering Committee has decided to include two variable message sign installations in Wyoming as an additional early winner project. These signs are located in advance of alternate routes or traveler facilities (i.e., lodging and food) and are designed to give advanced warning of weather conditions in order to modify travel behavior.

The signs are located on Highway 89/191 south of Jackson. The total project cost, estimated at $72,000, is being paid by the Wyoming Department of Transportation. WYDOT has taken the lead role in this effort, facilitating all pre-construction, construction and operations efforts. WTI will have no role in this project and the $72,000 is being used toward GYRITS local match.

Potential benefits include increased traveler awareness of existing road conditions. This may result in a reduction in weather related crashes because drivers may modify their trip itinerary or driving behavior. To what magnitude the variable message signs will affect weather-related crashes is difficult to determine prior to installation. Crash evaluation after the installation will require several years of crash data in order to obtain a statistically significant sample. Crash analysis may be able to show some indication of the affect of variable message signs on safety. However, it is important to realize that there are many influences on vehicle crashes making it difficult to determine with absolute certainty the causes and effects of crashes.

Project Benefit/Cost Summary

Costs were estimated based on the data available. Some, potential benefits were described. Benefits will be further defined and measured through evaluation after the early winner projects are implemented. The project costs are summarized in Table 7. Annual costs, which include costs of operating and maintaining the system, were estimated to be 10% of the initial project cost, rounded to the nearest thousand dollars. Project costs may fluctuate depending on specific implementations. The initial costs shown in Table 7 do not necessarily include match requirements by local agencies. Match costs may include pre-construction document preparation, dedicated staff time, and donation of equipment (kiosks and variable message signs).

Table 7: Summary of Early Winner Benefit Costs Information

Early Winner Project	Initial Cost (all sites)	Annual Cost (all sites)	Number of Sites
Interactive Kiosk	$120,000	$12,000	22
Cellular Incident Reporting Hotline Signing	$12,000	$1,000	3
Dynamic Warning VMS	$330,000	$33,000	3*
Incident Management Plan and Hazardous Materials Tracking	$100,000	$10,000	Area-wide
Automatic Vehicle Identification at Park Gates	$300,000	$30,000	2

*number of sites will vary depending on available funding

Evaluation

After the specific early winner projects have been implemented, they will be evaluated in order to assess the benefits of each system. Table 9 provides an overview of the planned evaluation of these early winner projects, although certain tasks may need to be adjusted depending on funding and resource availability.

The number of **touch screen kiosk** users may be measured and surveys administered at selected kiosk sites. The surveys will help to determine user acceptance, how information affects travelers trip plans, type of information used, and so forth.

Incident reporting hotline signing may be evaluated by analyzing emergency notification times before and after the installation of static signs at the designated locations and interviews with emergency response providers and dispatchers.

At the sites of **dynamic warning VMS**, before and after data may be collected to determine the effect of the system on vehicle speeds, erratic maneuvers, and crashes. In order to account for crash data variations from year to year, the crash evaluation may be delayed to accumulate several years of data.

The effectiveness of an **incident management plan and hazardous materials tracking** may be evaluated by case study analyses of specific incidents, including interviews with personnel from the agencies involved in incident response activities.

Reduced delay at Yellowstone National Park gates through the use of **Automatic Vehicle Identification/Smart Cards** may be determined by before and after delay time studies at those locations. Additionally, gate staff and AVI system users may be interviewed.

Variable Message Signs may be evaluated by reviewing before and after crash records.

Table 8: Evaluation Matrix for Early Winners

Early Winner Project	Objective	MOE	Data
Interactive Kiosks	• Improve quality of tourist trip	• Increase length of stay in area • Reduced impact of hazardous road conditions on travelers	• Number of kiosk users • User surveys
Cellular Incident Hotline Reporting Signing	• Improve safety by reducing response time to crashes	• Reduce notification time	• Notification times • Interviews
Dynamic Warning VMS	• Improve safety at spot locations by changing driver behavior	• Reduce average speed • Reduce crashes	• Spot speed study • Crash records
Incident Management Plan	• Improve coordinated response to road closures and hazardous materials spills	• Analysis of response to specific incidents	• Interviews of involved agencies • Case studies
Automatic Vehicle Identification for Park Entrances	• Improve operations at park gates	• Reduce delay times at gates • Reduce staffing requirements	• Spot delay time study • Interviews of staff
Variable Message Signs	• Improve traveler convenience • Improve safety by modifying travel behavior	• Reduced crashes	• Crash records

SUMMARY

This document was developed to summarize efforts in selecting early winner projects for the Greater Yellowstone Rural ITS Corridor and to provide information to facilitate implementation of these projects. For each early winner project, this document provides (1) a description, (2) potential implementation sites, (3) suggested agency roles, (4) estimated costs, (5) an evaluation plan and (6) potential benefits and project objectives. After an extensive project prioritization and selection process the following early winner projects were identified for implementation and subsequent evaluation:

1. **Interactive kiosks** will be installed at 22 locations including Yellowstone National Park and Grand Teton National Park. Each system will provide travel (i.e. road, weather, and construction) updates and tourism information and users will have the ability to make campground reservations. All information will be real-time through the Internet.

2. **Cellular Incident Hotline Reporting Signing** will be erected in areas were Geographic Information Systems (GIS) data show previously higher than average notification times and cellular coverage exists, such as Monida Pass or Dubois, ID.

3. **Dynamic Warning VMS** (for speed and conditions), will be constructed in Snake River Canyon, Gallatin Canyon, Homestake Pass, Island Park, or Monida Pass.

4. **An Incident Management Plan** will be developed for areas of known roadway closures within the three participating states and national parks.

5. **An AVI System** will be installed at Yellowstone National Park entrance gates in Cooke City and Gardiner for transit users, employees, concessionaires and locals who are impacted by tourist congestion. Future phases may include a Yellowstone National Park gate in West Yellowstone and gates in Grand Teton National Park at Moran and Moose. Ideally, a prototype electronic pass developed in this project can be initially used in Yellowstone National Park and then put to expanded use in other parks.

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APPENDIX A: GYRITS CORRIDOR INFRASTRUCTURE DOCUMENT

APPENDIX B: INFRASTRUCTURE PRIORITIZATION TABLES AND SUMMARIES

APPENDIX C: GYRITS CORRIDOR PROJECTS DOCUMENT

APPENDIX D: ESTIMATED COSTS FOR PROJECTS