TEST PLAN:

Branson TRIP (Travel and Recreational Information Program) Travel Time/Data Accuracy Test

June 1, 1998

Prepared for:

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PREFACE

This document is part of a series of planning documents for the evaluation of Field Operational Tests of Traveler Information Services in Rural Tourism Areas (Branson TRIP and I-40 TTIS) prepared by Battelle, along with subcontractors BRW Incorporated and CJI Research, for the U.S. Department of Transportation's ITS Joint Program Office (DOT/JPO). Electronic versions of these documents are available through the ITS Electronic Document Library (EDL):

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Test Plan: I-40 TTIS Focus Groups and Personal Interviews	May 18, 1998	
Test Plan: I-40 TTIS System/Historical Data Analysis	May 20, 1998	
Test Plan: I-40 TTIS Route Diversion Study	May 20, 1998	
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Test Plan: Branson TRIP System/Historical Data Analysis	June 1, 1998	
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FOR

THE BRANSON TRAVEL AND
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FIELD OPERATIONAL TEST

1.0 INTRODUCTION

The Branson Travel and Recreational Information Program (TRIP) in Branson, Missouri, and the I-40 Traveler and Tourist Information System (TTIS) in the I-40 corridor of Northern Arizona are two Field Operational Tests (FOTs) of Traveler Information Services in Tourism Areas funded through the National Advanced Rural Transportation Systems Program. The evaluation of Branson TRIP and the I-40 TTIS is being conducted by Battelle under the ITS Program Assessment Support contract with the Department of Transportation's ITS Joint Program Office.

As part of the overall evaluation, several tests have been planned. This document serves as a detailed test plan for one such test: travel time/data accuracy. Section 2.0 of this plan summarizes the approach, and the remaining sections present specific details for implementing the approach.

The rural ITS test site programs (I-40 TTIS and Branson TRIP) have five central objectives: improve mobility, increase awareness, reduce congestion, stimulate economic development, and improve safety. This test validates the traffic condition information provided by the TRIP system, such as travel times and routing recommendations, against actual field conditions for the time and locations in question. In addition to verifying the accuracy of the information provided, this test will identify the impact of the information on traffic patterns and estimate the savings realized due to route deviations.

2.0 APPROACH

The accuracy of the travel condition information provided by the TRIP, specifically the route- specific traffic flow information (color-coded regional traffic map) and alternate route recommendations, will be validated against actual field conditions. TRIP information sources will be consulted, and the information provided will be verified in the field by driving the routes in question. The actual change in traffic patterns associated with this information will also be identified. The percentage of traffic using the recommended alternate route will be identified and compared to the percentage using the same route under conditions when no alternate route information is provided. The specific approach is described in greater detail in the sections that follow.

2.1 Type of Information to be Verified

The TRIP system will provide two basic types of information: (1) alternate route recommendations and (2) traffic flow information (e.g., congestion levels). Table 1 identifies which user interfaces will provide which type of information.

Table 1. TRIP Traffic Information and Sources

User Interface	Type of Traffic Information Provided		
	Alternate Routes	Traffic Flow	Other [1]
Interactive Voice Response System (Phone)	X		
Kiosks		X	
Internet Web Site [2]		X	
Changeable Message Signs	X		
Highway Advisory Radio	X		
Cable Television			X

[1]Live, still-frame video from the four TRIP closed-circuit television cameras.

[2]The kiosks and the Internet web site will have exactly the same information, in the same format.

2.1.1 Alternate Route Information

The TRIP system will support the existing Branson area color-coded alternate route system, which includes three east-west routes that represent alternates to Route 76. The phone system will allow travelers to input their origin and destination by quadrant (northeast, northwest, southeast, or southwest) and will receive a recommendation on which route to take. The changeable message signs and highway advisory radio information will provide route recommendations, but without the interactive origin-destination component.

Alternate route information will be provided under two basic scenarios: during traditional peak periods of recurring congestion and during incident scenarios, such as traffic accidents. It is expected that alternate route information will be provided on a daily basis during peak traffic periods. Alternate route information relating to specific incidents will be provided less frequently and on an unpredictable basis.

2.1.2 Traffic Flow Information

The traffic flow information will be provided in the form of a color-coded regional route map, accessible via kiosks, and the Internet web site. A likely coding scheme would show routes with normal conditions (free flowing or minimal delays) in green, routes with moderate delays in yellow, and routes with severe delays in red.

2.2 Verification Methods

2.2.1 Overview

Alternate route information that will be provided on a daily basis during periods of recurring congestion will be verified in the field by two-person crews on June 25 and 26, and August 15 and 16, 1998. During these same data collection periods, traffic flow information will be verified during non-peak periods and whenever no alternate route messages are in effect. Alternate route information provided during incidents, which will occur infrequently and in an unpredictable manner, will be verified over the period September through December 1998.

Traffic count information will be collected and used to identify the change in the percentage of traffic using alternate and main routes. This information will be collected for the time periods corresponding to each of the verification runs performed for changeable message sign alternate route data.

Table 2. Data to be Verified by Time Frame

Time Period	Type of Data to be Verified		
	Traffic Flow Data	**Recurring Congestion-Related Alternate Route Information**	**Incident-Related Alternate Route Information**
Peak Periods			
11 AM - 2 PM	☐	■	☐
5 - 7 PM	☐	■	☐
10 - 11 PM	☐	■	☐
Off-Peak Periods			
8 - 10 AM	■	☐	☐
8 - 9 PM	■	☐	☐

■ This data is the primary focus during this time period.

☐ Data will be collected as time allows and if these types of messages are present, but this data is not the primary focus for this time period.

2.2.2 Recurring Congestion-Related Alternate Route Information

Alternate route information will be collected from the phone, changeable message signs, and highway advisory radio TRIP interfaces. For each verification run, the two researchers will consult the TRIP information source together; identify the specific origin, destination, and route to be driven; then separate and drive the two routes (one researcher driving the main route and one driving the alternate route recommended by TRIP).

For planning purposes, it is estimated that it will take approximately 60 minutes to perform a single alternate route verification run. This includes approximately 10 minutes to consult the TRIP information

source and to identify the route pairs to be driven, up to 40 minutes to drive the routes, and up to 10 minutes to drive to the location where the next user interface will be consulted and/or to reach the starting point for the next run.

The phone information system will provide information on a total of 12 possible origin-destination combinations (the user will be able to enter any of four different quadrants as their origin or destination, yielding a total of 12 possible routings). Verification runs will be made for only 10 of these 12 possible routes. The trips between the northeast and southeast quadrants will not be evaluated since these trips will be short and there are no significant alternate routes.

2.2.3 Incident-Related Alternate Route Information

Incident-related alternate route information will be sent directly from the TRIP operations center to local MoDOT personnel, in the same format as it will be disseminated through the TRIP user interfaces. The MoDOT personnel will then identify a routing plan and drive the main route, the route with the incident, and the recommended alternate route. In some cases, it may not be possible, or advisable, to drive the incident route, although use of local agency staff may make it more acceptable. In these cases, only the recommended alternate route will be driven.

The number and timing of the incident-related alternate routing information postings are unpredictable, but the total number of verification runs made each month is not expected to exceed two over the eight-month evaluation period, June 1998 through January 1999. This would yield a total of 16 runs for analysis.

2.2.4 Traffic Flow Information

Each of the two researchers will independently consult one of the TRIP kiosks, one of the two sources of traffic flow information. The Internet web site will not be consulted since it will provide exactly the same information as the kiosks. The researcher will select a route, note the level of congestion indicated by TRIP, which may include different levels of congestion over the route, then drive the route, recording the observed level of congestion.

It is estimated that it will take approximately 45 minutes to perform a single traffic flow verification run. This includes approximately 10 minutes to consult the TRIP information source and to identify the route to be driven, up to 25 minutes to drive the route, and up to 10 minutes to drive to the location where the next user interface will be consulted and/or to reach the starting point for the next run.

In selecting routes for verification, an effort will be made to obtain an approximately equal number of runs for each of the following routes: Route 248, Roark Valley Road, Route 76, and Fall Creek Road. The researchers will keep track of the routes they have driven and rotate their route selection. It is expected that by varying the routes, a variety of roadway conditions (e.g., "green-," "yellow-," and "red-" coded routes, corresponding to the three categories of congestion/delay that will be used to describe traffic conditions) will also be verified.

Tables 3 and 4 present detailed schedules for conducting the recurring congestion-related alternate route and the traffic flow verification runs. The schedules describe the first of the two planned three-day data collection periods. Following the first three-day session, the schedule for the second session may be

Table 3. Schedule for Alternate Route [1] Data Collection: Session #1 (June)

	Number of Runs by Day			Total Runs
	Day 1	**Day 2**	**Day 3**	
11 AM - 2 PM	NW-NE [2] NW-SE NW-SW	SE-NW SE-SW NE-SW	CMS #3 HAR [4] HAR	**9**
5 - 7 PM	SW-SE SW-NE	NE-NW CMS #1 [3]	HAR HAR	**6**
10 - 11 PM	SW-NW	CMS #2	CMS #2	**3**
Total Runs	**6**	**6**	**6**	**18**

[1] Each of these runs will verify conditions on a pair of routes, the recommended alternate route and the main, or traditional, route.

[2] The runs verifying information obtained from the phone system are identified by origin-destination quadrant (the phone system will allow users to enter their origin-destination quadrants).

[3] CMS location #1–US 65, north of Route 76 (facing southbound traffic); CMS location #2–US 65, south of Route 76 (facing northbound traffic); CMS location #3–Route 165, south of Route 76 (facing northbound).

[4] The single HAR Transmitter will broadcast 3-minute messages that will include information on multiple routes. For each HAR run, information for a different route will be verified.

Table 4. Schedule for Traffic Flow Data Collection: Session #1 (June)

	Number of Runs by Day			Total Runs
	Day 1	**Day 2**	**Day 3**	
8-10 AM	Route 248 Roark Valley Road Route 76 Fall Creek Road Route 248 Roark Valley Road	Route 248 Roark Valley Road Route 76 Fall Creek Road Route 248 Roark Valley Road	Route 248 Roark Valley Road Route 76 Fall Creek Road Route 248 Roark Valley Road	**18**
8 - 9 PM	Route 76 Fall Creek Road	Route 76 Fall Creek Road	Route 76 Fall Creek Road	**6**
Total Runs	**8**	**8**	**8**	**24**

adjusted based on preliminary results and lessons learned. In Table 3, the phone runs are identified according to the origin-destination quadrants, e.g., northeast-southwest.

As shown in Tables 3 and 4, the sequence of alternate route runs will work through the 10 routes described by the phone system, the three changeable message sign locations, and the HAR messages. The traffic flow runs will work through the four major alternate routes. Ultimately, the exact timing of specific runs is not critical; rather, it is important to obtain samples from each of the user interfaces and routes. The schedule provides a useful guide to help insure that all sources are consulted and all major routes tested.

2.2.5 Information to be Logged on Verification Runs

The information to be logged for each verification run is identified in Table 5. A one-page form will be developed that includes blanks for the information to be logged on each run. The qualitative information in Table 5 would include information such as "expect delays," "heavy congestion," "accident," etc. The personnel driving the routes will provide an immediate, brief qualitative assessment of the validity of this information.

Table 5. Information to be Logged on Verification Runs

Information Source	Route Identification	Run Statistics	Qualitative Information
• Time consulted • Location consulted • Type of TRIP user interface • Specific information obtained	• Start location • End location • Travel path (roads traveled)	• Start mileage • End mileage • Start time • End time	• Qualitative assessment of the travel conditions on the route, focusing on level of congestion and delay, as well as any other information referred to in the TRIP

2.2.6 Changeable Message Sign Route Diversion Data

Traffic count information will be collected and used to identify the change in the percentage of traffic using alternate and main routes. This information will be collected for the time periods corresponding to each of the verification runs performed for changeable message sign alternate route data.

The ratio of traffic continuing straight along the main route versus turning onto the alternate route will be calculated for one hour before the posting of the TRIP alternate route message on the CMS and for the duration of the message posting. The count data will be supplied by the TRIP traffic detection system. Using this information, the total benefit of any route diversions can be calculated using the travel time differential obtained in the verification run (the time savings on the alternate route) and the volume of traffic diverted onto the alternate route. For example, if the alternate route saved 3 minutes in travel time, and 500 more cars used the alternate route than under normal conditions (e.g., when no message is posted), the total benefit could be estimated as 3 minutes x 500 vehicles = 1,500 minutes (25 hours).

3.0 SCHEDULE

Table 6 presents the anticipated schedule for the completion of all activities related to this test.

Table 6. Anticipated Schedule for Test

Activity	1998									1999			
	A	M	J	J	A	S	O	N	D	J	F	M	A
Pre-Test Activities (design)	X	X											
Test Activities (data collection)			X	X	X	X	X	X	X	X			
Post-Test Activities											X		
Analysis and Reporting								X				X	X

4.0 PRE-TEST ACTIVITIES

Necessary training aids and the forms for recording data will be developed.

5.0 TEST ACTIVITIES

Verification of recurring congestion-related alternate route information and traffic flow information will done over two, three-day periods: June 24–26 and August 5–7, 1998. The local MoDOT staff who will be conducting the verification runs will be trained on June 23, 1998. This training will also include test runs and debriefing. If necessary the data collection plan will be fine-tuned based on these results.

During the two data collection sessions, recurring congestion-related and traffic-flow information will be collected during daytime and evening times shown in Tables 2, 3, and 4. Baseline condition information, documenting the uncongested, free-flow conditions on routes, will be collected at the end of the June and August data collection periods, during the early morning hours.

At the conclusion of each two-day data collection period, system operators will be debriefed regarding the circumstances, including the intended impacts, of the alternate route messages that will be verified.

Between the first and second data collection periods, and immediately following the second data collection period, the start and stop times for the TRIP messages that were evaluated will be collected from the system operators. This information will be used to establish the "age" of the message relative to the time when the information was consulted and verified in the field. Also during the first and second data collection sessions, the data will be organized and reviewed for accuracy.

Local agency staff will verify incident-related alternate route messages as they occur over the period September–December 1998. This data will be relayed to the evaluation team on a regular basis throughout this period.

6.0 POST-TEST ACTIVITIES

The data from the June and August data collection periods, and whatever data has been received from local agency staff through the end of September 1998, will be analyzed and results will be documented in the November 1998 Summary of Preliminary Results Report. Any remaining data received from local agency staff through December 1998 will be analyzed and incorporated into the April 1999 Final Evaluation Report.

7.0 DATA REQUIREMENTS AND ANALYSIS

7.1 Alternate Route Information

The analysis of the alternate route run data will compare the travel times and conditions encountered on the alternate and main routes. Baseline travel times will also be obtained for each route so that the relationship between travel times on the main and alternate routes during periods of congestion (when the TRIP alternate route messages will be posted) can be contrasted with the relationship between the times during normal, uncongested conditions. This will help place the congested travel time differentials within a context.

The alternate route information analysis will also document the route diversion impacts in terms of the change in traffic as a result of posting alternate route information on specific changeable message signs.

Table 7 summarizes the comparisons that will be made as part of the analysis of alternate route information. As indicated, comparisons between alternate and main routes will include both average travel time and speed, since it is assumed that travelers sometimes value increased speed even in the absence of significant travel time savings, i.e., a minute spent driving is less important that a minute spent waiting. Chi Square tests will be used to establish the statistical significance of any differences found between compared conditions.

The proposed analysis recognizes that under some circumstances, such as during incidents, system operators may have reasons for diverting traffic that are not related to improving travel time for drivers. For example, when a route becomes impassable due to a major incident, or when an accident is being investigated, the decision to reroute could be based on safety concerns or may be in response to a complete route closure. Under these circumstances, diversion of traffic onto routes with longer or equivalent travel times could be considered an appropriate and successful outcome if the objective is simply to remove traffic from the main route. For this reason, the TRIP operators' motivations for each alternate route message scenario that is analyzed will be documented and factored into the interpretation of the analysis results.

This analysis also includes documentation of the start and end times for the TRIP information, that is, the time when the information was first posted, and the time when the information was removed or changed. This information could be useful in interpreting the results of this analysis. For example, if the TRIP information was consulted, and the verification run was made long after a message was first posted and shortly before it was removed or changed, this could help explain a lack of differentiation between main and alternate routes since the conditions on the routes will tend toward equilibrium if the underlying condition on the main route has cleared or if the route diversion has effectively balanced demand over available routes. Also, if the information was consulted very early in the life of the message, few drivers may have responded to the information by switching to the alternate route, and the relative advantage of the alternate route may be more pronounced but may decrease with time. If, over the course of the

Table 7. Alternate Route Information Analysis

Comparison	Required Data	Hypothesized Outcomes
Individual alternate route data to corresponding data for individual main routes	• Travel times for individual alternate routes and main routes • Average speeds for individual alternate routes and main routes • System operator's motivation/intention for each scenario • Start and stop times of information consulted[1]	Assuming diversions are motivated by anticipated travel time advantages, travel times for alternate routes should be no slower, and/or should have higher average travel speeds, than main routes.
Cumulative alternate route data to cumulative main route data	• Travel times for individual alternate routes and main routes • Average speeds for individual alternate routes and main routes • System operator's motivation/intention for each scenario • Start and stop times of information consulted[1]	Assuming diversions are motivated by anticipated travel time advantages, average travel times over all of the alternate routes should be no slower, and/or should have higher average travel speeds, than average times and speeds over all of the main routes.
Observed main route conditions to reported main route conditions	• Qualitative description/assessment of observed main route conditions • Alternate route message, including descriptive/qualitative content • Start and stop times of information consulted[1]	Assuming that descriptive information is provided within the alternate route message (e.g., "accident"), field observations should confirm the condition.
Route diversion impacts of CMS messages	• Traffic turning movement volumes at CMS location during normal and "with message" conditions • Travel times for alternate and main routes	The total benefit of an alternate route message will be equal to the travel time saving on the alternate route multiplied by the number of vehicles diverted to the alternate route (that would normally not divert).

[1] The time that the message was first disseminated and the time the message was removed from the TRIP system or changed.

verification runs, enough runs are made corresponding to different ages of the TRIP information (e.g., recently posted, removed, or changed shortly after consultation, etc.), the impact of the "age" of the message can be identified statistically using logistic regression.

7.2 Traffic Flow Information

Table 8 summarizes the comparisons that will be made as part of the analysis of traffic flow information. As for the analysis of alternate route data, the relationship between the time that the TRIP data is consulted and the "age" of the information will be documented and used to aid in interpretation of results and, assuming that sufficient variation in age of the messages is found among the verification runs, will be analyzed as an influence on the results of the comparisons.

Table 8. Traffic Flow Information Analysis

Comparison	Required Data	Hypothesized Outcomes
Reported information to observed information (Relative Validity)	• Qualitative descriptions of observed traffic conditions. • TRIP descriptions of traffic conditions. • Start and stop times of information consulted[1]	Observed conditions should be similar to reported conditions, e.g., if a route is identified as having "significant delays", longer than normal delays should be observed.
Observed conditions relative to the normal or free-flow baseline conditions (Absolute Validity)	• Qualitative descriptions of observed traffic conditions. • TRIP descriptions of traffic conditions. • Start and stop times of information consulted[1] • Baseline conditions for each route	Each category of traffic condition reported in the TRIP system and observed in the field should differ from the baseline (normal or "free-flow") conditions for the route in question in a reasonable manner. For example, if a route is described as "normal", its observed conditions should be similar to those found under baseline or normal conditions. Or, if a route is described as having "significant delays", significantly greater delay should be encountered than is present on that route under baseline conditions.
Observed conditions to observed conditions (Relative Validity)	• Qualitative descriptions of observed traffic conditions. • TRIP descriptions of traffic conditions. • Start and stop times of information consulted[1] • Baseline conditions for each route	The conditions encountered for routes identified under a specific traffic condition category should be similar, and different from the conditions encountered for routes identified under a different specific traffic category. For example, all routes coded red and identified as having "significant delays" should all have comparable levels of delay as verified in the field.

[1] The time that the message was first disseminated and the time the message was removed from the TRIP system or changed.

As indicated in Table 8, the analysis includes three types of comparisons. The first focuses on the relationship between conditions as they are described in TRIP and observed conditions. Clearly, in an accurate and reliable system, these conditions should be closely correlated. This comparison focuses on agreement between reported and field conditions. It does not address the relationship between certain types of conditions, both in the field and as reported by TRIP, as they relate in real terms, to the baseline conditions for the routes in question. This comparison is made by a separate analysis that compares the conditions associated with a given description in the TRIP system, such as "little or no delay," with an absolute reference point, the baseline or free flow conditions on the route. The third and final comparison focuses on the consistency in assigning labels to certain conditions (e.g., routes described as having "little or no delay" should be similar in terms of their delay) and the differences between the different labels (e.g., routes described as having "significant delay" should have notably more delay than routes described as having "moderate delay").

8.0 REPORT FORMAT

The results of this test will be summarized in a technical report. The report will contain the following sections:

1.0 Executive Summary
2.0 Introduction and Background
3.0 Summary of the Approach
4.0 Results
5.0 Conclusions
6.0 Recommendations for Future Analysis

9.0 ESTIMATED RESOURCES

Table 9 presents the required allocation of hours for personnel to conduct the test.

Table 9. Estimated Allocation of Project Staff Hours

Staff	Task				
	Pre-Test Activities	Test Activities	Post-Test Activities	Analysis and Reporting	Total
Task Manager and Evaluation Leader	0	0	0	2	2
On-Site Evaluator	8	16	4	16	44
Statistical	0	0	0	6	6
ATIS Specialist	0	0	0	2	2
Local Agency Staff [(1)]	0	160	0	0	160
Support/Administrative	0	0	0	4	4
Total	8	176	4	30	218

[(1)] Two local MoDOT staff will drive all of the verification runs.