

TEST PLAN:

I-40 TTIS (Traveler and Tourist Information System) Route Diversion Study



May 20, 1998

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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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| Title | Date | DOT Report No. |
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| Evaluation Plan: The I-40 Traveler and Tourist Information System Field Operational Test | February 25, 1998 | FHWA-JPO-99-028 |
| Test Plan: I-40 TTIS Tourist Intercept Survey | May 18, 1998 | FHWA-JPO-99-029 |
| 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 | |
| Evaluation Plan: The Branson Travel and Recreational Information Program Field Operational Test | February 25, 1998 | FHWA-JPO-99-027 |
| Test Plan: Branson TRIP Tourist Intercept Survey | May 29, 1998 | |
| Test Plan: Branson TRIP Focus Groups and Personal Interviews | May 29, 1998 | |
| Test Plan: Branson TRIP System/Historical Data Analysis | June 1, 1998 | |
| Test Plan: Branson TRIP Travel Time/Data Accuracy Test | June 1, 1998 | |
| Executive Summary: Evaluation Plan (for the) National Advanced Rural Transportation Systems Field Operational Tests of Traveler Information Services in Tourism Areas | July 1998 | |

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TEST PLAN: I-40 TTIS ROUTE DIVERSION DETAILED STUDY

FOR

THE I-40 TRAVELER AND TOURIST INFORMATION SYSTEM 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: route diversion. Section 2.0 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 measures driver response to TTIS messages in terms of the change in the ratio of traffic on main and alternative routes during periods when specific types of travel advisory messages are disseminated through the TTIS system, including kiosks, Internet web pages, automated phone information line and roadside variable message signs (VMSs). If the TTIS advisories are successful in rerouting traffic onto safer and/or less congested roadways, congestion, safety, and mobility will be improved.

The specific hypothesis to be evaluated in this test is that drivers will alter their travel routes based on the presence of specific advisories on the TTIS. Specifically, it is hypothesized that these route changes will be manifested in a change in the proportion of traffic on the main and alternative roadway, i.e., during periods when certain types of messages are posted, such as those that indicate poor traffic or weather conditions on the main route, the percentage of traffic on the main route will be lower and the percentage of traffic on the alternative route will be higher than normal.

2.0 APPROACH

The ratio of traffic on I-40, near the Ash Fork VMS, being deployed as part of the TTIS, and on an alternate route, SR 89, will be compared under conditions when messages are, and are not, displayed on the VMS. A significant change in the proportion of traffic on SR 89, the alternate route, coincident with the display of various types of messages on the VMS and through the other TTIS user interfaces (kiosks, phone line and web page), will indicate that the messages are impacting route selection.

2.1 Selection of a Route Diversion Study Location

The junction of I-40 eastbound with SR 89, located approximately 55 miles west of Flagstaff and near the town of Ash Fork, Arizona, was selected as the study location. This location was the only site that passed a number of selection criteria that were developed and applied in conjunction with the Arizona Department of Transportation (ADOT). These criteria include the availability of traffic counts (permanent ADOT automated traffic recorders), the presence of a TTIS variable message sign, and a likely pair of alternate routes. Other variable message sign locations within the TTIS deployment area were rejected due to the absence of traffic counting equipment and/or absence of alternate routes and likely route diversions.

Figure 1 shows the location of the selected route diversion study location. As shown in the figure, the I-40/SR 89 junction represents a routing decision point for two potential trips. The first trip, referred to as the “Southern Arizona trip”, includes destinations in the southern part of the state, such as Phoenix and Tucson. For this trip, eastbound I-40 travelers can either continue east on I-40 to Flagstaff before turning south on I-17 (the main route), or they can take SR 89 (the alternate route) south through Prescott and connect with I-17 via State Route 69, approximately 70 miles south of Flagstaff at the town of Cordes Junction. Between I-40 and Prescott, SR 89 is a two-lane highway with considerable changes in elevation and twists and turns in some segments. For this reason, SR 89 is considered the alternate route for the Southern Arizona trip, with most travelers likely to use the I-40 route under normal driving conditions.

The second trip, referred to as the “Northeastern Arizona trip” includes destinations along I-40 east of Flagstaff, including New Mexico. For this trip, travelers can either continue east on I-40 through Flagstaff (the main route) or can take SR 89 south (the alternate route), then continue east on State Route 260, then north on any of a number of potential state highways to rejoin I-40 east of Flagstaff.

Both the Southern Arizona and Northeastern Arizona route diversions bypass the portion of I-40 between SR 89 and Flagstaff, an area where snow, ice, fog and traffic incidents can seriously slow traffic or result in the closure of the highway. Of the two potential route diversions, the Southern Arizona trip is considered the much more likely diversion, since the Northeastern Arizona alternate route adds considerable mileage to the trip.

Figure 1 shows the location of the two ADOT automatic traffic recorders (ATRs) that will be used to gather the traffic counts required to identify route diversions at the I-40/SR 89 junction. The ATRs are permanent, in-pavement devices that operate 24-hours a day, seven days a week. The first ATR is located on I-40 near Seligman, approximately 25 miles west of the Ash Fork VMS and the junction with SR 89. There are no opportunities for traffic to get on or off I-40 between the ATR and the Ash Fork VMS. This location will provide the needed traffic counts on I-40. The second ATR is located on SR 89, just south of the junction with I-40. This location will provide the needed counts on SR 89.

2.2 Identification of TTIS Impacts

The impact of the TTIS traffic advisory information that will potentially impact eastbound I-40 travelers at the Ash Fork/SR 89 junction, including information disseminated through kiosks, telephone, Internet and through the Ash Fork VMS, will be gauged by the extent of route diversion. Route diversion will be estimated by comparing the baseline ratio of traffic on I-40 and SR 89 to the ratio during those times when advisory messages are posted, including those that suggest use of an alternate route (due to road,

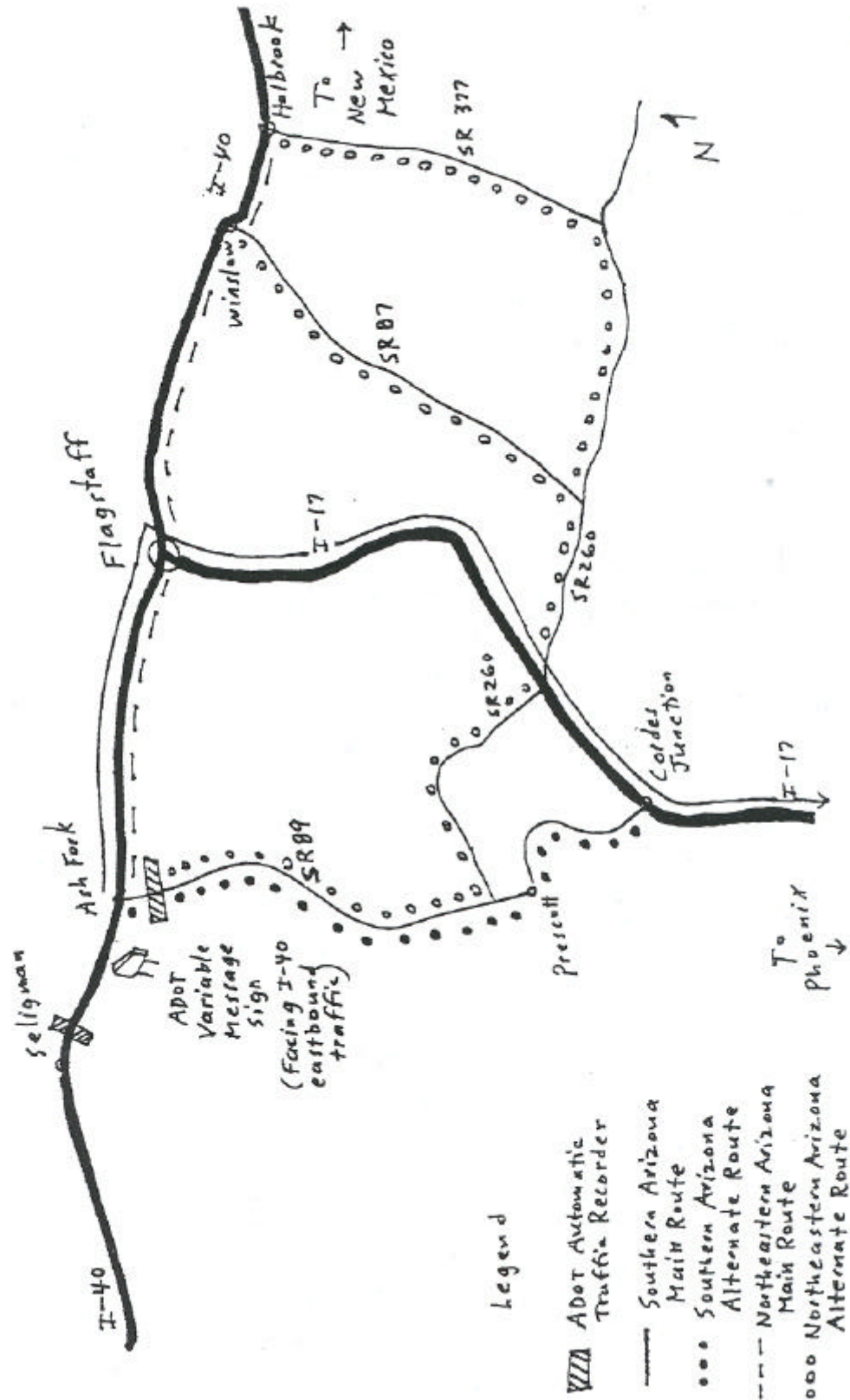


Figure 1. Route Diversion Study Location

weather or other conditions) or simply provide notice of road or weather conditions (e.g., slow traffic ahead, watch for ice, etc.).

The selection of analysis scenarios will be based primarily on the posting of messages on the Ash Fork VMS, which is assumed to be the most important influence on route selection at the I-40/SR 89 juncture. Message postings to the Ash Fork VMS will be tracked and analysis scenarios will be screened based on several screening criteria related to the duration of the incident itself, the duration of the message posting, and the conditions prior to the message posting. In terms of the duration of the incident and the message posting, it is important that the event and message durations are long enough to expose a significant volume of traffic. It is important to select scenarios where no messages have been posted for several hours in order to eliminate the influence of any carry-over effects of previous messages. The screening criteria that will be applied may be fine-tuned during the early portions of the test based on additional input from ADOT and based on the first several weeks of actual messages. The proposed criteria are:

1. Only message postings relating to conditions lasting one hour or more will be considered.
2. Only messages postings that are displayed one hour or more will be considered.
3. Only message postings that follow a period of at least six hours during which there were no message postings will be considered.
4. Mandatory detour scenarios (“prescribed” alternate routes) will not be evaluated since compliant travelers will have no choice whether to detour or not.

Those messages that pass the screening will be considered for analysis. A total of six message scenarios will be analyzed, three during the summer season (June 1, 1998–September 30, 1998), and three during the fall-winter season (October 1, 1998–January 31, 1999), assuming at least this many scenarios are identified. The number of potential scenarios will depend on a number of factors, including the number of messages that pass the above screening criteria, the availability of traffic count data (the ADOT ATRs do experience outages which prevents counting, and sometimes data that is recorded cannot be retrieved), ADOT data reduction resources (retrieval of the hourly traffic counts requires non-routine processing activities), and road and weather conditions in the I-40 corridor (although traffic volumes are generally higher in the summer months, weather-related advisories and closures occur primarily in the winter months).

ADOT logs of the Ash Fork VMS message postings will be acquired and reviewed on a weekly basis throughout the test period (June 1, 1998–January 31, 1999). Message postings will be screened and analysis scenarios identified. Hourly ATR traffic count data for the 24-hour period that includes the time that the message was posted will be requested from ADOT on a monthly basis, so as to spread out their data processing requirements.

At the end of September, the identified scenarios will be analyzed, which will consist of comparing traffic splits (the proportion of traffic on I-40 and SR 89) during the “with message” time periods with traffic splits for the hour immediately preceding the message posting. The difference between the traffic splits will indicate the combined influence of the VMS and any other traffic information received. In order to identify any lingering effects of the message, traffic splits during the message period will also be compared with traffic splits for several hours after the message has been removed.

For each scenario analyzed, other traffic condition information that may have had an impact on route selection will be documented, including information from other TTIS sources and information from non-TTIS sources such as commercial radio and television. Assuming that enough scenarios with equivalent message content can be identified, the influence of these other sources can be statistically isolated, thus revealing the singular impact of the VMS messages. Regardless of whether this will be possible, documentation of non-VMS information that may have played a role in route selection will help place the role of the Ash Fork VMS messages within the broader traveler information context and will aid in the interpretation of results.

3.0 SCHEDULE

Table 1 presents the anticipated schedule for the completion of all activities related to this test.

Table 1. 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 | | | | X | | |
| Analysis and Reporting | | | | | | | | X | | | | X | X |

4.0 PRE-TEST ACTIVITIES

Several activities will occur prior to the beginning of the route diversion test on June 1, 1998. Sample ATR data will be collected from ADOT and required analysis tools, e.g., spreadsheets, will be constructed and data import/export procedures will be developed. Procedures for obtaining and screening the Ash Fork VMS message log will be developed and tested. Procedures for identifying non-VMS TTIS message information during selected time periods, and procedures for identifying relevant non-TTIS information (e.g., establishing contacts with radio and television traffic reporting outlets) will be developed and tested.

5.0 TEST ACTIVITIES

As described in Section 2.0, VMS logs will be obtained from ADOT and messages will be screened on a weekly basis. When scenarios are identified for analysis, contacts will be made immediately with non-TTIS data sources in order to collect anecdotal information on what information was provided from those sources. At the end of each month, the list of analysis scenarios will be submitted to ADOT and ATR data for those periods will be requested. It is expected that no more than six (6) scenarios will be analyzed.

6.0 POST-TEST ACTIVITIES

Data from the June 1–September 30, 1998 period will be organized into a database. The analysis of the data will be performed in October and the results will be documented in the November 1998 Summary of Preliminary Results Report. Assuming that the results of the analysis are useful and the continued availability of the required ADOT traffic count data, data collection will continue through January 31, 1999. Data from the October 1, 1998–January 31, 1999 period will be analyzed in February and results will be documented, along with the results of the June-September period, in the April 1990 Final Evaluation Report.

7.0 DATA REQUIREMENTS AND ANALYSIS

Traffic volumes on I-40 and SR 89 during baseline and message scenarios will be displayed graphically in separate charts such as the one shown in Figure 2. Each chart will graphically depict the relationship between traffic volumes on I-40 and SR 89. These charts will allow visual comparisons between the baseline and message scenarios.

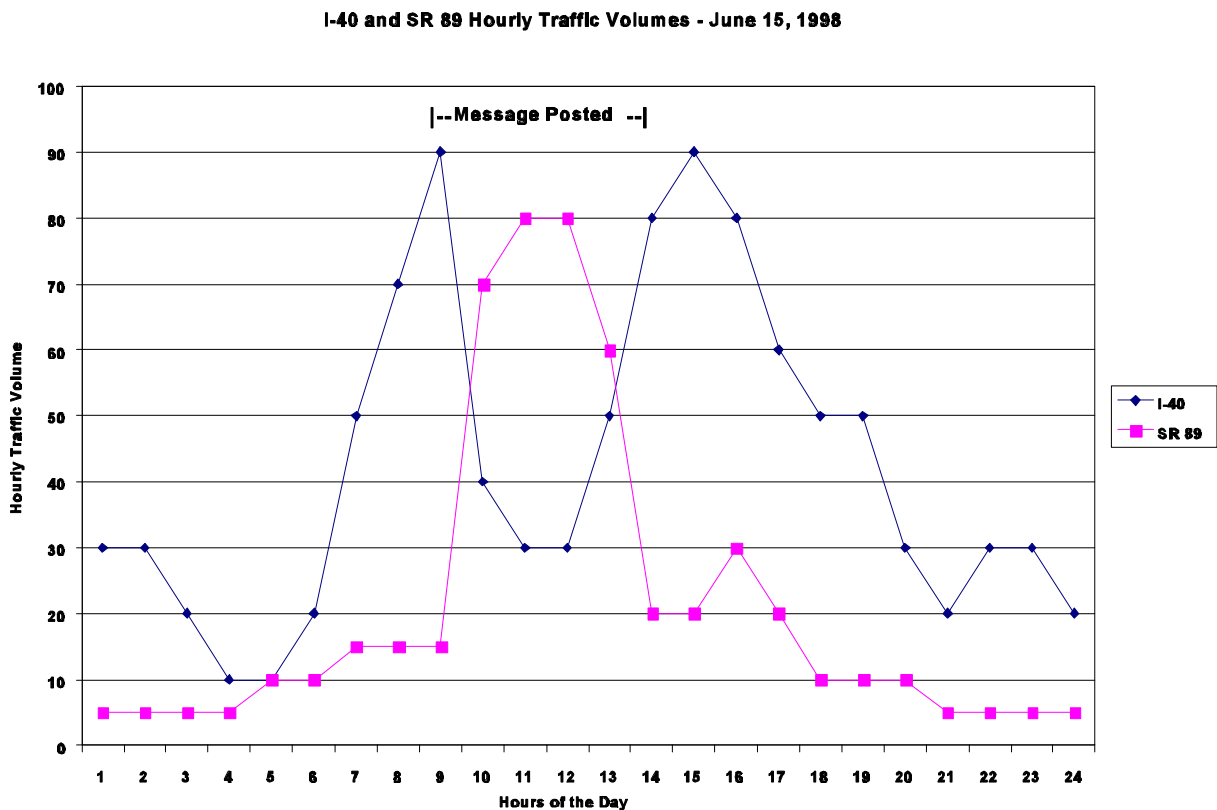


Figure 2. Example Chart: I-40 and SR 89 Traffic Volumes Under “With Message Conditions.”

The statistical significance of the differences between “message” and “no-message” traffic volumes will be measured using the Chi Square test. The impact of other travel condition information that could have impacted route selection and that was made available before and during the VMS message posting will be isolated using logistic regression. This test will require a sufficient number of equivalent message scenarios, i.e., messages with equivalent content, that vary according to the amount of non-VMS travel condition information that was disseminated. Assuming that a number of equivalent message scenarios are identified and that the amount of non-VMS information varies over these several scenarios, the impact of the non-VMS information can be extracted using logistic regression. The Chi Square and logistic regression results, along with the documentation of what other, non-VMS information was available during the message scenario, will be used to develop conclusions regarding the impact of the TTIS on route diversions during the scenario.

If possible, when significant increases in alternate route use are identified, estimates of the total travel time, fuel, and accident reduction savings will be made. These estimates will be based on the volume of traffic detouring as a result of TTIS information, the length and estimated average speeds of the main and alternate route (including estimates of incident-related delay on the main route based on TTIS traffic detection), and the accident history along the main and alternate routes under comparable weather conditions. The ability to make these calculations will depend primarily on the ability to estimate delay on the main route, which may not be possible under all scenarios.

The results of this test will be compared to other similar tests that have been conducted on the influence of traveler information on route selection, including the VMS test portion of the I-10/I-17 (Phoenix Metro) Phase I Freeway Management System Evaluation (ADOT, July 1997).

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 1 presents the required allocation of hours for project staff to conduct the test.

Table 2. Estimated Allocation of Project Staff Hours⁽¹⁾

| 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 | 20 | 0 | 40 | 68 |
| Statistician | 4 | 0 | 0 | 10 | 14 |
| ATIS Specialist | 0 | 0 | 0 | 2 | 2 |
| ADOT Local Evaluator ⁽²⁾ | 8 | 116 | 0 | 0 | 124 |
| Support/Administrative | 0 | 0 | 0 | 8 | 8 |
| Total | 20 | 136 | 0 | 62 | 218 |

⁽¹⁾ Assumes that up to six (6) scenarios will be analyzed.

⁽²⁾ The ADOT local evaluator will be responsible for collecting and reviewing weekly ADOT VMS message logs and identifying potential analysis scenarios based on the agreed upon screening criteria. Once scenarios have been identified by the FHWA evaluation team, the local evaluator will collect required traffic count data from ADOT and data on the non-VMS travel information made available immediately before and during the VMS message posting, including documentation of information potentially available to travelers via other TTIS sources and from non-TTIS sources such as commercial radio and television.