Assessing Roadway Traffic Count Duration and Frequency Impacts on Annual Average Daily Traffic Estimation

Evaluating Special Event, Recreational Travel, and Holiday Traffic Variability

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16. Abstract

The FHWA Travel Monitoring Analysis System (TMAS) volume data were utilized from 418 sites/years in the United States where data were available for all 24 hours of every day of the year. These sites collectively represented a wide range of AADT volumes, 9 functional classes, 35 states, and years 2000 through 2012.

The TMAS hourly data were converted to daily ratios of volume to the overall AADT for the site. These daily volume ratios were fit to statistical analysis of variance models to estimate the mean changes in volume for national holidays and the days surrounding them. Further subsets of sites were utilized to model the traffic impacts of roadways near recreational areas and associated with special events. The report includes the analysis methodology and summary statistics findings.

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Preface

We would like to acknowledge the following Technical Advisory Committee members for their contributions, support and technical guidance during this project.

Steven Jessberger	Federal Highway Administration
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William Morgan	Illinois DOT
Gene Hicks, Thomas Nelson, Mark Flinner	Minnesota DOT
Jeremy Freeland, Joseph Pipe	Pennsylvania DOT
William Knowles	Texas DOT
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Additionally, several contacts generously provided input on potential events and recreational sites in their states that could be studied. These individuals included representatives from Alabama DOT, Florida DOT, Idaho Transportation Department, Indiana DOT, Iowa DOT, Kansas DOT, Kentucky DOT, Maine DOT, Nebraska DOT, New Hampshire DOT, Oregon DOT, Utah DOT, Washington State DOT, and Wyoming DOT.

Table of Contents

List of Tables

Executive Summary

This task was completed using a set of 418 permanent count stations with data from the Federal Highway Administration (FHWA) Travel Monitoring Analysis System (TMAS) for every hour of a year. The hourly volumes were summed to the daily level and then an AADT was estimated using the American Association of State Highway and Transportation Officials (AASHTO) method. The ratio of daily traffic volume divided by the AADT provided a profile for variability in traffic volume over the course of a year for any particular site. To understand the impact of national holidays, these profiles were fit to statistical models with the holiday and the days surrounding the holiday compared to similar reference days (usually the same days of the week in the same time period). A similar analysis was conducted for volume profiles at sites with identified special events or recreational travel characteristics. In these latter cases, the volume profiles for the events or recreational sites in season were compared to a set of reference sites without the changed volume profiles. In this way, it was possible to characterize a range of different travel profile patterns pertaining to special event and recreational travel. The results are provided for each the targeted days of the holidays, events, and recreational periods themselves as well as the shoulder days before and after. In each case, results are shown as percentage increase or decrease for the corresponding reference with associated 95 percent confidence intervals, and indication of whether the observed results were statistically significant (from no difference) at the 0.05 level. The aggregate results provide a picture of the impact both large-scale, repeatable events and local or limited events can have on AADT estimation. This is a final task report that includes the analysis methodology and summary statistics findings.

Introduction

Annual Average Daily Traffic (AADT) volume is an important measure of road use. For a set of locations nationally known as permanent traffic count stations, AADT can be measured quite accurately and precisely, even if some limited periods of time are missing or unavailable. For most roads, it is not economically or logistically practical to maintain a permanent traffic count station, but an accurate AADT is still needed. To determine AADT for such roads, the typical practice is to deploy a temporary counter for anywhere from a few hours to as many as seven days. After the counter is retrieved, the hourly traffic volume is extracted, processed and then converted to an expected annual average daily value based on the characteristics of the roadway and of the period sampled. This conversion, or factoring, is based on the same period (e.g., Tuesday, or Tuesday in November) and for a set of sites with permanent count stations that are considered similar to the location of the temporary count. This process relies on the temporal traffic patterns in the factor group reliably matching that of the temporary count station. However, there are a number of conditions where such an assumption may not hold.

- Typical monthly and day of week patterns of traffic volume do not necessarily follow in the periods around a **holiday**
- **Special events** may significantly change traffic in one local area
- **Recreational area** travel patterns may differ significantly from those of similar roadway types outside of these areas

This task was undertaken to understand the impacts of each of holidays, special events, and recreational area travel on AADT estimation. Of interest were the days of the events themselves as well as those surrounding them.

An overall research effort was begun in 2014 in which the Federal Highway Administration (FHWA) Travel Monitoring Analysis System (TMAS) data from 14 years (2000-2013) were the source data. From nearly 43,000 continuous permanent volume traffic data sites (25 million records) in the entire dataset, approximately 6,000 of them had 24 hourly volumes for all days of the year. Over the course of two other investigations, "Assessing Roadway Traffic Count Duration and Frequency Impacts on Annual Average Daily Traffic Estimation: Assessing AADT Accuracy Issues Related to Short-Term Count Durations,"[1] and,

[1] Publication No. FHWA-PL-016-008, October 2015.

"Assessing Roadway Traffic Count Duration and Frequency Impacts on Annual Average Daily Traffic Estimation: Assessing AADT Accuracy Issues Related to Annual Factoring,"[2] a subset of 418 unique sites were identified with accuracy of AADT estimation available for each day of the year.

This evaluation fits statistical models to the daily traffic volume as a proportion of the AADT for each site from some or all of the 418 sites and then compares proportional volume differences between targeted locations and/or time periods to that of reference locations and/or time periods. This modeling produces estimates of the absolute and relative volume variability for all of the following:

- National Holiday Periods – The holidays evaluated included:
  - Easter
  - Memorial Day
  - Independence Day
  - Labor Day
  - Thanksgiving
  - Christmas
  - New Year's Eve

- Special Events – These are events that might impact traffic flow. Events were selected that were planned (e.g., festivals, sporting events), as well as those that were unplanned (e.g., weather events). Events had varying durations and could be repeated or one-time/limited time.

- Recreational Travel – Sites were selected that corresponded to recreational areas. Attempts were made to include water-based recreational as well as other types. Different times of the year were evaluated so that both summer and winter recreational sites would be included.

The special events and recreational travel evaluation were based on inputs from numerous state DOTs. To the extent possible, these were sought to represent a national cross-section. Suggested sites from the states had to be among the 418 available in the evaluation. Sites where no significant patterns of travel difference were found are considered findings in themselves and are reported. Due to the ad hoc nature of the special event and recreational travel results, only a limited number of events are shown. Other patterns of travel may well be present in certain areas, but those presented here provide some scope for the variability and scale of the effects that may be observed.

The following sections of this report discuss the methods employed to select the sites for evaluation, to provide detailed descriptions of the evaluation scenarios, and to fit statistical models to the data. The Methods section is followed by the Results section, which presents the summary results and discusses how they address the key research objectives of the task. This is followed by Conclusions of the key findings of the research. An Appendix with a comprehensive listing of the holidays complete the report.

Methods

Traffic Monitoring Site Data

For this evaluation, FHWA TMAS traffic volume data were used as the input data. Following a series of data processing steps, which are discussed in more detail in the report, "Assessing Roadway Traffic Count Duration and Frequency Impacts on Annual Average Daily Traffic (AADT) Estimation: Assessing Accuracy Issues with Current Known Methods in AADT Estimation from Continuous Traffic Monitoring Data,"[1] a complete dataset of available sites with corresponding hourly traffic volumes was generated. This dataset consisted of 42,876 site and year combinations for which adequate hourly data existed to determine an AADT using the American Association of State Highway and Transportation Officials (AASHTO) method. For 5,681 of the site and year combinations, data were available for every hour of the year. It was this latter set of data which constitutes the core of this task, since an exact AADT is known for each of these sites (i.e., no missing data).

[2] Publication No. FHWA-PL-016-012, February 2016.

A number of other criteria for selection of sites were provided by FHWA to assure that the aggregate results would be representative of traffic count patterns as a whole across the United States:

- A minimum of 200 sites;
- To the extent possible, all states and roadway functional classifications; and
- All years from 2000 through 2012.

Site Selection

The sites to include in this analysis were the aggregate of those for the Task 3[1] and Task 4[2] analyses of this evaluation. A total of 418 sites were selected that include nine of the 14 functional classifications and 35 states. The sites included years of 2000 through 2012. The summary of the 418 sites by state and year is provided in Table 1, and by functional classification and year in Table 2.

Table 1. Summary of Sites Selected for Holiday and Special Events/Recreational Area Analysis by State and Year

State	Year													State Totals
	00	01	02	03	04	05	06	07	08	09	10	11	12	
Alabama	2													2
Alaska											5			5
Arizona						4								4
California				7										7
Colorado												2		2
Florida						1	1							2
Hawaii											3			3
Idaho				2	7		3							12
Illinois												2		2
Indiana								1						1
Iowa	16	15		25	22									78
Kansas		5	6		2					2				15
Kentucky				4			2							6
Maine									30			16		46
Massachusetts	9													9
Michigan				2			3							5
Minnesota								24	10	10				44
Mississippi									1					1
Montana							1			2				3
Nebraska		3							7					10
Nevada									4					4
New Hampshire												7		7
New Mexico						2								2
New York							3							3
Ohio						2								2
Oklahoma									1					1
Oregon		8	4			9								21
Pennsylvania			7	7	3		8					6		31
South Dakota	15													15
Texas		11	15											26
Utah						13								13
Vermont											6	3	9	18
Washington						8								8
Wisconsin										1	2			3
Wyoming	7													7
Year Totals	49	42	32	47	34	39	21	25	53	15	16	36	9	418

Source: Battelle

Table 2. Summary of Sites Selected for Holiday and Special Events/Recreational Area Analysis by Roadway Functional Classification and Year

Functional Classification	Year													FC
	00	01	02	03	04	05	06	07	08	09	10	11	12	Totals
1R				23	3	4		1						31
1U	18		7				3	10	10	11	3			62
2U				3			3		1					7
3R	18		4	4	9	10			23	2	4			74
3U	6	15		4	15	10			1		2	2		55
4R		8	21	2		9	5	7				18		70
4U	7				7	4			3		5			26
5R		19		11		2	8	7	15	2	2	16	9	91
5U							2							2
Grand Total	49	42	32	47	34	39	21	25	53	15	16	36	9	418

Source: Battelle

Data for Evaluation

The data for this evaluation were derived from previous tasks completed under this project as referenced above. For each of the 418 site and year combinations, there was data for the total tabulated traffic count on each day of the year from January 1 through December 31, and the corresponding estimated AADT for that site and year using the AASHTO method. From these data, the relative daily *j* proportion of the average daily traffic (ADT) compared to the overall AADT for a site *i* was calculated as:

$ADT\_Prop_{ij} = ADT_{ij} / AADT_i$

These daily volumes as a percent of true AADT were then base-10 log transformed to generate the response data for this evaluation. The log transformation eased the interpretation of the final model results and was more appropriate for analysis of ratio data.

Statistical Modeling

Within each of the holiday, special event, or recreational site categories, either all or a designated subset of the 418 sites were selected to characterize the proportional AADT volume by the time periods of interest. The base-10 log transformed proportion of AADT data for specific sites were fit to statistical models of the form:

$$Log_{10}(ADT\_Prop)_{ij} = \alpha + \beta(Time_i * Event_j) + \varepsilon_{ij}$$

Where

$Time_i$ is the time period of interest in the model and could be a day, day of week, or month, depending on the particular evaluation and was a fixed effect

$Event_j$ is an indicator variable coded as a “1” when the data falls into the category of evaluation such as a holiday-related day, a special event, or a recreational site, and a “0” for the reference condition and was a fixed effect

α is the intercept, β is the slope and the ε_{ij} are random errors assumed to be independent and distributed as $N{\sim}(0,\sigma^2)$

After obtaining the model estimates, appropriate least squares means were obtained and corresponding linear contrasts were developed to identify the impacts of interest. One of two types of comparisons were made:

a) Comparison of the target site(s) mean accuracy on a particular date(s) to the mean accuracy in the rest of the time period of interest (e.g., Sunday special event vs. other Sundays in same period). When this type of comparison was completed, the same comparison was also made for the reference sites to establish if the observed difference could be due to a larger pattern not consistent with the limited event.
b) Comparison of the target site statistic of interest directly to that of the reference sites. For instance, the average of Friday traffic volume estimation errors for a recreational area in the summer as compared to a broader pool of sites (presumably not recreational sites) over the same period. An example might be the average accuracy value for Independence Day compared to the average accuracy for the other dates in July that shared the same day of the week.

Each of these estimates was compared to a difference of zero (i.e., no difference in accuracy) and the p-value was produced for the comparison. Results with a p-value for comparison less than 0.05 are considered statistically significant. This means there is only one chance in 20 that a result as extreme or more extreme than was observed could have occurred by random chance if there truly was no difference between the quantifies being compared. However, it should be noted that this evaluation consisted of a large number of comparisons and no multiple comparison adjustments were applied. For this reason, even though each reported significant difference has no more than one chance in 20 of being erroneous, across the set of all comparisons, it is possible that some of the differences flagged as significant could be in error.

The estimates produced from the models were of log-transformed data. Therefore, the results of the estimates as well as the 95 percent confidence intervals for them were produced by raising 10 to the power of the particular estimate. This would generate estimates as geometric mean ratios and confidence intervals relative to AADT. For ease of interpretation, the results were further converted to percentage increases or decreases relative to the true AADT or relative to the reference differences. The models were fit in SAS®, version 9.3, using PROC MIXED.

Specific Evaluations

Each holiday, special event, or recreational site model featured some small differences, which are discussed below.

Many of the sites included in the study exhibit variability in traffic volumes that exceeds that of a typical day-of-week, or month of year travel pattern, even beyond the holiday accounting that has been documented. Of particular interest here are special events, which may be associated with a spike in traffic volume over a short period of time, or possibly a reduction in traffic volume if the event resulted in road closures, for instance. Another important form of differing travel patterns is that associated with a recreational area such as a park or lake. In either of these situations, traffic volumes fluctuations may require different factor groupings than would otherwise be dictated either by total volume profile, roadway type, or regional alignment.

Input was solicited from state DOTs to identify sites in the existing data used in this evaluation that could support a hypothesis of potential influence of special events and recreational sites. Furthermore, if such an effect was detectable, it was desired to quantify its impact.

Holidays

1. Easter

This analysis was based on data for all 418 sites from the months of March and April only. The data were modeled with each day of week in the time period identified either as within the holiday period or not. The holiday period was defined as extending from the Tuesday preceding Easter through the Monday after Easter. The following comparisons were performed of difference from AADT:

- Tuesday before Easter vs. average of all other Tuesdays in March/April
- Wednesday before Easter vs. average of all other Wednesdays in March/April
- Thursday before Easter vs. average of all other Thursdays in March/April
- Friday before Easter vs. average of all other Fridays in March/April
- Saturday before Easter vs. average of all other Saturdays in March/April
- Easter Sunday vs. average of all other Sundays in March/April
- Monday after Easter vs. average of all other Mondays in March/April

The observed dates for Easter Sunday in this analysis included:

- 2000 – April 23
- 2001 – April 15
- 2002 – March 31
- 2003 – April 20
- 2004 – April 11
- 2005 – March 27
- 2006 – April 16
- 2007 – April 8
- 2008 – March 23
- 2009 – April 12
- 2010 – April 4
- 2011 – April 24
- 2012 – April 8

2. Memorial Day

This analysis was based on data for all 418 sites from the months of May and June only. The data were modeled with each day of week in the time period identified either as within the holiday period or not. The holiday period was defined as extending from the Wednesday preceding Memorial Day through the Tuesday after Memorial Day. The following comparisons were performed of difference from AADT:

- Wednesday before Memorial Day vs. average of all other Wednesdays in May/June
- Thursday before Memorial Day vs. average of all other Thursdays in May/June
- Friday before Memorial Day vs. average of all other Fridays in May/June
- Saturday before Memorial Day vs. average of all other Saturdays in May/June
- Sunday before Memorial Day vs. average of all other Sundays in May/June
- Memorial Day vs. average of all other Mondays in May/June
- Tuesday after Memorial Day vs. average of all other Tuesdays in May/June

The observed dates for Memorial Day in this analysis included:

- 2000 – May 29
- 2001 – May 28
- 2002 – May 27
- 2003 – May 26
- 2004 – May 30
- 2005 – May 29
- 2006 – May 28

- 2007 – May 26
- 2008 – May 25
- 2009 – May 31
- 2010 – May 30
- 2011 – May 28
- 2012 – May 27

3. Independence Day

This analysis was based on data for all 418 sites from the month of July only. It was desired to evaluate the impact of traffic around Independence Day, so evaluation was completed for each calendar day starting July 1 and ending July 7. Generally, each day's estimated geometric mean (ADT/AADT) was compared to the same days in July with the same day of week. An additional subtlety of this analysis is that July 4 falls on different days of the week. If it falls on a Saturday, the Federal holiday for it is the preceding Friday (as in 2009), and if it falls on a Sunday, the Federal holiday for it is the following Monday (as in 2004, 2010). To account for these variations, modeling was completed at two levels. An overall model was fit where the comparisons are:

- July 1 vs. the average of July 8, 15, 22 and 29
- July 2 vs. the average of July 9, 16, 23 and 30
- July 3 when not a Federal Holiday vs. the average of July 10, 17, 24 and 31
- July 3 when a Federal Holiday vs. the average of July 10, 17, 24 and 31
- July 4 vs. the average of July 11, 18 and 25
- July 5 when not a Federal Holiday vs. the average of July 12, 19 and 26
- July 5 when a Federal Holiday vs. the average of July 12, 19 and 26
- July 6 vs. the average of July 13, 20 and 27
- July 7 vs. the average of July 14, 21, and 28

To further study these impacts, the data were subset into seven different day of week models, one for each day that Independence Day (July 4) can fall. These models ended up separating by years as:

- Independence Day is Monday – 2005 and 2011
- Independence Day is Tuesday – 2000, 2006
- Independence Day is Wednesday – 2001, 2007 and 2012
- Independence Day is Thursday – 2002
- Independence Day is Friday – 2003 and 2008
- Independence Day is Saturday – 2009
- Independence Day is Sunday – 2004 and 2010

4. Labor Day

This analysis was based on data for all 418 sites for the months of August and September only. The data were modeled with each day of week in the time period identified either as within the holiday period or not. The holiday period was defined as extending from the Wednesday preceding Labor Day through the Tuesday after Labor Day. The following comparisons were performed of difference from AADT:

- Wednesday before Labor Day vs. average of all other Wednesdays in August/September
- Thursday before Labor Day vs. average of all other Thursdays in August/September
- Friday before Labor Day vs. average of all other Fridays in August/September
- Saturday before Labor Day vs. average of all other Saturdays in August/September
- Sunday before Labor Day vs. average of all other Sundays in August/September
- Labor Day vs. average of all other Mondays in August/September
- Tuesday after Labor Day vs. average of all other Tuesdays in August/September

The observed dates for Labor Day in this analysis included:

- 2000 – September 4
- 2001 – September 3
- 2002 – September 2
- 2003 – September 1
- 2004 – September 6
- 2005 – September 5
- 2006 – September 4
- 2007 – September 3
- 2008 – September 1
- 2009 – September 7
- 2010 – September 6
- 2011 – September 5
- 2012 – September 3

5. Thanksgiving

This analysis was based on data for all 418 sites for the entire month of November and December 1 only. The data were modeled with each day of week in the time period identified either as within the holiday period or not. The holiday period was defined as extending from the Monday preceding Thanksgiving through the Sunday after Thanksgiving. The following comparisons were performed of difference from AADT:

- Monday before Thanksgiving vs. average of all other Mondays in November+December 1
- Tuesday before Thanksgiving vs. average of all other Tuesdays in November+December 1
- Wednesday before Thanksgiving vs. average of all other Wednesdays in November+December 1
- Thanksgiving vs. average of all other Thursdays in November+December 1
- Friday after Thanksgiving vs. average of all other Fridays in November+December 1
- Saturday after Thanksgiving vs. average of all other Saturdays in November+December 1
- Sunday after Thanksgiving vs. average of all other Sundays in November+December 1

The observed dates for Thanksgiving in this analysis included:

- 2000 – November 23
- 2001 – November 22
- 2002 – November 28
- 2003 – November 27
- 2004 – November 25
- 2005 – November 24
- 2006 – November 23
- 2007 – November 22
- 2008 – November 27
- 2009 – November 26
- 2010 – November 25
- 2011 – November 24
- 2012 – November 22

6. Christmas and New Year's Eve

This analysis was based on data for all 418 sites for the entire month of December only. It was desired to evaluate the impact of traffic around Christmas Day and New Year's Eve, so evaluation was completed for each calendar day starting December 22 and ending December 31. Generally, each day's estimated geometric mean (ADT/AADT) was compared to the same days in December with the same day of week. An additional subtlety of this analysis is that Christmas Day and New Year's Eve fall on different days of the week. If Christmas falls on a Saturday, the Federal holiday for it is the preceding Friday (2004, 2010), and if it falls on a Sunday, the Federal holiday for it is the following Monday (2005, 2011). The same is true for New Year's Day, with New Year's Eve being a Federal holiday if New Year's Day falls on a Saturday (2005 and 2011, meaning December 31 was a Federal holiday in 2004 and 2010). Note in this modeling that New Year's Day itself was not included because site data extended from January 1 to December 31 for a year so that the subsequent January 1 (or other early January days) were not necessarily available.

To account for the variations in day of the week for Christmas and New Year's Eve, modeling was completed at two levels. An overall model was fit where the comparisons are:

This analysis was based on data for all 418 sites from the month of December only.

- December 22 vs. the average of December 1, 8, 15, and 29
- December 23 vs. the average of December 2, 9, 16, and 30
- December 24 when a Federal Holiday vs. the average of December 3, 10, and 17*
- December 24 when not a Federal Holiday vs. the average of December 3, 10, and 17*
- December 25 vs. the average of December 4, 11, and 18
- December 26 when a Federal Holiday vs. the average of December 5, 12, and 19
- December 26 when not a Federal Holiday vs. the average of December 5, 12, and 19
- December 27 vs. the average of December 6, 13, and 20
- December 28 vs. the average of December 7, 14, and 21
- December 29 vs. the average of December 1, 8, 15, and 22
- December 30 vs. the average of December 2, 9, 16, and 23
- December 31 when a Federal Holiday vs. the average of December 3, 10, and 17**
- December 31 when not a Federal Holiday vs. the average of December 3, 10, and 17**

*Note that the December 24 comparison is only to the 3rd, 10th, and 17th of the month of December. December 31 has been excluded since it is itself a holiday and may not be a "typical" same day of the week for December which is what is desired as the comparison for the holiday volumes.

**Note that the December 31 comparison is only to the 3rd, 10th, and 17th of the month of December. December 24 has been excluded due to its proximity to Christmas, and the fact that it sometimes falls as a Federal holiday, make it inconsistent with a "typical" same day of the week for December which is what is desired as the comparison for the holiday volumes.

To further study these impacts, the data were subset into seven different day of week models, one for each day that Christmas Day (December 25) can fall. These models ended up separating by years as:

- Monday – 2000, 2006
- Tuesday – 2001, 2007 and 2012
- Wednesday – 2002
- Thursday – 2003 and 2008
- Friday – 2009
- Saturday – 2004 and 2010
- Sunday – 2005 and 2011

Recreational Sites

Ten sites located at six different locations were identified for analysis as recreational sites, as presented in Table 3 and described in more detail below.

Table 3. Recreational Sites identified for Analysis

#	State	Year	Site	Functional Classification	Description
1	UT	2005	000702	3U	SR 18 Bluff St at 500 N. St. George MP 2.7
			000703	3U	SR 8 Sunset Blvd at 1313 W. St. George MP 0.5
			000704	3U	2250 East Red Cliff Drive, St. George MP 8.00
2	PA	2011	000306	4R	.9 mi S of US 6 (Hawley)
3	ME	2008	0038704	3R	South East of State Route 11 (Naples)
			0038714	3R	South East of State Route 11 (Naples)
4	IA	2003	000600	5R	Co Rd F25 EB 0.1 mi W OF Co Rd P18 Springbrook
5	OR	2002	006004	3R	1.3 mi. S of Bandon
			029001	3R	2.2 mi. S of Rockaway Beach
6	WY	2000	00036N	3R	US 26/89/189/191 0.5 mi N of Hoback Jct

Source: Battelle

1. St. George, UT 2005

Utah identified three functional classification 3U sites in 2005 from the 418 sites in this evaluation as recreational areas. These sites are in the city of St. George in southwestern Utah. Analysis was conducted using these three sites and seven other 3U sites for 2005. Data were restricted to just January, and the 1st of January was excluded since it was a national holiday.

2. Lake Wallenpaupack, PA 2011

Pennsylvania identified Site 000306, a 4R site in 2011 from among the 418 sites in this evaluation as near a water recreational area, Lake Wallenpaupack. It was evaluated compared to 17 other 4R sites in 2011 over the months of June, July, and August.

3. Lake Sebago, ME 2008

Maine identified two 3R sites in Cumberland County, close to Naples. Maine DOT has reported that these locations see significant summer recreational traffic to and from the Sebago Lake region. They are evaluated as a water-related recreational area for the period from June 30 through August 31, 2008. Eight other 3R sites from 2008 form the reference sites for comparison. These reference sites exclude any in Maine since several of these have potential to include recreational travel as well.

4. Springbrook State Park, IA 2003

This site, identified as Yale, Iowa, is an entry road for the Springbrook State Park, which is expected to have larger traffic volumes over the summer months. It is a 5R roadway and is compared in the statistical model to 10 other 5R roadways, all in Iowa, for June through August, 2003, none of which is identified as near a recreational site.

5. Pacific Coast Highway, Oregon, 2002

Oregon identified two sites on 3R roadways as recreational, associated with Highway 101, the Oregon Coast Highway. In order to develop enough reference comparison sites, these two sites traffic volume patterns were compared to a set of 15 other 3R sites in 2002 through 2004. For these Oregon sites, recreational travel patterns were assessed by comparing the monthly average traffic patterns.

6. South of Grand Teton National Park, near Jackson, Wyoming, 2000

The 00036N site (which no longer exists) was south of the Grand Teton National Park. Traffic volume there was expected to be heavily increased in the summer months. The modeling for this recreational area took into account both the monthly travel patterns for the entire year as well as the day of week patterns in the summer months (June-August). Due to a lack of suitable comparison sites in 2000, the reference sites selected were 3R sites for the period of 2000 through 2004. Additionally, other Wyoming sites were excluded from consideration due to potential of having the same travel patterns as 00036N.

Special Events

Eleven sites located at six different locations were identified for analysis given their proximity to special events, as presented in **Table 4** and described in more detail below.

Table 4. Sites identified for Analysis as Special Events

#	State	Year	Site	Functional Classification	Site Description	Event Description
1	UT	2005	000702	3U	SR 18 Bluff St at 500 N., St. George MP 2.7	Flood
			000703	3U	SR 8 Sunset Blvd at 1313 W., St. George MP 0.5	
			000704	3U	2250 East Red Cliff Dr., St. George MP 8.00	
2	PA	2006	000389	5R	3.5 mi W of PA36 (Frostburg)	Groundhog Day
3	ME	2008	003606	3R	Southwest of Rockport Woods	Lobster Festival
			003616	3R	Southwest of Rockport Woods	
4	IA	2000, 2004	000906	4U	Dubuque St S OF Davenport St Iowa City	University of Iowa Football Games
5	FL	2005	720161	3U	SR-10/US-90 (ATL Blvd) - Jacksonville	Super Bowl XXXIX
6	FL	2005	720161	3U	SR-10/US-90 (ATL Blvd) - Jacksonville	Tropical Storm Tammy
7	KY	2003	000311	3R	North of Pineville, 1 mi North of KY 92 - Northbound	NASCAR at Bristol Motor Speedway
			000315	3R	North of Pineville, 1 mi North of KY 92 - Southbound	

Source: Battelle

1. Flood in St. George, UT 2005

Utah identified three functional classification 3U sites in 2005 from the 418 sites in this evaluation as recreational areas. These sites are in the city of St. George in southwestern Utah. Analysis was conducted using these three sites and seven other 3U sites for 2005. Data were restricted to just January, and the 1st of January was excluded since it was a national holiday.

When evaluating the recreational site aspect of the St. George sites, it was discovered that significant flooding had occurred on January 10-11, 2005. Consequently, these sites were also examined as a special weather event site.

2. Groundhog Day near Punxsutawney, PA in 2006

This site in Frostburg, PA is near Punxsutawney, PA. It was hypothesized that the Groundhog Day festivities in the nearby town might provide elevated traffic volumes compared to other days of the same week in February.

3. Rockport, Maine 003606 and 003616 for Lobster Festival, July 30 – August 3, 2008

These 3R permanent count stations are on US 1, near Rockport Maine. Rockport is the site of a Lobster Festival each summer and in 2008 this took place between Wednesday, July 30 and Sunday, August 3. For this event, traffic volumes estimates as a proportion of AADT are compared between sites in the festival week to the same days of the week throughout the rest of August, and also cross referenced to the same comparison for another eight 3R sites from the same time period. The reference sites intentionally excluded Maine due to possibility that they also could be impacted by summer tourist travel at this time.

4. Iowa City, Iowa 000906 University of Iowa Football Games, Post-Labor Day to Pre-Thanksgiving, 2000 and 2004

This site in Iowa City was identified as one subject to increased traffic around University of Iowa football games. A total of 6 home games in 2000 (9/9, 9/16, 10/7, 10/21, 10/28, and 11/11) and 5 home games in 2004 (9/11, 10/2, 10/16, 11/6, and 11/20) were identified as taking place after Labor Day and before Thanksgiving. Data from this site in these two years on Friday, Saturday, and Sunday of each weekend was compared to weekends within the same time period without a home football game. For reference, a set of six other 4U sites in Iowa for both years were also included in the modeling to identify if there were traffic differences between the subject weekends independent of the university football connection.

5. Jacksonville, Florida 720161 Super Bowl XXXIX, February 5, 2005

This site is near the site of Super Bowl XXXIX, which was held at (former) Alltel Stadium in Jacksonville, FL on February 5, 2005. Traffic volumes are compared in the week of the game from the Wednesday preceding to the Tuesday following. Each day of the week is compared to the other three of the same day of the week through the rest of February at this site. For reference, nine other 3U sites for the same time period are also included in the model and comparison is made of their traffic volumes in the first week of February to the rest of the month.

6. Jacksonville, Florida 720161 Tropical Storm Tammy, October 5, 2005

Tropical Storm Tammy, which developed southeast of Jacksonville, made landfall near Mayport, Florida in the early evening of Wednesday, October 5, 2005. It was observed by the Florida DOT to reduce traffic volumes over that evening and into the next morning at Site 720161 in Jacksonville. A model was fit to compare the traffic volumes on these days with the other three of the same day of the week through the rest of October at this site. For reference, nine other 3U sites for the same time period are also included in the model and comparison is made of their traffic volumes on the subject dates in October to the rest of the same days of week in the month.

7. Pineville, KY 000311, 000315 Route to Bristol Motor Speedway, 2003

Kentucky indicated that the count stations 000311 and 000315 were candidates to show special event traffic related to NASCAR races at Bristol Motor Speedway in Bristol, TN. The specific events selected for the evaluation included the NASCAR Nationwide Series Channellock 250 on Saturday, March 22, 2003, and the NASCAR Sprint Cup Ford City 500 in Sunday, March 23, 2003. The two sites are on Kentucky 25E, with Site 311 measuring northbound traffic and Site 315 measuring southbound traffic. Statistical models were fit separately to each of the two sites with the same nine functional classification 3R reference sites used in each case. The models evaluated traffic volume as a proportion of AADT for each site by day of the week from the Wednesday preceding the race day (March 19, 2003) through the Tuesday after the race (March 25). For the reference sites, there were none in 2003, so 2004 sites were used instead, with the “race week” offset to March 24, 2004 through March 30, 2004 (consistent with the race in 2004 occurring on March 28).

Results

Holidays

The results in this section include estimates, confidence intervals, and p-values from the statistical models for the proportional difference in (ADT/AADT) for the holiday period compared to the non-holiday reference period. Estimates are also provided for the geometric means of the (ADT/AADT) for each period expressed as a percentage difference from 100 percent (i.e., ADT=AADT).

1. Easter

Counts for Thursday and Friday before Easter, Easter Sunday itself, and the day after Easter were all found to be statistically significantly higher than the same days of the week throughout the rest of March and April. The average ratio of ADT/AADT for the Thursday before Easter was 5.9 percent higher than that of other Thursdays in the same period, while Friday was 2.8 percent higher, Sunday was 4.2 percent higher, and Easter Monday was 7.2 percent higher, as shown in Table 5.

Table 5. Holiday Analysis for Easter

Day of Week Around Easter	% Difference in Geometric Mean of (Volume/AADT) for Easter Week Relative to Reference[1]			Geometric Mean (Volume/AADT) as % Difference From 1.0	
	Estimate	95% CI	p-Value	Holiday Week	Other Weeks March, April
Tuesday	1.7	(-0.2, 3.6)	0.0832	-2.8	-4.3
Wednesday	-0.4	(-2.2, 1.5)	0.6953	-4.1	-3.7
Thursday	5.9	(3.9, 7.8)	<.0001	4.9	-0.9
Friday	2.8	(0.9, 4.7)	0.0037	10.9	7.8
Saturday	-0.2	(-2.0, 1.7)	0.8347	-10.9	-10.7
Sunday	4.2	(2.2, 6.1)	<.0001	-20.8	-23.9
Monday (after)	7.2	(5.2, 9.2)	<.0001	0.3	-6.5

[1] Month includes March and April

Source: Battelle

2. Memorial Day

Counts for Wednesday before Memorial Day were not different than other Wednesdays in May and June. From the Thursday before to the Tuesday after Memorial Day, each day of the week was significantly different in volume in the Memorial Day week than the other weeks in May and June. Thursday, Friday, Saturday, and Sunday before Memorial Day and Tuesday after Memorial Day produced volumes 1.8 to 5.7 percent proportional to AADT above those of the same days of the week throughout the rest of May and June. In the case of Thursday (13.3) and Friday (27.5), the geometric mean volumes were much larger than overall AADT. On the Sunday before Memorial Day, the geometric mean volume was 9.5 percent below AADT, but as the other Sundays in the same period had an even greater deficit relative to AADT (-11.2), the volumes were still significantly higher. On Memorial Day itself, geometric mean volumes were 7.8 percent lower than other Mondays in the same period and this reduction was highly significant compared to the 4.7 percent mean increase on other May/June Mondays. The higher holiday travel returned on the Tuesday after Memorial Day and the 7.3 percent increase was a 2.3 percent higher increase than the 4.9 percent higher volumes throughout the rest of May and June, as shown in Table 6.

Table 6. Holiday Analysis for Memorial Day

Day of Week Around Memorial Day	% Difference in Geometric Mean of (Volume/AADT) for Memorial Day Week Relative to Reference [1]			Geometric Mean (Volume/AADT) as % Difference From 1.0	
	Estimate	95% CI	p-Value	Holiday Week	Other Weeks May, June
Wednesday (Before)	0.4	(-1.2, 2.0)	0.6581	7.1	6.7
Thursday	2.8	(1.1, 4.5)	0.0009	13.3	10.2
Friday	5.7	(4.0, 7.5)	<.0001	27.5	20.6
Saturday	3.3	(1.6, 5.0)	<.0001	4.3	1.0
Sunday	1.8	(0.2, 3.5)	0.0278	-9.5	-11.2
Monday	-11.9	(-13.4, -10.5)	<.0001	-7.8	4.7
Tuesday (After)	2.3	(0.6, 3.9)	0.007	7.3	4.9

[1] Reference is other days throughout May and June

Source: Battelle

3. Independence Day

Independence Day is a holiday that occurs on different days of the week. As such, we are interested in evaluating its impact overall as well as depending on when it falls in the week. For this evaluation, we compared Independence Day and the days around it from the 1st through the 7th of July to the same days of the week for each date in the rest of July. We find that July 1 through July 3 show significantly higher volumes relative to the same days of the week throughout the rest of July. The one exception is that of July 3 when it is the designated Federal holiday (i.e., July 4 is a Saturday). July 4 volume lags that of the 11th, 18th, and 25th of July by 20 percent and is highly significant. When July 5th is the designated Federal holiday (i.e., July 4 is a Sunday), it also significantly lags in volume compared to the 12th, 19th, and 26th. Interestingly, in other cases, the day after Independence Day does not exhibit higher traffic volumes. This pattern continues through the 6th and 7th of July, where volumes are not higher or lower than their comparison dates in July (13th, 20th, 27th for July 6 and 14th, 21st, 28th for July 7), as shown in Table 7.

An additional set of analyses was conducted for Independence Day where seven separate models were fit, one for each weekday on which July 4 may fall. Results from this analysis are shown in Table 8 and they provide some interesting insights. The overall analysis showed July 1 volumes significantly increased compared to the 8th, 15th, 22nd, and 29th. These results hold true regardless of what day of the week July 1 is. With the exception of July 2nd as a Sunday, the same is true for this day of the month. July 3 provides a much more mixed outcome. While the overall impact of July 3 is higher than the 10th, 17th, 24th or 31st, this is largely driven by much higher volumes in years when the 3rd is a Tuesday, Wednesday, or Thursday. When the 3rd is a Friday (i.e., the holiday), Saturday, Sunday, or Monday, the volumes are actually less, and significantly so in the case of the 3rd being a Monday. The reduced volumes for the 4th hold regardless of what day of week it is, and are significant in every case. July 5th is a case where it shows significantly lower volumes than the 12th, 19th, and 26th when it falls on a Friday, Saturday, or Monday (i.e., the Federal holiday). When it falls on Tuesday, it shows significantly higher volumes. Both July 6th and 7th in the separate day of week models show limited differences, but both show significantly larger volumes compared to their reference dates when they fall on a Saturday.

Table 7. Holiday Analysis for Independence Day

Date	% Difference in Geometric Mean of (Volume/AADT) for First July Week Relative to Reference[1]			Geometric Mean (Volume/AADT) as % Difference From 1.0 on Targeted Date and for Other Dates of Same Day of Week								
				Date	Other Days of Week in Same Month							
	Estimate	95% CI	p-Value	%Diff for Day	Day	%Diff	Day	%Diff	Day	%Diff	Day	%Diff
July 1	3.6	(1.4, 5.9)	0.0013	13.5	8	9.3	15	9.5	22	9.4	29	10.1
July 2	2.6	(0.3, 4.8)	0.0236	12.1	9	8.4	16	9.3	23	9.0	30	10.7
July 3 (not FH)	3.5	(1.2, 5.8)	0.0025	13.6	10	9.1	17	9.9	24	9.1	31	11.1
July 3 (FH)	-3.5	(-13.0, 7.0)	0.4998	6.0	10	9.1	17	9.9	24	9.1	31	11.1
July 4	-20.0	(-21.8, -18.2)	<.0001	-10.2	11	11.8	18	12.5	25	12.3		
July 5 (not FH)	-0.6	(-3.0, 1.7)	0.5956	10.9	12	11.1	19	12.0	26	11.6		
July 5 (FH)	-17.5	(-22.1, -12.6)	<.0001	-7.9	12	11.1	19	12.0	26	11.6		
July 6	1.1	(-1.2, 3.4)	0.3602	12.3	13	10.6	20	11.4	27	11.4		
July 7	0.5	(-1.8, 2.8)	0.6797	13.4	14	12.3	21	12.9	28	13.3		

[1] Reference is other days throughout July

FH = Federal Holiday

Source: Battelle

Table 8. Holiday Analysis for Independence Day by Day of Week it Occurs

Date	% Difference in GM (Volume/AADT) vs. Same Day of Week in Month	Independence Day as a:						
		Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
	Overall Estimate	2005, 2011	2000, 2006	2001, 2007, 2012	2002	2003, 2008	2009	2004, 2010
	n=418 Sites	n=75	n=70	n=76	n=32	n=100	n=15	n=50
July 1	**3.6**	**7.7**	3.5	1.3	0.3	2.8	4.2	**5.2**
July 2	**2.6**	2.8	-0.8	3.1	0.4	**4.5**	4.1	3.2
July 3 (not FH)	**3.5**	**-4.9**	-4.6	**9.3**	**13.2**	**14.6**		-3.7
July 3 (FH)	-3.5						**-13.5**	
July 4	**-20.0**	**-11.4**	**-26.2**	**-19.6**	**-21.0**	**-27.4**	**-17.9**	**-7.2**
July 5 (not FH)	-0.6	**9.7**	2.2	0.8	**-7.8**	**-8.7**	-2.1	
July 5 (FH)	**-17.5**							**-16.6**
July 6	1.1	0.9	-0.3	-1.0	-2.5	**5.0**	0.6	1.2
July 7	0.5	-0.4	-0.6	-3.2	**6.4**	2.7	0.9	0.7

Values in **bold** indicate a statistically significant difference at the 0.05 level
FH = Federal Holiday

Source: Battelle

4. Labor Day

The Labor Day holiday only produced a small number of significant findings, presented in Table 9. Traffic volume proportions of AADT the Friday before Labor Day were 5.7 percent greater than those for the other Fridays in August and September. Traffic volume proportions of AADT on Labor Day were 12.7 percent lower than those for the other Mondays in August and September.

Table 9. Holiday Analysis for Labor Day

Day of Week Around Labor Day	% Difference in Geometric Mean of (Volume/AADT) for Labor Day Week Relative to Reference[1]			Geometric Mean (Volume/AADT) as % Difference From 1.0	
	Estimate	95% CI	p-Value	Holiday Week	Other Weeks August, September
Wednesday (Before)	-0.4	(-2.2, 1.4)	0.6679	8.5	8.9
Thursday	1.7	(-0.1, 3.5)	0.0722	14.0	12.1
Friday	5.7	(3.8, 7.6)	<.0001	30.7	23.6
Saturday	1.7	(-0.1, 3.6)	0.0648	5.5	3.7
Sunday	0.9	(-0.9, 2.7)	0.3435	-8.5	-9.3
Monday	-12.7	(-14.3, -11.2)	<.0001	-6.7	6.9
Tuesday (After)	0.1	(-1.7, 1.9)	0.9061	7.5	7.4

[1] Reference is other days throughout August and September

Source: Battelle

5. Thanksgiving

The Thanksgiving results showed several highly significant differences in travel patterns, as shown in Table 10. For Tuesday and Wednesday preceding Thanksgiving, the relative ratio of daily volume to AADT for sites was 82 and 13.9 percent higher, respectively, than the other Tuesdays and Wednesdays in November. For Thanksgiving Day itself, as well as the following Friday, volumes were significantly lower (30.7 and 15.5 percent, respectively) than other Thursdays and Fridays in the same month. The traffic volume was no different on Saturday after Thanksgiving, but then increased again significantly on Sunday, at 8.4 percent higher than other Sundays in the month.

Table 10. Holiday Analysis for Thanksgiving

Day of Week Around Thanksgiving	% Difference in Geometric Mean of (Volume/AADT) for Thanksgiving Week Relative to Reference [1]			Geometric Mean (Volume/AADT) as % Difference From 1.0	
	Estimate	95% CI	p-Value	Holiday Week	Other Weeks November [1]
Monday	1.5	(-0.4, 3.5)	0.1214	-3.5	-4.9
Tuesday	8.2	(6.1, 10.3)	<.0001	3.6	-4.3
Wednesday	13.9	(11.8, 16.1)	<.0001	11.1	-2.5
Thursday	-30.7	(-32.0, -29.3)	<.0001	-30.6	0.0
Friday	-15.5	(-17.1, -13.9)	<.0001	-6.6	10.5
Saturday	-0.9	(-2.7, 1.0)	0.3677	-11.6	-10.8
Sunday	8.4	(6.4, 10.5)	<.0001	-18.1	-24.4

[1] Reference is all remaining days within November and the first day of December

Source: Battelle

6. Christmas and New Year's Eve

The overall Christmas and New Year's Eve results show significantly reduced traffic relative to AADT on December 24 (whether or not it is the Federal holiday), December 25, December 26 (whether or not it is the Federal holiday), and December 31 (only when it is not the Federal holiday (i.e., New Year's Day is not a Saturday)) relative to the others of the same day of the week in the month of December, as presented in Table 11. Significant increases in traffic are seen on December 22 and December 23. The days December 27 through December 30 show no significant volume differences than the same days of the week throughout the rest of December. The detailed percentage differences for the target days in proportion of AADT and the corresponding reference days are provided to the right side of the table.

Table 11. Holiday Analysis for Christmas and New Year's Eve

Date	% Difference in Geometric Mean of (Volume/AADT) for Christmas Week Relative to Reference			Geometric Mean (Volume/AADT) as % Difference From 1.0								
				Date	Other Days of Week in Same Month							
	Estimate	95% CI	p-Value	%Diff for Day	Day	%Diff	Day	%Diff	Day	%Diff	Day	%Diff
December 22	2.7	(0.1, 5.4)	0.0428	-4.8	1	-7.0	8	-8.1	15	-6.7	29	-7.4
December 23	6.3	(3.6, 9.1)	<.0001	-6.8	2	-10.2	9	-13.5	16	-13.2	30	-12.2
December 24 (FH)[1]	-7.2	(-13.3, -0.6)	0.0319	-18.5	3	-11.4	10	-14.8	17	-10.4		
December 24 (not FH)[1]	-8.1	(-10.6, -5.5)	<.0001	-19.3	3	-11.4	10	-14.8	17	-10.4		
December 25	-37.3	(-38.9, -35.6)	<.0001	-45.8	4	-13.4	11	-16.3	18	-11.2		
December 26 (FH)	-13.4	(-18.1, -8.4)	<.0001	-21.1	5	-9.8	12	-11.3	19	-5.5		
December 26 (not FH)	-4.0	(-6.7, -1.2)	0.0057	-12.5	5	-9.8	12	-11.3	19	-5.5		
December 27	-2.1	(-4.7, 0.5)	0.1162	-10.2	6	-9.7	13	-9.2	20	-5.8		
December 28	0.3	(-2.3, 3.0)	0.8082	-10.5	7	-11.8	14	-11.9	21	-8.7		
December 29	-0.9	(-3.4, 1.7)	0.506	-7.4	1	-7.0	8	-8.1	15	-6.7	22	-4.8
December 30	-1.4	(-3.9, 1.2)	0.2838	-12.2	2	-10.2	9	-13.5	16	-13.2	23	-6.8
December 31 (FH)[2]	-2.9	(-9.3, 4.0)	0.4024	-14.7	3	-11.4	10	-14.8	17	-10.4		
December 31 (not FH)[2]	-8.3	(-10.9, -5.7)	<.0001	-19.5	3	-11.4	10	-14.8	17	-10.4		

[1] Comparisons exclude New Year's Eve (December 31)

[2] Comparisons exclude Christmas Eve (December 24)

FH = Federal Holiday

Source: Battelle

Since the Christmas and New Year's Eve holidays occur on different days of the week, the evaluation was further divided into groups of years where Christmas (and hence, New Year's Day) fell on the same day of the week. Examining the previous significant differences in this context provides some additional understanding. Table 12 shows the percent difference relative to AADT for each day in the Christmas/New Year's period as a function of what day of the week Christmas occurs. The gray highlighted cells are those in which the difference observed is statistically significant. For reference, the first column of the table shows the differences and significance from the table above for all data.

For instance, December 22 and 23 show significantly elevated volumes related to AADT in comparison to others of the same day of week, but this appears to be driven by Christmas falling on a Friday or Sunday in the case of December 22 (which will be a Tuesday or Thursday) or a Wednesday or Thursday in the case of December 23 (which will be a Tuesday or Wednesday). In other words, December 22 and 23 show significantly elevated volumes overall, but this appears driven by when they are in the middle of the Christmas week. December 24 shows lower traffic volume on almost any day of the week, and December

25 exhibits a lower traffic volume, and significantly so, on every day of the week. December 31, New Year's Eve, has significantly lower volume, but it is predicated on New Year's Day falling on a Saturday, Sunday, or Monday (meaning New Year's Eve is a Friday, Saturday, or Sunday). For New Year's Eve that occurs on a weekday, the traffic volume, while lower than the same days of week for Monday, Tuesday, and Thursday, is not significantly less.

Table 12. Holiday Analysis for Christmas and New Year's Eve by Day of Week they Occur

Date	% Difference in GM (Volume/AADT) vs. Same Day of Week in Month	Christmas Day/New Years Day as a:						
		Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
	Overall Estimate	2000, 2006	2001, 2007, 2012	2002	2003, 2008	2009	2004, 2010	2005, 2011
	n=418 Sites	n=70	n=76	n=32	n=100	n=15	n=50	n=75
December 22	**2.7**	4.5	2.2	5.5	-3.7	**12.7**	5.0	**5.9**
December 23	**6.3**	3.1	-1.4	**8.7**	**18.2**	7.8	3.8	-4.4
December 24 (FH) [1]	**-7.2**						**-23.8**	
December 24 (not FH) [1]	**-8.1**	0.2	-6.2	**-9.4**	3.5	**-40.4**		**-11.3**
December 25	**-37.3**	**-33.1**	**-34.8**	**-40.3**	**-41.4**	**-62.9**	**-47.4**	**-20.6**
December 26 (FH)	**-13.4**							**-13.5**
December 26 (not FH)	**-4.0**	-4.9	-0.4	3.1	**-6.2**	**-26.6**	0.1	
December 27	-2.1	2.3	-2.8	-2.3	-3.7	-2.8	**-8.9**	1.6
December 28	0.3	**-13.8**	-2.6	-0.1	**17.4**	-4.1	-3.1	0.0
December 29	-0.9	**-6.5**	-1.2	-2.1	2.5	1.5	-4.5	3.1
December 30	-1.4	**-9.6**	1.2	0.3	2.9	2.4	-3.8	-1.5
December 31 (FH) [2]	-2.9						**-20.2**	
December 31 (not FH) [2]	**-8.3**	**-11.6**	-2.6	-4.6	3.4	-6.9		**-15.1**

[1] Comparisons exclude New Year's Eve (December 31)
[2] Comparisons exclude Christmas Eve (December 24)
Values in **bold** indicate a statistically significant difference at the 0.05 level
Source: Battelle

Recreational Sites

1. St. George, UT 2005

The statistical model for St. George, UT in January 2005 compared the three sites to seven other sites and found that for January traffic volume, the St. George volume was significantly different than the reference sites only for Saturday (22.6 percent greater), Sunday (5.6 percent greater), and Monday (6.0 percent greater). Findings are shown in Table 13. The finding of significantly increased Monday traffic was unexpected and led to discovery of a special cause that is documented in the special events section.

Table 13. Recreation Site Analysis for St. George, Utah 2005

	% Difference in Geometric Mean of (Volume/AADT) for Sites in January 2005 Relative to Reference [1]			Geometric Mean (Volume/AADT) as % Difference From 1.0	
Comparisons	Estimate	95% CI	p-Value	Special Sites	Ref Sites
St George UT 2005 January Monday vs. 7 Ref sites 2005 January Monday	6.0	(0.8, 11.5)	0.023	8.1	1.9
St George UT 2005 January Tuesday vs. 7 Ref sites 2005 January Tuesday	1.5	(-4.1, 7.3)	0.609	7.5	5.9
St George UT 2005 January Wednesday vs. 7 Ref sites 2005 January Wednesday	1.1	(-4.5, 6.9)	0.7148	6.2	5.1
St George UT 2005 January Thursday vs. 7 Ref sites 2005 January Thursday	-0.4	(-5.8, 5.4)	0.8892	5.6	6.0
St George UT 2005 January Friday vs. 7 Ref sites 2005 January Friday	1.1	(-4.4, 7.0)	0.6949	14.9	13.6
St George UT 2005 January Saturday vs. 7 Ref sites 2005 January Saturday	22.6	(15.9, 29.7)	<.0001	3.2	-15.8
St George UT 2005 January Sunday vs. 7 Ref sites 2005 January Sunday	5.6	(0.4, 11.1)	0.0335	-43.2	-46.3

[1] Reference is all remaining of the same day of the week in January 2005
Source: Battelle

2. Lake Wallenpaupack, PA 2011

The results for Site 000306, a 4R site in Pennsylvania for 2011, show a very strongly differentiated pattern of summer volume differences relative to AADT when compared to other 4R sites in the same year. Friday, Saturday, Sunday, and Monday all showed significantly elevated volumes over the summer months, at 42.7, 48.8, 10.7, and 21.5 percent, respectively, compared to the overall site AADT. While the other 4R sites showed 29.4 and 17.5 percent increased volumes for Friday and Saturday relative to their AADTs, the 306 site far outstripped these. And while the 306 site volumes for Sunday and Monday did not increase as much as Friday and Saturday, the reference sites were below AADT for Sunday and only 6.3 percent above for Monday, so the 306 increases were significantly greater. Results are presented in Table 14.

Table 14. Recreation Site Analysis for Lake Wallenpaupack, Pennsylvania 2011

Day of Week	% Difference in Geometric Mean of (Volume/AADT) for Site in Summer 2011 Relative to Reference [1]			Geometric Mean (Volume/AADT) as % Difference From 1.0	
				PA 306 2011	Other 4R 2011
	Estimate	95% CI	p-Value	Summer	Summer
Sunday	14.5	(3.9, 26.2)	0.0061	10.7	-3.4
Monday	14.3	(3.7, 25.9)	0.0069	21.5	6.3
Tuesday	8.7	(-1.3, 19.8)	0.0912	20.0	10.4
Wednesday	8.5	(-1.2, 19.1)	0.087	22.0	12.4
Thursday	6.0	(-3.8, 16.8)	0.236	23.7	16.7
Friday	10.3	(0.1, 21.5)	0.048	42.7	29.4
Saturday	26.7	(15.0, 39.5)	<.0001	48.8	17.5

Summer Defined as June, July, August

[1] Reference is other 4R sites over same time period.
Source: Battelle

3. Lake Sebago, ME 2011

The Lake Sebago sites in Maine showed an exceptionally strong increase in traffic volume for the summer months of 2008 compared to the reference set of eight sites. The relative volume compared to AADT was 18.4 percent at the lowest (Tuesday) and 54.6 percent at the highest (Saturday) above that of the reference sites. Every day of the week was highly statistically significantly greater relative volume for the Maine sites. Within the Maine sites, there was some variability relative to AADT with Sunday through Wednesday at 25-30 percent above AADT, Thursday at 35 percent above AADT, and Friday and Saturday each at about 45 percent above AADT, as seen in Table 15.

Table 15. Recreation Site Analysis for Lake Sebago, Maine 2011

Day of Week	% Difference in Geometric Mean of (Volume/AADT) for Site in Summer 2008 Relative to Reference [1]			Geometric Mean (Volume/AADT) as % Difference From 1.0	
				ME 038704,038714	Other 3R 2008
	Estimate	95% CI	p-Value	Summer	Summer
Sunday	49.6	(42.5, 57.2)	<.0001	27.1	-15.1
Monday	20.0	(14.3, 26.1)	<.0001	25.8	4.8
Tuesday	18.4	(12.7, 24.4)	<.0001	25.2	5.7
Wednesday	20.0	(14.2, 26.0)	<.0001	27.3	6.1
Thursday	20.7	(14.9, 26.8)	<.0001	34.5	11.4
Friday	27.6	(21.5, 34.0)	<.0001	46.9	15.1
Saturday	54.6	(47.2, 62.4)	<.0001	44.0	-6.9

Summer Defined as June 30 - August 31, 2008
[1] Reference is other 3R sites over the same time period.
Source: Battelle

4. Springbrook State Park, IA 2003

This 5R roadway in Iowa shows a strong summer weekend pattern compared to other 5R sites in the same state for 2003. Traffic was significantly higher on Friday (47.2 percent, p<0.0001), Saturday (95.9

percent, p<0.0001), and Sunday (88.3 percent, p<0.0001). Monday traffic volumes were actually significantly less than the reference sites (-11.0 percent, p=0.0011) as presented in Table 16, suggesting recreational traffic that has all left by Sunday evening. The traffic volumes on Tuesday, Wednesday, and Thursday were higher relative to AADT than the reference sites, but not significantly so.

Table 16. Recreation Site Analysis for Springbrook State Park, Iowa 2003

Day of Week	% Difference in Geometric Mean of (Volume/AADT) for Site in Summer 2003 Relative to Reference [1]			Geometric Mean (Volume/AADT) as % Difference From 1.0	
				IA 300 2003	Other 5R 2003
	Estimate	95% CI	p-Value	Summer	Summer
Sunday	88.3	(76.0, 101.5)	<.0001	57.9	-16.2
Monday	-11.0	(-17.1, -4.6)	0.0011	-2.6	9.5
Tuesday	-6.3	(-12.6, 0.6)	0.0708	2.3	9.1
Wednesday	5.9	(-1.3, 13.6)	0.1089	18.1	11.5
Thursday	5.6	(-1.5, 13.3)	0.1258	20.5	14.1
Friday	47.2	(37.2, 57.9)	<.0001	72.8	17.4
Saturday	95.9	(82.6, 110.1)	<.0001	91.1	-2.4

Summer Defined as June, July, August
[1] Reference is other 5R sites over the same time period.
Source: Battelle

5. Pacific Coast Highway, Oregon, 2002

The traffic patterns for the Pacific Coast Highway U.S. 101 in Oregon are reflective of weather effects. For the peak summer months of July and August, traffic volumes are significantly higher (11.3 and 17.6 percent, respectively with p-values of <0.0001 in both cases) than those of the reference 3R sites, as seen in Table 17. Traffic volumes are significantly lower than the reference sites in April (6.1 percent, p=0.0143), October (5.2 percent, p=0.0352) and November (7.0 percent, p=0.0051). Traffic is lowest overall in January (27.9 percent below AADT), but that is also true of the reference sites, so this difference is not significant.

Table 17. Recreation Site Analysis for the Pacific Coast Highway, Oregon, 2002

Month	% Difference in Geometric Mean of (Volume/AADT) for Sites in 2002 Relative to Reference [1]			Geometric Mean (Volume/AADT) as % Difference From 1.0	
	Estimate	95% CI	p-Value	OR 006004, 029001 2002	Other 3R 2002-04
January	1.7	(-3.2, 6.9)	0.5	-27.9	-29.1
February	4.5	(-0.8, 10.1)	0.0992	-18.0	-21.5
March	-3.0	(-7.7, 1.9)	0.2276	-11.9	-9.1
April	-6.1	(-10.8, -1.3)	0.0143	-7.3	-1.2
May	-3.1	(-7.8, 1.8)	0.2111	0.9	4.1
June	-4.5	(-9.3, 0.4)	0.0715	7.8	12.9
July	11.3	(5.9, 17.0)	<.0001	33.5	20.0
August	17.6	(11.9, 23.6)	<.0001	36.4	16.0
September	2.3	(-2.7, 7.7)	0.3693	14.4	11.8
October	-5.2	(-9.8, -0.4)	0.0352	-0.8	4.6
November	-7.0	(-11.6, -2.1)	0.0051	-15.0	-8.7
December	-4.4	(-9.0, 0.5)	0.077	-22.9	-19.4

[1] Reference is other 3R sites over the same time period.
Source: Battelle

6. Grand Teton National Park, near Jackson, Wyoming, 2000

The travel patterns for Wyoming Site 00036N, south of the Grand Teton National Park, are different than was observed for other state recreational areas. First, the volume relative to AADT for the site is very strongly and significantly greater than the reference set of 17 functional classification 3R sites on every day of the week throughout the summer. The magnitude of these estimates ranges from 27.6 percent higher on Thursdays to 37.9 percent higher on Sundays, as presented in Table 18. When looking at individual days of the week, relative volume is more uniformly distributed than some other recreational sites. Volume is 70.3 percent higher on summer Fridays, but all the other days of the week fall in a small range of 48.2 to 56.7 percent above AADT. This suggests less of a day of week pattern than seen at other sites.

Table 18. Recreation Site Analysis for Grand Teton National Park, near Jackson, Wyoming, 2000

Day of Week	% Difference in Geometric Mean of (Volume/AADT) for Site in 2000 Relative to Reference [1]			Geometric Mean (Volume/AADT) as % Difference From 1.0	
				WY 00036N 2000	Other 3R 2000-04
	Estimate	95% CI	p-Value	Summer	Summer
Sunday	37.9	(26.5, 50.4)	<.0001	48.2	7.4
Monday	33.9	(22.8, 46.0)	<.0001	54.5	15.4
Tuesday	31.1	(20.2, 43.0)	<.0001	49.1	13.7
Wednesday	32.7	(21.7, 44.8)	<.0001	53.6	15.7
Thursday	27.6	(17.4, 38.8)	<.0001	54.7	21.2
Friday	28.1	(17.4, 39.7)	<.0001	70.3	33.0
Saturday	34.2	(23.1, 46.3)	<.0001	56.7	16.8

Summer Defined as June, July, August
[1] Reference is other 3R sites over the same time period.
Source: Battelle

When evaluating the Wyoming 00036N site from a monthly perspective, the volume relative to AADT is differentially and significantly higher than the reference 3R sites in June through September, as shown in Table 19. During the rest of the year, the volume relative to AADT is differentially lower than the reference 3R sites, with May being the sole month where this difference is not statistically significant. Therefore, even though the reference 3R sites show a similar seasonal pattern of significantly higher summer volumes and lower volumes throughout the rest of the year, this effect is considerably more pronounced for Wyoming 00036N.

Table 19. Recreation Site Analysis for Grand Teton National Park, near Jackson, Wyoming, 2000 by month

Month	% Difference in Geometric Mean of (Volume/AADT) for Sites in 2002 Relative to Reference [1]			Geometric Mean (Volume/AADT) as % Difference From 1.0	
	Estimate	95% CI	p-Value	WY 00036N 2000	Other 3R 2000-04
January	-15.3	(-20.9, -9.4)	<.0001	-39.9	-29.0
February	-14.3	(-20.1, -8.1)	<.0001	-32.4	-21.1
March	-21.4	(-26.5, -15.8)	<.0001	-28.8	-9.5
April	-24.6	(-29.7, -19.2)	<.0001	-26.1	-2.0
May	-6.6	(-12.8, -0.1)	0.0481	-3.2	3.7
June	21.2	(13.1, 29.9)	<.0001	36.1	12.3
July	42.3	(33.0, 52.3)	<.0001	72.9	21.5
August	33.7	(24.9, 43.1)	<.0001	58.0	18.2
September	9.8	(2.5, 17.7)	0.0079	23.1	12.1
October	-11.7	(-17.5, -5.4)	0.0004	-8.2	3.9
November	-23.9	(-29.0, -18.5)	<.0001	-31.1	-9.4
December	-17.7	(-23.1, -11.9)	<.0001	-34.0	-19.8

[1] Reference is other 3R sites over the same time period.
Source: Battelle

Special Events

1. Flooding in St. George, UT in January 2005

When evaluating the St. George statistical model for recreational travel, it was observed that ADT was higher on Mondays than at other comparable sites. After some review, it was determined that this was largely driven by higher volumes on one particular Monday, January 10, 2005. On January 10-11, 2005, a flood of the Virgin and Santa Clara Rivers in Washington County, UT, near St. George caused considerable damage. Estimated AADT for Monday, January 10 at the three St. George permanent count stations were 11.4 (p=0.0306, 95 percent confidence interval (1.0, 22.9)) and 13.6 (p=0.0137, 95 percent confidence interval (2.7, 25.7)) percent higher, respectively, than other Monday and Tuesday estimates through the month of January in that year. These increases were statistically significant. For reference, the same Monday and Tuesday were compared to others of the same day of the week in January for the reference set of 2005 permanent count stations, and these showed no significantly higher expected volume estimation for those two dates (p=0.5593, 0.4718), as shown in Table 20.

Table 20. Special Event Analysis for flooding in St. George, Utah in January 2005

Comparisons	% Difference in Geometric Mean of (Volume/AADT) for Site(s) in 2005 Relative to Reference [1]			Geometric Mean (Volume/AADT) as % Difference From 1.0									
	Estimate	95% CI	p-Value	Ref Day	%Diff	Day	%Diff	Day	%Diff	Day	%Diff	Day	%Diff
UT St George Mon Jan 10 2005 (flood) vs. Other Jan Mondays	11.4	(1.0, 22.9)	0.0306	10	17.9	3	4.9	17	3.4	24	6.5	31	8.3
UT St George Tues Jan 11 2005 (flood) vs. Other Jan Tuesdays	13.6	(2.7, 25.7)	0.0137	11	18.3	4	1.4	18	6.5	25	4.6		
Non-SG 2005 Mon Jan 10 2005 vs. Other Jan Mondays	1.9	(-4.4, 8.7)	0.5593	10	3.5	3	2.1	17	-8.7	24	5.4	31	8.3
Non-SG 2005 Tues Jan 11 2005 vs. Other Jan Tuesdays	-2.4	(-8.7, 4.3)	0.4718	11	4.0	4	5.4	18	7.2	25	7.2		

[1] Reference is all 7 3U sites remaining and the others of the same day of the week in January 2005 (excluding January 1)

Source: Battelle

2. Groundhog Day near Punxsutawney, PA in 2006

At Site 000389, despite being in close proximity to Punxsutawney, PA, there was not significant evidence of different AADT estimates on Groundhog Day, February 2, 2006. The daily volume on February 2 at this site as a proportion of AADT was actually estimated at 13.9 percent lower than the same proportion for the aggregate of the other Thursdays in February, 2006. For reference, this same comparison was made with the other seven 5R sites for February, 2006, and these sites actually showed slightly elevated (though still not significant) volume by 2.2 percent on the 2nd of February compared to the other February Thursdays, as seen in Table 21. Therefore, we can conclude in this case that there is no strong evidence for a special event impact associated with Groundhog Day as measured in 2006 from site PA 000389.

Table 21. Special Event Analysis of Groundhog Day near Punxsutawney, Pennsylvania in 2006

February 2006 Thursdays	% Difference in Geometric Mean of (Volume/AADT) for Site in 2006 Relative to Reference [1]		
	Estimate	95% CI	p-Value
PA 000389 2-2-06 vs. Other February Thursdays	-13.9	(-30.6, 6.9)	0.1735
Reference Sites 2-2-06 vs. Other February Thursdays	2.2	(-5.9, 10.8)	0.6077

[1]Reference sites are other 5R sites in 2006 and reference days are other February Thursdays (excluding the 2nd).

Source: Battelle

3. Lobster Festival in Rockport, Maine in July-August 2008

For the two Rockport, Maine sites, traffic volume on the individual days of Wednesday, July 30 through Sunday, August 3, 2008 were all greater relative to AADT than the same estimates for the respective days of the week through the rest of August. However, none of these days were individually significant increases. When they entire festival was considered, there was evidence that daily volume at the two sites was 5.8 percent higher (p=0.0485, 95 percent confidence interval (0.0, 11.8)) relative to AADT than the same days of the week through the remainder of August. The same comparisons were applied to the eight other 3R reference sites in 2008, with no evidence that the July 30-August 3 period would produce higher volumes. This supports that the volume increases in Maine are associated with the identified event. Findings are shown in Table 22.

Table 22. Special Event Analysis of the Lobster Festival in Rockport, Maine in July-August 2008

July 30 - August 31, 2008 vs. Rest of August 2008	% Difference in Geometric Mean of (Volume/AADT) for Sites in 2008 Relative to Reference [1]		
	Estimate	95% CI	p-Value
-Wed 7-30 vs. Same Days of Week	2.8	(-6.9, 13.6)	0.583
-Thu 7-31 vs. Same Days of Week	4.2	(-5.7, 15.1)	0.4195
-Fri 8-1 vs. Same Days of Week	5.8	(-4.2, 16.9)	0.2665
-Sat 8-2 vs. Same Days of Week	7.4	(-2.8, 18.7)	0.1578
-Sun 8-3 vs. Same Days of Week	2.8	(-6.9, 13.5)	0.5867
ME 0003606, 3616 Lobster Festival vs. Same Days of Week	5.8	(0.0, 11.8)	0.0485
-Wed 7-30 vs. Same Days of Week	0.7	(-4.1, 5.9)	0.7686
-Thu 7-31 vs. Same Days of Week	0.5	(-4.4, 5.6)	0.8494
-Fri 8-1 vs. Same Days of Week	-0.8	(-5.6, 4.3)	0.7658
-Sat 8-2 vs. Same Days of Week	3.9	(-1.1, 9.2)	0.1316
-Sun 8-3 vs. Same Days of Week	1.9	(-3.0, 7.1)	0.4555
Reference Sites 7-30 to 8-3 vs. Same Days of Week	1.6	(-1.2, 4.4)	0.2749

[1]Reference sites are other 3R sites in 2008 and reference days are other (non-festival) days in August of 2008.

Source: Battelle

4. University of Iowa Football Games in Iowa City, IA in Fall 2000 and 2004

Site 000906 in Iowa City shows the impact of home football games at the University of Iowa on traffic. Over the post-Labor Day and pre-Thanksgiving Day period, traffic volume as a proportion of AADT was 7.5 percent higher on Fridays preceding a Saturday home football game than other Fridays, though this was not statistically significant (p=0.0842). Saturday game day volume was 15.3 percent greater proportion of AADT than non-home game Saturdays and was significant (p=0.0007), as seen in Table 23. Post=game volume on the following Sundays was 8.8 percent greater proportion of AADT than non-home game Sundays and was significant (p=0.0439). The significance of these results was further verified by looking at a set of six other 4U sites in Iowa for the two years. In all cases, volumes on the Friday, Saturday, and Sunday around University of Iowa home football games in these other locations was not significantly different than volumes for the same sites on non-home game weekends. Therefore, the observed differences for Site 000906 are highly attributable to the games themselves and not to natural patterns of traffic on the weekends of the games.

Table 23. Special Event Analysis of University of Iowa Football Games in Iowa City, IA in Fall 2000 and 2004

September post-Labor Day to November pre-Thanksgiving	% Difference in Geometric Mean of (Volume/AADT) for Site in 2000, 2004 Relative to Reference [1]			Geometric Mean (Volume/AADT) as % Difference From 1.0	
				IA 000906 2000,2004	
	Estimate	95% CI	p-Value	Home Game	No Game
Iowa 000906 Game Fridays in 2000, 2004 vs. Other Fridays	7.5	(-1.0, 16.8)	0.0842	32.1	22.8
Non-000906 sites Iowa Game Fridays in 2000, 2004 vs. Other Fridays	-1.6	(-4.8, 1.8)	0.359		
Iowa 000906 Game Saturdays in 2000, 2004 vs. Other Saturdays	15.3	(6.2, 25.2)	0.0007	12.0	-2.8
Non-000906 sites Iowa Game Saturdays in 2000, 2004 vs. Other Saturdays	-2.4	(-5.7, 0.9)	0.152		
Iowa 000906 Game Sundays in 2000, 2004 vs. Other Sundays	8.8	(0.2, 18.2)	0.0439	-2.4	-10.4
Non-000906 sites Iowa Game Sundays in 2000, 2004 vs. Other Sundays	-3.1	(-6.3, 0.2)	0.0646		

[1]Reference sites are other 4U sites in 2000, 2004 and reference days are other non-home game weekend days in fall of each year.

Source: Battelle

5. Super Bowl XXXIX in Jacksonville, Florida on February 5, 2005

Analysis of the Jacksonville, Florida site 720161 near (formerly) Alltel Stadium, the site of Super Bowl 39 on February 5, 2005, shows the traffic impact of that event. Traffic volumes on the Wednesday, Thursday, and Friday before the Super Bowl were 3.5, 12.4, and 12.0 percent higher, respectively, than the same days of the week throughout the rest of February as presented in Table 24. However, these differences were not statistically significant. The Saturday before the game and the day of the game, Sunday, February 5, 2005, showed volumes 41.0 and 36.6 percent higher as a proportion of AADT, with both highly statistically significant (p=0.0006, 0=0.0017). While significant increases, the scheduling of the game on the weekend still limited the absolute impact of traffic volume as other Saturdays in February averaged 15.1 percent below AADT, and February 4, 2005 was 19.7 percent greater than AADT. Similarly, the traffic volume of the other Sundays in February average 40.0 percent below AADT, so even with the 36.6 percent higher volumes on the day of the game, the February 5, 2005 volume was still 18.0 percent below AADT. The higher volumes dropped off quickly after the game as the increase was only 5.5 percent on Monday and 2.7 percent on Tuesday, and neither was statistically significant in comparison to other Mondays and Tuesdays in February 2005 at Site 720161. For each comparison discussed above, a similar comparison was made between the day in the Super Bowl week and the remaining of those days of the week throughout the rest of February, but in an independent set of nine 3U functional classification sites. In every case, the traffic volumes in these reference sites were not statistically significant between the days of the Super Bowl week and the remainder of the days in February. This suggests that the observed impact of the differences for 720161 are related primarily to the event and are not explained by some other typical temporal differences in traffic between the beginning and end of February.

Table 24. Special Event Analysis of Super Bowl XXXIX in Jacksonville, Florida on February 5, 2005

Weekdays in the Week Around the Super Bowl vs. Others in February	% Difference in Geometric Mean of (Volume/AADT) for Site in 2005 Relative to Reference [1]			Geometric Mean (Volume/AADT) as % Difference From 1.0 — FL 720161	
	Estimate	95% CI	p-Value	SB Week	Other Feb 2005
JAX Wed Feb 1 2005 vs. JAX Feb 2005 Wed	3.5	(-14.7, 25.6)	0.7242	22.7	18.5
Other Wed Feb 1 2005 vs. Other Feb 2005 Wed	0.0	(-6.2, 6.7)	0.9973		
JAX Thurs Feb 2 2005 vs. JAX Feb 2005 Thurs	12.0	(-7.7, 35.8)	0.2512	34.2	19.9
Other Thurs Feb 2 2005 vs. Other Feb 2005 Thurs	-0.3	(-6.5, 6.4)	0.9351		
JAX Fri Feb 3 2005 vs. JAX Feb 2005 Fri	12.4	(-7.4, 36.4)	0.2361	37.4	22.3
Other Fri Feb 3 2005 vs. Other Feb 2005 Fri	0.0	(-6.3, 6.6)	0.9957		
JAX Sat Feb 4 2005 vs. JAX Feb 2005 Sat	41.0	(16.2, 71.0)	0.0006	19.7	-15.1
Other Sat Feb 4 2005 vs. Other Feb 2005 Sat	1.1	(-5.2, 7.8)	0.7391		
JAX Sun Feb 5 2005 vs. JAX Feb 2005 Sun	36.6	(12.6, 65.7)	0.0017	-18.0	-40.0
Other Sun Feb 5 2005 vs. Other Feb 2005 Sun	-7.5	(-13.2, -1.3)	0.0186		
JAX Mon Feb 6 2005 vs. JAX Feb 2005 Mon	5.5	(-13.0, 28.0)	0.5857	17.4	11.3
Other Mon Feb 6 2005 vs. Other Feb 2005 Mon	-4.0	(-10.0, 2.4)	0.213		
JAX Tues Feb 7 2005 vs. JAX Feb 2005 Tues	2.7	(-15.4, 24.6)	0.7867	23.5	20.3
Other Tues Feb 7 2005 vs. Other Feb 2005 Tues	1.4	(-4.9, 8.1)	0.6731		

[1]Reference sites are other 3U sites in 2005 and reference days are other non-Super Bowl week days in February 2005.

Source: Battelle

6. Tropical Storm Tammy in Jacksonville, Florida in October 2005

The Florida DOT observed that there were reduced traffic volumes at 720161, near Jacksonville, associated with Tropical Storm Tammy which made landfall near Jacksonville at Mayport, FL on the evening of Wednesday, October 5, 2005. In modeling the traffic impact, it can be observed that volumes as a proportion of AADT for Wednesday the 5th were 5.4 percent lower than for the other Wednesdays in October that year, as seen in Table 25. Additionally, the reference sites actually showed slightly higher volumes for this Wednesday compared to the others in October. However, the volume reduction was not statistically significant due to the small sample size and variability overall in volumes. The lower volume estimate persisted into Thursday the 6th, at 1.7 percent reduction, but similarly was not statistically significant.

Table 25. Special Event Analysis of Tropical Storm Tammy in Jacksonville, Florida in October 2005

Tropical Storm Tammy Around Days of Landfall, October 2005	% Difference in Geometric Mean of (Volume/AADT) for Site in 2005 Relative to Reference [1]			Geometric Mean (Volume/AADT) as % Difference From 1.0 — FL 720161	
	Estimate	95% CI	p-Value	TS Tammy	Other Oct 2005
JAX Wed Oct 5 2005 vs. JAX Oct 2005 Wed	-5.4	(-19.8, 11.6)	0.5064	5.6	11.7
Other Wed Oct 5 2005 vs. Other Oct 2005 Wed	2.0	(-3.5, 7.8)	0.479		
JAX Thu Oct 6 2005 vs. JAX Oct 2005 Thu	-1.7	(-16.7, 15.9)	0.8367	12.2	14.2
Other Thu Oct 6 2005 vs. Other Oct 2005 Thu	2.2	(-3.3, 7.9)	0.4468		

[1]Reference sites are other 3U sites in 2005 and reference days are other October week days in 2005.

Source: Battelle

7. Pineville, KY 000311, 000315 Route to Bristol Motor Speedway, 2003

The analysis of the Kentucky sites clearly shows the bi-directional traffic flows. At 64.2 percent higher than AADT, the Friday traffic southbound passing Site 000315 is significantly elevated compared to other Fridays in the same month (p=0.0496). No other day of the week shows the elevated traffic for the race week in this direction. However, at 45.3 and 53.2 percent, respectively, for Sunday and Monday, the northbound traffic passing the same location (Site 000311) is significantly higher than these same days of the week for the remainder of March 2003 (p=0.0014, p=0.0086). When evaluating the nine reference 3R sites for 2003 and 2004, there was no significant difference between the equivalent race week of March and the other weeks of March in terms of traffic flow except for Sunday. Some 13 percent of the 74 percent increase observed at Site 000311 also occurred for the reference sites and may be indicative of general traffic trends at 3R sites in late March compared to earlier in March. For reproducibility, a similar analysis to this one was completed for the Saturday, August 23, 2003 race. It showed a similar pattern with increased southbound flow at 000315 on Friday (though not statistically significant) and highly significant spike in northbound traffic at 000311 on the Sunday after the race (though not extending into Monday). Even though sites 000311 and 000315 are around 100 miles from Bristol, there is some evidence that the NASCAR events there may be influencing their traffic. Results are presented in Table 26.

Table 26. Special Event Analysis of Bristol NASCAR Race in March 2003

	Geometric Mean (Volume/AADT) as % Difference From 1.0 for Race Week and Other Weeks in March 2003 and % Difference in Geometric Mean of (Volume/AADT) for Sites in 2003 Relative to Reference [1]									
	Inbound Bristol (North-South) 000315					Outbound Bristol (South-North) 000311				
	March		% Difference in GM Race Wk vs Other Weeks in Same Mth			March		% Difference in GM Race Wk vs Other Weeks in Same Mth		
March	Race Wk	Other Weeks	Estimate	95% CI	p-Value	Race Wk	Other Weeks	Estimate	95% CI	p-Value
KY Wed Mar 19 2003 vs. KY Mar 2003 Wed	-1.8	-4.6	3.0	(-27.3, 46.0)	0.8682	-1.7	-2.2	0.5	(-29.1, 42.4)	0.9775
Other Wed Mar 19 2003 vs. Other Mar 2003 Wed			6.4	(-5.0, 19.0)	0.2813			6.4	(-5.0, 19.0)	0.2811
KY Thu Mar 20 2003 vs. KY Mar 2003 Thu	23.1	0.5	22.5	(-13.6, 73.6)	0.2536	-1.8	-0.4	-1.4	(-30.4, 39.7)	0.9362
Other Thu Mar 20 2003 vs. Other Mar 2003 Thu			10.3	(-1.8, 23.9)	0.0978			10.3	(-1.8, 23.9)	0.0977
KY Fri Mar 21 2003 vs. KY Mar 2003 Fri	**64.2**	**15.8**	**41.8**	**(0.1, 101.0)**	**0.0496**	6.6	8.3	-1.5	(-30.5, 39.6)	0.9311
Other Fri Mar 21 2003 vs. Other Mar 2003 Fri			8.4	(-3.5, 21.8)	0.1726			8.4	(-3.5, 21.8)	0.1725
KY Sat Mar 22 2003 vs. KY Mar 2003 Sat	22.3	-4.4	27.9	(-8.7, 79.3)	0.1522	-7.9	-9.1	1.3	(-27.7, 42.1)	0.9378
Other Sat Mar 22 2003 vs. Other Mar 2003 Sat			3.8	(-7.6, 16.6)	0.5266			3.8	(-7.6, 16.6)	0.5265
KY Sun Mar 23 2003 vs. KY Mar 2003 Sun	-15.0	-24.6	12.8	(-19.6, 58.1)	0.4842	**45.3**	**-16.5**	**74.0**	**(24.2, 143.9)**	**0.0014**
Other Sun Mar 23 2003 vs. Other Mar 2003 Sun			13.3	(0.9, 27.3)	0.0354			13.3	(0.9, 27.3)	0.0353
KY Mon Mar 24 2003 vs. KY Mar 2003 Mon	-5.6	-5.6	0.0	(-28.7, 40.1)	0.9986	**53.2**	**-2.7**	**57.4**	**(12.3, 120.7)**	**0.0086**
Other Mon Mar 24 2003 vs. Other Mar 2003 Mon			8.1	(-3.5, 20.9)	0.1767			8.1	(-3.4, 20.9)	0.1766
KY Tue Mar 25 2003 vs. KY Mar 2003 Tue	-1.3	0.6	-1.9	(-30.8, 39.1)	0.915	0.4	0.7	-0.2	(-29.6, 41.4)	0.9893
Other Tue Mar 25 2003 vs. Other Mar 2003 Tue			5.7	(-5.6, 18.3)	0.3352			5.7	(-5.6, 18.3)	0.335

Values in **bold** indicate a statistically significant difference at the 0.05 level
[1]Reference sites are other 3R sites, but in 2004, and reference days are other March week days in 2003 (or 2004) not in the subject race week.

Source: Battelle

Conclusions

This evaluation provided some important observations. For national holidays,

- *Easter* – Although not a Federal holiday, significantly increased traffic volume is seen across a broad national cross-section of sites the Thursday and Friday before the holiday, as well as on Easter Sunday and the following Monday compared to the same days of the week in the rest of March and April.
- *Memorial Day* – Across a broad national cross-section of sites, traffic was shown to increase significantly for the period from the Thursday through Sunday preceding Memorial Day, as well as the Tuesday after Memorial Day, compared to the same days of the week in the rest of May and June. The holiday itself saw significantly lower travel volumes than other Mondays in the same period.
- *Independence Day* – Across a broad national cross-section of sites, traffic was shown to increase significantly for July 1, July 2, and July 3 (when not a Federal holiday), before decreasing significantly on July 4 and July 5 (when a Federal holiday) compared to the same days of the week in the rest of July. When evaluated with separate models for which day of the week was Independence Day, the overall pattern of significance shows dependence on the day of the week of July 4 and even opposite conclusions of increased or decreased traffic in some cases. The one clear fact is that volumes for July 3 as a Federal holiday (i.e., when July 4 is a Saturday), July 4 itself regardless of day of week, and July 5 as a Federal holiday (i.e., when July 4 is a Sunday) are all significantly decreased relative to the same days of the week throughout the rest of July.
- *Labor Day* – Across a broad national cross-section of sites, traffic was shown to increase significantly only on the Friday preceding Labor Day, compared to the same days of the week in the rest of August and September. The holiday itself saw significantly lower travel volumes than other Mondays in the same period.
- *Thanksgiving* – Across a broad national cross-section of sites, traffic was shown to increase significantly for the Tuesday and Wednesday prior to Thanksgiving and the Sunday after, compared to the same days of the week in the rest of November. The holiday itself and the Friday after saw significantly lower travel volumes than other Thursdays and Fridays in the same period.
- *Christmas* – Across a broad national cross-section of sites, traffic was shown to increase significantly for December 22 and December 23, before decreasing significantly on December 24 (whether or not a Federal holiday), 25, and 26 (whether or not a Federal holiday) compared to the same days of the week in the rest of December. When evaluated with separate models for which day of the week was Christmas Day, the overall pattern of significance shows dependence on the day of the week of December 25 and even opposite conclusions of increased or decreased traffic in some cases. The one clear fact is that volumes for December 24 as a Federal holiday (i.e., when December 25 is a Saturday), December 25 itself regardless of day of week, and December 26 as a Federal holiday (i.e., when December 25 is a Sunday) are all significantly decreased relative to the same days of the week throughout the rest of December.
- *New Year's Eve* – Across a broad national cross-section of sites, traffic was shown to decrease significantly for December 31 when not a Federal holiday and under the separate Christmas day of week models to also decrease significantly for December 31 as a Federal holiday (i.e., the subsequent January 1 is a Saturday) compared to the similar days of the week through the rest of December (excluding December 24).

For recreational sites, a pattern of significant traffic increases over weekends was observed for several sites, though this spanned the range from just one day to the entire weekend. Some sites have a more persistently elevated volume that spans the entire week, especially for significant tourist destinations. Additionally, the recreational site patterns were often seasonal in nature with summer peak being the most prevalent.

For special events, the pattern of increased or decreased traffic is far more variable. Known events were studied that ranged from no significant changes in volume to extremely significant changes. Importantly, though, the identification of these special events was made by knowledgeable local DOT staff, and when researched they generally revealed quantifiable effects consistent with the DOT inputs.

Appendix: Holidays

Table A-1: Federal Holidays and Easter Over Evaluation Period

Holiday	Year												
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
New Year's Day	Saturday 01 Jan	Monday 01 Jan	Tuesday 01 Jan	Wednesday 01 Jan	Thursday 01 Jan	Saturday 01 Jan	Sunday 01 Jan	Monday 01 Jan	Tuesday 01 Jan	Thursday 01 Jan	Friday 01 Jan	Saturday 01 Jan	Sunday 01 Jan
New Year's Day observed							Monday 02 Jan						Monday 02 Jan
Martin Luther King Day	Monday 17 Jan	Monday 15 Jan	Monday 21 Jan	Monday 20 Jan	Monday 19 Jan	Monday 17 Jan	Monday 16 Jan	Monday 15 Jan	Monday 21 Jan	Monday 19 Jan	Monday 18 Jan	Monday 17 Jan	Monday 16 Jan
Presidents' Day (Washington's Birthday)	Monday 21 Feb	Monday 19 Feb	Monday 18 Feb	Monday 17 Feb	Monday 16 Feb	Monday 21 Feb	Monday 20 Feb	Monday 19 Feb	Monday 18 Feb	Monday 16 Feb	Monday 15 Feb	Monday 21 Feb	Monday 20 Feb
Easter	Sunday 23 Apr	Sunday 15 Apr	Sunday 31 Mar	Sunday 20 Apr	Sunday 11 Apr	Sunday 27 Mar	Sunday 16 Apr	Sunday 08 Apr	Sunday 23 Mar	Sunday 12 Apr	Sunday 04 Apr	Sunday 24 Apr	Sunday 08 Apr
Memorial Day	Monday 29 May	Monday 28 May	Monday 27 May	Monday 26 May	Monday 31 May	Monday 30 May	Monday 29 May	Monday 28 May	Monday 26 May	Monday 25 May	Monday 31 May	Monday 30 May	Monday 28 May
Independence Day observed										Friday 03 Jul			
Independence Day	Tuesday 04 Jul	Wednesday 04 Jul	Thursday 04 Jul	Friday 04 Jul	Sunday 04 Jul	Monday 04 Jul	Tuesday 04 Jul	Wednesday 04 Jul	Friday 04 Jul	Saturday 04 Jul	Sunday 04 Jul	Monday 04 Jul	Wednesday 04 Jul
Independence Day observed					Monday 05 Jul						Monday 05 Jul		
Labor Day	Monday 04 Sep	Monday 03 Sep	Monday 02 Sep	Monday 01 Sep	Monday 06 Sep	Monday 05 Sep	Monday 04 Sep	Monday 03 Sep	Monday 01 Sep	Monday 07 Sep	Monday 06 Sep	Monday 05 Sep	Monday 03 Sep
Columbus Day	Monday 09 Oct	Monday 08 Oct	Monday 14 Oct	Monday 13 Oct	Monday 11 Oct	Monday 10 Oct	Monday 09 Oct	Monday 08 Oct	Monday 13 Oct	Monday 12 Oct	Monday 11 Oct	Monday 10 Oct	Monday 08 Oct
Veterans Day observed	Friday 10 Nov						Friday 10 Nov						
Veterans Day	Saturday 11 Nov	Sunday 11 Nov	Monday 11 Nov	Tuesday 11 Nov	Thursday 11 Nov	Friday 11 Nov	Saturday 11 Nov	Sunday 11 Nov	Tuesday 11 Nov	Wednesday 11 Nov	Thursday 11 Nov	Friday 11 Nov	Sunday 11 Nov
Veterans Day observed		Monday 12 Nov						Monday 12 Nov					Monday 12 Nov
Thanksgiving Day	Thursday 23 Nov	Thursday 22 Nov	Thursday 28 Nov	Thursday 27 Nov	Thursday 25 Nov	Thursday 24 Nov	Thursday 23 Nov	Thursday 22 Nov	Thursday 27 Nov	Thursday 26 Nov	Thursday 25 Nov	Thursday 24 Nov	Thursday 22 Nov
Christmas Day observed					Friday 24 Dec						Friday 24 Dec		
Christmas Day	Monday 25 Dec	Tuesday 25 Dec	Wednesday 25 Dec	Thursday 25 Dec	Saturday 25 Dec	Sunday 25 Dec	Monday 25 Dec	Tuesday 25 Dec	Thursday 25 Dec	Friday 25 Dec	Saturday 25 Dec	Sunday 25 Dec	Tuesday 25 Dec
Christmas Day observed						Monday 26 Dec						Monday 26 Dec	
New Year's Day observed					Friday 31 Dec						Friday 31 Dec		

Source: Battelle

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