



# State Department of Transportation's (DOT's) Travel Monitoring Survey Results Report

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November, 2007

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## 1. Abstract

As State agencies compete for federal, state, and local funding sources, many State Department of Transportation (DOT) Agencies are faced with staffing, software, and other operational challenges related to managing an efficient travel monitoring program. Without adequate funding, travel monitoring programs suffer, ultimately requiring state agencies to partially fund and prioritize travel monitoring activities. DOT Agencies typically fund mission critical priorities that allow for maintaining a travel monitoring program while other priorities, such as researching new traffic counting technologies, remain unfunded. With better coordination and management practices, more established standards, and additional technology tools, DOT Agencies could save time and money potentially allowing for additional funding to complete more research projects.

As the Colorado Department of Transportation (CDOT) began to research DOT's management, coordination, and operational activities specific to maintaining an efficient travel monitoring program, the need for additional research became obvious. Therefore, the Federal Highway Administration (FHWA) supported the Colorado Department of Transportation's (CDOT's) effort to survey DOT Agencies for the purpose of understanding today's travel monitoring and traffic analysis programs. Successful travel monitoring policies, procedures, and programs are influenced by the DOT's ability to hire staff, allocate spending dollars, acquire hardware and software assets, and ability to implement new and efficient technologies. This paper provides a synthesized analysis of survey results sent to all 50 State DOT Agencies including one city (Washington DC) and provides a summary of the staffing, software, and operational trends and challenges discovered and documented from the survey results gathered in June of 2007. Additionally, conclusions are drawn from the survey results indicating an overall need to standardize operational procedures across State DOT Agencies. For example, the need to standardize business processes, as well as software and quality assurance procedures to process and finalize travel monitoring data is paramount in comparing or sharing data across states. Due to this lack of automation and standardization, State DOT Agencies are confronted with challenges in sharing, validating, and comparing data.

Researching DOT travel monitoring business practices provides an understanding of how state DOT's are managing their travel monitoring programs specifically in regards to staffing, software and operational management activities. Methods used to conduct travel monitoring research included a literature review of existing state agency travel monitoring program documentation and the development of an on-line survey (see Appendix). A literature review showed minimal information availability. Travel monitoring guidance documentation such as the Federal Highway Administration's (FHWA's) Traffic Monitoring Guide (TMG) found at: <http://www.fhwa.dot.gov/ohim/tmguides/pdf/tmg0.pdf> and the American Association of State Highway and Transportation Officials (AASHTO) Guidelines for Traffic Data Programs, 1992, ISBN 1 - 56051 - 054 - 4, provide a number of guidelines for state DOT's. However, these guide books fall short of providing current year 2007 travel monitoring implementation information and/or relevant details on how to manage a travel monitoring program. The on-line survey was developed with the help of FHWA by CDOT. For a copy of the individual survey responses or additional documentation and literature resources, please contact the author.

## 2. Introduction

The Colorado Department of Transportation (CDOT) developed an on-line travel monitoring survey for the purpose of gathering information from State Department of Transportations (DOT's) related to travel monitoring program management, operations, and staffing that included data usage as well as software and technology questions. A total of **51** survey participants were contacted and **49** participants responded to the survey by electronically submitting answers to the on-line survey questions.

The survey was developed by CDOT and reviewed by the Federal Highway Administration (FHWA). The on-line survey included a total of 30 questions (see Appendix) and most of the questions provided respondents with the opportunity to provide additional information in an open-ended question format. Respondents had the opportunity to skip a question if they did not understand or know the answer to the question. Consequently, there were a number of respondents that skipped the last several questions of the survey. All skipped responses are reflected as a No Response throughout this report.

On-line survey results are presented in written and tabular formats throughout this report. This report provides DOT Agency Representatives with references to neighboring and other State DOT Representatives. Some information contained in this report is static but a majority of information is dynamic and therefore updated information or current conditions could have an affect on the survey results. Discussions between FHWA and CDOT have included making this survey a regular travel monitoring and reporting activity with mandatory survey result updates every other year.

## 3. State Participants and Contact Information

To gather as much participation as possible, CDOT contacted all potential survey participants by e-mail to request participation. In some cases, phone calls were made in attempt to find the correct travel monitoring program contacts.

Although CDOT attempted to gather responses from all participants a few states did not participate due to time constraints, lack of contact information, or other reasons. See Table 1 for the survey status of each respondent contacted. Table 1 also shows the list of states that attempted or completed the survey including the state travel monitoring program contact names, titles, phone numbers, and e-mail addresses.

**Table 1 - General Contact Information**

#	General Contact Information					
	State Name	State Traffic Monitoring Program Contact Name	Survey Status	State Contact Title	State Contact Phone Number	State Contact E-mail
1	Alabama	Charles W. Turney	Complete	Traffic Engineer	(334) 242-6393	<a href="mailto:turneyc@dot.state.al.us">turneyc@dot.state.al.us</a>
2	Alaska	MaryAnn Dierckman	Complete	Transportation Planner	(907) 465-6993	<a href="mailto:Maryann.dierckman@alaska.gov">Maryann.dierckman@alaska.gov</a>
3	Arizona	Mark Catchpole	Complete	Planner IV	(602) 712-8596	<a href="mailto:mcatchpole@azdot.gov">mcatchpole@azdot.gov</a>
4	Arkansas	Elizabeth Mayfield-Hart	Complete	Staff Planning Engineer, Technical Services	(501) 569-2111	<a href="mailto:elizabeth.mayfieldhart@arkansashighways.com">elizabeth.mayfieldhart@arkansashighways.com</a>
5	California	Joe Avis	Complete	Chief, Traffic Data and Photolog Branch	(916) 654 3072	<a href="mailto:joe_avis@dot.ca.gov">joe_avis@dot.ca.gov</a>
6	Colorado	Elizabeth Stolz	Complete	Traffic Analysis Unit Manager	(303) 757-9495	<a href="mailto:elizabeth.stolz@dot.state.co.us">elizabeth.stolz@dot.state.co.us</a>
7	Connecticut	Kerry Ross	Complete	Transportation Supervising Planner	(860) 594-2087	<a href="mailto:Kerry.Ross@po.state.ct.us">Kerry.Ross@po.state.ct.us</a>
8	Delaware	Paul McKenna	Not Submitted			
9	District of Columbia	Yusuf Aden	Complete	Traffic Safety Engineer Supervisor, Traffic Data Quality	(202) 671-2305	<a href="mailto:yusuf.aden@dc.gov">yusuf.aden@dc.gov</a>
10	Florida	Joey D. Gordon	Complete	QC & Data Reporting Branch Chief	(850) 414-4738	<a href="mailto:joey.gordon@dot.state.fl.us">joey.gordon@dot.state.fl.us</a>
11	Georgia	Tim Christian	Complete	Engineer (Civil) V, DOT-Highways Division, Planning Branch	(770) 986-1434	<a href="mailto:Tim.Christian@dot.state.ga.us">Tim.Christian@dot.state.ga.us</a>
12	Hawaii	Napoleon Agraan	Complete	Roadway Data Manager	(808) 587-1838	<a href="mailto:napoleon.agraan@hawaii.gov">napoleon.agraan@hawaii.gov</a>
13	Idaho	Glenda Fuller	Complete	Data Management Unit Chief	(208) 334-8217	<a href="mailto:glenda.fuller@itd.idaho.gov">glenda.fuller@itd.idaho.gov</a>
14	Illinois	Rob Robinson	Complete	Traffic Monitoring Section Engineer	(217) 785-2353	<a href="mailto:rob.robinson@illinois.gov">rob.robinson@illinois.gov</a>
15	Indiana	Scott MacArthur	Complete	Systems Monitoring Manager	(317) 233-1166	<a href="mailto:smacarthur@indot.in.gov">smacarthur@indot.in.gov</a>
16	Iowa	Phillip Meraz	Complete	Traffic and Field Operations Engineer	(515) 239-1548	<a href="mailto:phillip.meraz@dot.iowa.gov">phillip.meraz@dot.iowa.gov</a>
17	Kansas	Alan Spicer	Complete	Transportation Engineering Branch Manager	(785) 296-3470	<a href="mailto:spicer@ksdot.org">spicer@ksdot.org</a>
18	Kentucky	Ted Noe	Complete	Planning Support Engineer	(502) 564-7183	<a href="mailto:ted.noe@ky.gov">ted.noe@ky.gov</a>
19	Louisiana	James C. Porter	Complete	Traffic Monitoring Manager	(225) 242-4556	<a href="mailto:jimporter@dotd.la.org">jimporter@dotd.la.org</a>
20	Maine	Deborah Morgan	Complete	Manager-Traffic Monitoring System	(207) 624-3606	<a href="mailto:deborah.morgan@maine.gov">deborah.morgan@maine.gov</a>
21	Maryland	Karl Hess	Complete	Supervisor Statewide Traffic Data Collection	(410) 545-5523	<a href="mailto:KHess@sha.state.md.us">KHess@sha.state.md.us</a>
22	Massachusetts	Stephen R. Greene	Complete	Transportation Planner	(617) 973-7327	<a href="mailto:stephen.greene@MHD.state.ma.us">stephen.greene@MHD.state.ma.us</a>
23	Michigan	Mike Walimaki	Complete	Manager	(517) 335-2914	<a href="mailto:walimakim@michigan.gov">walimakim@michigan.gov</a>
24	Minnesota	Gene Hicks	Complete	Principal Engineer	(651) 366-3856	<a href="mailto:gene.hicks@dot.state.mn.us">gene.hicks@dot.state.mn.us</a>
25	Mississippi	Jeff Altman	Complete	Engineering Analysis Manager	(601) 359-7675	<a href="mailto:jaltman@mdot.state.ms.us">jaltman@mdot.state.ms.us</a>
26	Missouri	Mary Beth Anthony	Complete	Planning Supervisor	(573) 751-3702	<a href="mailto:MaryBeth.Anthony@modot.mo.gov">MaryBeth.Anthony@modot.mo.gov</a>
27	Montana	Tedd Little	Incomplete	Weigh In Motion Analyst	(406) 444-9417	<a href="mailto:tlittle@mt.gov">tlittle@mt.gov</a>
28	Nebraska	Rick Ernstmeyer	Complete	Traffic Analysis Supervisor	(402) 479-4520	<a href="mailto:RickErnstmeyer@dor.state.ne.us">RickErnstmeyer@dor.state.ne.us</a>
29	Nevada	Michael W Lawson	Complete	Traffic Information Division Chief	(775) 888-7443	<a href="mailto:mlawson@dot.state.nv.us">mlawson@dot.state.nv.us</a>

**Table 1 – General Contact Information – Continued**

General Contact Information						
#	State Name	State Traffic Monitoring Program Contact Name	Survey Status	State Contact Title	State Contact Phone Number	State Contact E-mail
30	New Hampshire	Subramanian N. Sharma	Complete	Chief of Research and Engineering	(603) 271-1625	<a href="mailto:ssharma@dot.state.nh.us">ssharma@dot.state.nh.us</a>
31	New Jersey	Louis C. Whiteley	Complete	Section Chief	(609) 530-3501	<a href="mailto:Louis.Whiteley@dot.state.nj.us">Louis.Whiteley@dot.state.nj.us</a>
32	New Mexico	Elizer Pena	Complete	Management Analyst	(505) 827-5529	<a href="mailto:elizer.pena@state.nm.us">elizer.pena@state.nm.us</a>
33	New York	Kurt Matias	Complete	Associate Transportation Analyst	(518) 457-2815	<a href="mailto:kmatias@dot.state.ny.us">kmatias@dot.state.ny.us</a>
34	North Carolina	Kent Taylor	Complete	State Traffic Survey Engineer	(919) 212-4550	<a href="mailto:kitaylor@dot.state.nc.us">kitaylor@dot.state.nc.us</a>
35	North Dakota	Robert Olzweski	Complete	Senior Transportation Project Manger	(701) 328-3479	<a href="mailto:rolzweski@nd.gov">rolzweski@nd.gov</a>
36	Ohio	Dave Gardner	Complete	Manager, Traffic Monitoring Section	(614) 752-5740	<a href="mailto:dave.gardner@dot.state.oh.us">dave.gardner@dot.state.oh.us</a>
37	Oklahoma	Jay Adams	Complete	Assist. Division Mgr. - Planning & Research	(405) 521-2175	<a href="mailto:jadams@odot.org">jadams@odot.org</a>
38	Oregon	Don R. Crownover	Complete	TSM Unit Team Leader	(503) 986-4132	<a href="mailto:don.r.crownover@odot.state.or.us">don.r.crownover@odot.state.or.us</a>
39	Pennsylvania	Laine Heltebride	Complete	Manager, Transportation Planning Division	(717) 787-2277	<a href="mailto:lheltebrid@state.pa.us">lheltebrid@state.pa.us</a>
40	Rhode Island	David A. Doyle, Jr.	Incomplete	Senior Planner	(401) 222-2694 ext 4213	<a href="mailto:ddoyle@dot.ri.gov">ddoyle@dot.ri.gov</a>
41	South Carolina	Angela Hance	Complete	Assistant Chief of Road Data Services	(803) 737-1466	<a href="mailto:hancema@scdot.org">hancema@scdot.org</a>
42	South Dakota	Kenneth E. Marks	Complete	Engineering Supervisor	(605) 773-3336	<a href="mailto:Ken.Marks@state.sd.us">Ken.Marks@state.sd.us</a>
43	Texas	Rhonda Christensen	Not Submitted			
44	Tennessee	Steve Allen	Complete	Director - Project Planning Division	(615) 741-2208	<a href="mailto:steve.allen@state.tn.us">steve.allen@state.tn.us</a>
45	Utah	Toni Butterfield	Incomplete	Research Analyst	(801) 965-4737	<a href="mailto:tbutterfield@utah.gov">tbutterfield@utah.gov</a>
46	Vermont	David Gosselin	Incomplete	Tech VI	(802) 828-2694	<a href="mailto:Dave.gosselin@state.vt.us">Dave.gosselin@state.vt.us</a>
47	Virginia	Tom Schinkel	Complete	Program Manager	(804) 225-3123	<a href="mailto:Tom.Schinkel@VDOT.Virginia.Gov">Tom.Schinkel@VDOT.Virginia.Gov</a>
48	Washington	John Rosen	Complete	Highway Usage Branch Manager	(360) 570-2373	<a href="mailto:roseni@wsdot.wa.gov">roseni@wsdot.wa.gov</a>
49	West Virginia	Tom Myes	Complete	Transportation Manager	(304) 558-9611	<a href="mailto:tmyers@dot.state.wv.us">tmyers@dot.state.wv.us</a>
50	Wisconsin	Paul Stein	Complete	Manager Traffic Data Systems	(608) 266-8678	<a href="mailto:paul.stein@dot.state.wi.us">paul.stein@dot.state.wi.us</a>
51	Wyoming	Sherman Wiseman	Complete	Supervisor, Transportation Surveys	(307) 777-4190	<a href="mailto:sherman.wiseman@dot.state.wy.us">sherman.wiseman@dot.state.wy.us</a>

\* A total of 49 survey responses were received, a total of 4 responses were incomplete (only 5 survey questions or less were answered)

As seen in Table 1, general contact information results reveal the differences in how State DOT's are organized and how different types of resources manage their respective travel monitoring program. For example, a review of the state agency contact titles shows that travel monitoring programs are managed by transportation engineers, planners, data analysts, and other types of professionals. These state contact titles indicate different skills, education, years in the industry, and backgrounds. These differences in contact titles also illustrate how travel monitoring programs are organized and managed differently within each State DOT.

#### **4. General Program Management, Operations, and Staffing Question Results**

On-line survey participants provided information related to their respective travel monitoring program management, operations, and staffing. Results of the survey clearly support the notion that DOT Agency travel monitoring programs vary in management, organizational structure, staffing, and operations. These variations are attributed to several key factors such as State DOT's geographic location and the number of centerline miles of roadway managed by the DOT.

The number of centerline miles of roadway managed by a DOT provides an empirical number indicating the size (large, medium, or small) of travel monitoring program required. The DOT's travel monitoring program size offers insight to the quantity of travel monitoring required. For example, a large DOT travel monitoring program, such as the Pennsylvania DOT with over 39,000 centerline miles, is required to manage a large travel monitoring program. Travel monitoring program size is a key factor for budgeting and has repercussions for funding an efficient travel monitoring program.

Given that each DOT is responsible for maintaining a certain number of centerline miles of roadway each year, it is important to note the total number of centerline miles varies from year to year. This variation is dependent on many program aspects such as the number of local jurisdictional agreements executed by the DOT. The purpose of asking Agency Representatives the number of DOT managed centerline miles was to gather a "generally accepted" number of centerline miles of roadway by each DOT. The "generally accepted" number of centerline miles indicates the total mileage of state highways as well as any other roadway mileage required to be maintained by the State DOT that could come from formal agreements made by the DOT with local agencies. Centerline mileage indicates the amount of roadway in which travel monitoring activities are conducted by each State DOT. Results showed the number of centerline miles reported in the survey ranges from **940 miles in Hawaii** to **115,000 miles in New York**.

Also, in an effort to group DOT travel monitoring programs into large, medium, or small categories, each DOT was asked to provide the state agency managed centerline miles of roadway. For the purpose of grouping DOT travel monitoring programs, a large DOT travel monitoring program would be required if there are greater than 20,000 centerline miles of roadway. A medium sized travel monitoring program would be required if a DOT agency manages from 10,000 to 19,999 centerline miles of roadway and a small travel monitoring program would be required if a DOT agency manages from 0 to 9,999 centerline miles of roadway. Of the 39 responses, there are 11 large programs, 14 medium, and 19 small sized programs. These results show approximately 50% of all DOT's require a large or medium sized travel monitoring program. These results suggest that half of all DOT Agencies require a larger or medium sized staff and a greater number of travel monitoring activities to manage their respective travel monitoring programs.

Table 2 shows the responses to the managed centerline miles of roadway question. On the left-hand side of the table, total centerline miles are organized alphabetically by state and on the right-hand side of the table, total centerline miles are organized from the largest number of centerline miles to the smallest number of centerline miles.

**Table 2 – State Agency Managed Centerline Miles of Roadway**

#	State Name	How many total centerline miles of roadway are managed by the DOT?	In Order from Largest to Smallest Number of Centerline Miles of Roadway Managed		
			State Name	Centerline Miles	Rank
1	Alabama	11,005	New York	115,000	1
2	Alaska	6,200	Tennessee	91,417	2
3	Arizona	6,500	North Carolina	78,000	3
4	Arkansas	16,233	Virginia	67,763	4
5	California	15,000	New Mexico	64,060	5
6	Colorado	9,148	South Carolina	41,468	6
7	Connecticut	3,731	Pennsylvania	39,890	7
8	Delaware	Not Reported	West Virginia	36,292	8
9	*District of Columbia	1,250	Missouri	32,000	9
10	Florida	12,069	Minnesota	29,100	10
11	Georgia	18,000	Kentucky	27,511	11
12	Hawaii	<b>940</b>	Ohio	19,290	12
13	Idaho	4,945	Georgia	18,000	13
14	Illinois	16,000	Louisiana	16,700	14
15	Indiana	12,000	Arkansas	16,233	15
16	Iowa	9,355	South Dakota	16,000	16
17	Kansas	10,375	Illinois	16,000	17
18	Kentucky	27,511	California	15,000	18
19	Louisiana	16,700	Mississippi	13,000	19
20	Maine	Not Reported	Oklahoma	12,300	20
21	Maryland	5,235	Florida	12,069	21

**Table 2 - State Agency Managed Centerline Miles of Roadway - Continued**

#	State Name	How many total centerline miles of roadway are managed by the DOT?	In Order from Largest to Smallest Number of Centerline Miles of Roadway Managed		
22	Massachusetts	Not Reported	Indiana	12,000	22
23	Michigan	9,691	Wisconsin	11,756	23
24	Minnesota	29,100	Alabama	11,005	24
25	Mississippi	13,000	Kansas	10,375	25
26	Missouri	32,000	Nebraska	9,952	26
27	Montana	Not Reported	Michigan	9,691	27
28	Nebraska	9,952	Iowa	9,355	28
29	Nevada	5,200	Colorado	9,148	29
30	New Hampshire	4,200	Oregon	7,500	30
31	New Jersey	2,322	North Dakota	7,382	31
32	New Mexico	64,060	Washington	7,000	32
33	New York	<b>115,000</b>	Wyoming	6,859	33
34	North Carolina	78,000	Arizona	6,500	34
35	North Dakota	7,382	Alaska	6,200	35
36	Ohio	19,290	Maryland	5,235	36
37	Oklahoma	12,300	Nevada	5,200	37
38	Oregon	7,500	Idaho	4,945	38
39	Pennsylvania	39,890	New Hampshire	4,200	39
40	Rhode Island	Not Reported	Connecticut	3,731	40
41	South Carolina	41,468	New Jersey	2,322	41
42	South Dakota	16,000	Washington DC	1,250	42
43	Tennessee	91,417	Utah	942	43
44	Texas	Not Reported	Hawaii	940	44
45	Utah	942	Delaware	Not Reported	45
46	Vermont	Not Reported	Maine	Not Reported	46
47	Virginia	67,763	Massachusetts	Not Reported	47
48	Washington	7,000	Montana	Not Reported	48
49	West Virginia	36,292	Texas	Not Reported	49
50	Wisconsin	11,756	Rhode Island	Not Reported	50
51	Wyoming	6,859	Vermont	Not Reported	51

\*District of Columbia (Washington DC) is a city entity not a state DOT Agency

\*\*NOTE: In Table 2, there are potential errors in the results presented and 7 states did not respond to this question. These errors could be due to a number of reasons such as: misunderstanding the question, the number of reported miles has increased significantly, the reported miles are both state managed and local-agency managed miles, etc. An error rate of +/- 10% should be assumed.

Independent verification of centerline miles of roadway contained in each DOT was conducted using data found on the FHWA website. The URL accessed to perform the verification was: <http://www.fhwa.dot.gov/policy/ohim/hs05/xls/ps1.xls>  
The table found on this website was condensed to include only Rural and Urban Mileage from each state.

By verifying the (2007) centerline miles reported on the survey to the FHWA site (2005 data), a percent difference was calculated and is shown in Table 3. As expected, most of the results are within a plus or minus 10% range of each other. Differences in centerline mileages are from a number of factors such as the results of the survey reported as of May, 2007 and the FHWA results reported as of October 2006. This indicates most of the survey data reported is accurate within plus or minus 10%.

Although independent verification of these “generally accepted” centerline miles was conducted, it is difficult at best to find exact mileage matches from two data sources due to many factors such as; (when) the year centerline miles are reported, (what) centerline miles includes such as only interstate and other principal and minor arterials, and (where) the geographic extent of centerline miles based on varying local agreements.



A total of 9 State Survey Respondents reported centerline miles that were greater than 10% difference from the 2006 FHWA publication. Time constraints prevented verification of centerline miles from these 9 states. However, future research could be conducted to obtain verification of centerline miles managed by each State. See Table 3 for results.

**Table 3 – Verification of Centerline Miles Reported**

#	State	2007 - Survey Reported Centerline Miles	October 2006 (Publication) - Highway Performance Monitoring System Statistics -- State Highway Agency-Owned Roadway System Measures Table (TABLE PS-1 -- Sheet 2 of 2)	Percent Difference
1	Alabama	11,005	10,955	0.45
2	Alaska	6,200	5,659	8.73
3	Arizona	6,500	6,800	-4.62
4	Arkansas	16,233	16,444	-1.30
5	California	15,000	15,213	-1.42
6	Colorado	9,148	9,106	0.46
7	Connecticut	3,731	3,717	0.38
8	Delaware	Not Reported	5,243	N/A
9	District of Columbia	1250	1,392	-11.36
10	Florida	12,069	12,040	0.24
11	Georgia	18,000	17,930	0.39
12	Hawaii	940	928	1.28
13	Idaho	4,945	4,957	-0.24
14	Illinois	16,000	16,103	-0.64
15	Indiana	12,000	11,183	6.81
16	Iowa	9,355	8,895	4.92
17	Kansas	10,375	10,370	0.05
18	Kentucky	27,511	27,510	0.00
19	Louisiana	16,700	16,693	0.04
20	Maine	Not Reported	8,548	N/A
21	Maryland	5,235	5,140	1.81
22	Massachusetts	Not Reported	2,849	N/A
23	Michigan	9,691	9,698	-0.07
24	Minnesota	29,100	11,871	59.21
25	Mississippi	13,000	10,896	16.18
26	Missouri	32,000	32,464	-1.45
27	Montana	Not Reported	10,789	N/A
28	Nebraska	9,952	9,975	-0.23
29	Nevada	5,200	5,399	-3.83
30	New Hampshire	4,200	3,975	5.36
31	New Jersey	2,322	2,321	0.04
32	New Mexico	64,060	11,990	81.28
33	New York	115,000	15,033	86.93
34	North Carolina	78,000	79,031	-1.32
35	North Dakota	7,382	7,382	0.00
36	Ohio	19,290	19,292	-0.01
37	Oklahoma	12,300	12,285	0.12
38	Oregon	7,500	7,532	-0.43
39	Pennsylvania	39,890	39,890	0.00
40	Rhode Island	Not Reported	1,102	N/A
41	South Carolina	41,468	41,391	0.19
42	South Dakota	16,000	7,873	50.79
43	Tennessee	91,417	13,817	84.89

**Table 3 – Verification of Centerline Miles Reported – Continued**

#	State	2007 - Survey Reported Centerline Miles	October 2006 (Publication) - Highway Performance Monitoring System Statistics -- State Highway Agency-Owned Roadway System Measures Table (TABLE PS-1 -- Sheet 2 of 2)	Percent Difference
44	Texas	Not Reported	79,648	N/A
45	Utah	942	5,858	-521.87
46	Vermont	Not Reported	2,634	N/A
47	Virginia	67,763	57,860	14.61
48	Washington	7,000	7,045	-0.64
49	West Virginia	36,292	33,987	6.35
50	Wisconsin	11,756	11,782	-0.22
51	Wyoming	6,859	6,757	1.49

Another question in the on-line survey asked DOT contacts to provide the number of Full-time Employees (FTE's), which included either internal or outsourced employees, required to manage their respective travel monitoring program. The results of this question provide an overall indication of the amount of staff and staff effort required to manage an Agencies travel monitoring program. Thus, the greater number of staff required to manage a travel monitoring program would indicate a greater effort. Overall results show a majority of the DOT respondents indicated they manage their operations, including data collection, processing, and dissemination, through internal state agency staff.

DOT respondents indicated **37%** of the Agency programs require between 6 and 10 state employees for data collection operations. The responses showed an overwhelming **71%** of DOT's have between 1 and 5 FTE's for data dissemination. Data collection operations are typically the largest part of a travel monitoring program and require more staff than any other part of the travel monitoring program. As expected, the number of travel monitoring staff results implies fewer resources are required to disseminate data than collect data. Also, **67%** of DOT respondents require between 1 and 5 state agency FTE's for data processing.

The staffing question results further support the fact that more staffing requirements are evident in State DOT's that require a large travel monitoring program. Results show that almost 55% (State Agency and Outsourced) of all DOT Agencies manage their data collection operations with greater than 11 staff members. This implies consistency with earlier centerline mileage question results described with 56% of all DOT's that fall into a large travel monitoring program category.

A total of 41 respondents answered the number of travel monitoring staff question. Figure 1 shows DOT respondent answer percentages.

**Figure 1 - Number of Travel Monitoring Staff**

Total number of State employees, (Full-time employees (FTE's)), contractors, or consultants, required to manage (or currently in charge of managing) the federally mandated traffic monitoring program?							
	None	1 to 5	6 to 10	11 to 20	21 to 50	50 to 100	Response Count
State Agency: Data Collection	2.2% (1)	21.7% (10)	<b>37.0% (17)</b>	30.4% (14)	8.7% (4)	0.0% (0)	46
State Agency: Data Processing	0.0% (0)	<b>67.4% (31)</b>	21.7% (10)	8.7% (4)	2.2% (1)	0.0% (0)	46
State Agency: Data Dissemination	8.9% (4)	<b>71.1% (32)</b>	15.6% (7)	2.2% (1)	2.2% (1)	0.0% (0)	45
Outsourced: Data Collection	<b>42.1% (16)</b>	28.9% (11)	13.2% (5)	5.3% (2)	7.9% (3)	2.6% (1)	38
Outsourced: Data Processing	<b>65.8% (25)</b>	28.9% (11)	5.3% (2)	0.0% (0)	0.0% (0)	0.0% (0)	38
Outsourced: Data Dissemination	<b>81.1% (30)</b>	13.5% (5)	5.4% (2)	0.0% (0)	0.0% (0)	0.0% (0)	37
	<i>answered question</i>						<b>46</b>

In another survey question, State respondents were asked to supply names of contractors and consultants that support the travel monitoring program management, operations, and staffing. Table 4 shows the responses for each State. If a State did not have any contractors or consultants to support their travel monitoring program, the table shows a non-applicable (N/A) response. If a State respondent skipped the question, a “No Response” is shown in the table.

A total of 13 States indicated their Agency does not hire contractors or consultants to support travel monitoring program management, operations, and staffing. A total of 4 States skipped this question, and results show that a number of different consultants and contractors are supporting DOT’s with their travel monitoring program and staffing activities.

One interesting response in Table 4 shown below is from the Pennsylvania DOT. The Pennsylvania DOT points out a unique approach of contracting with their Metropolitan Planning Organizations (MPO) and Rural Planning Organizations (RPO) to collect traffic data. This implies that only one State DOT is actively relying on local organizations to supplement their travel monitoring program.

Typically State DOT’s coordinate and share traffic data (only after data collection and processing are complete) with their local planning organizations. This Pennsylvania DOT unique approach of contracting with the local agencies may indicate a greater level of coordination between the DOT and their respective local organizations. DOT Agencies struggle with sharing or gathering data with local agencies due to the differences in type of data collected, quality, format and other data management issues.

One could assume if a DOT coordinates with other data suppliers and collectors, duplicated data collection, processing, and dissemination efforts would be minimized. Although questions related to coordinating with local agencies were not asked in this survey, results from this survey signify the need to further investigate other data sources such as the local agency data sources. Table 4 below shows the results from the contractor and consultant question.

**Table 4 - Contractors and Consultants List**

#	State Name	Name of contractor(s)/consultant(s)
1	Alabama	N/A
2	Alaska	The Boutet Company (Northern and Central Region traffic data) Westmann and Associates (Headquarters WIM data)
3	Arizona	Traffic Research & Analysis, Inc
4	Arkansas	The Traffic Group
5	California	N/A
6	Colorado	Traffic Data Services
7	Connecticut	N/A
8	Delaware	<b>No Response</b>
9	District of Columbia	N/A
10	Florida	Various District Offices using various consultants.
11	Georgia	Southern Traffic (for field collection) Mid Western Consulting (developed web site for displaying data) Northrop Grumman is working on a future traffic database solution.
12	Hawaii	1) Continuous Count Program Contractor: Econolite Control Products, Inc 2) Short-Term Program Contractor: The Traffic Group 3) WIM/Continuous Vehicle Classification (CVC) Contractor: International Road Dynamics
13	Idaho	N/A
14	Illinois	Gewalt Hamilton & Associates Terra Engineering
15	Indiana	N/A
16	Iowa	N/A
17	Kansas	N/A
18	Kentucky	Southern Traffic Services
19	Louisiana	Southern Traffic
20	Maine	<b>No Response</b>

**Table 4 – Contractors and Consultants List – Continued**

#	State Name	Name of contractor(s)/consultant(s)
21	Maryland	Synergy Systems and Services Whitney Bailey Cox and Magnani/The Traffic Group-Joint Venture Sbra Wang and Associates/Roadway data Systems-Joint Venture The RBA Group Johnson Mirmiran and Thompson A. Morton Thomas
22	Massachusetts	N/A
23	Michigan	N/A
24	Minnesota	N/A
25	Mississippi	Southern Traffic Services 2911 Westfield Road Gulf Breeze, FL 32563
26	Missouri	N/A
27	Montana	<b>No Response</b>
28	Nebraska	<b>No Response</b>
29	Nevada	Joe Wilkinson, Chaparal Systems provides the data processing software and support.
30	New Hampshire	NHDOT has a cooperative program to collect traffic data with the nine regional planning commissions in the state. For short-term data collection: The Louis Berger Group (Northern NJ) Michael Baker Jr., Inc. (Central NJ) McCormick Taylor, Inc. (Southern NJ) Philadelphia MPO does counts in four New Jersey counties in addition to NJDOT's consultants.
31	New Jersey	
32	New Mexico	All Traffic Data CO DH Consulting Inc.
33	New York	International Road Dynamics (CC) Planert Utility (CC) Tri-State (SC) Traffic Group (SC) ATI (SC)
34	North Carolina	N/A
35	North Dakota	<b>No Response</b>
36	Ohio	Count Electronics - Urichsville, Ohio. Used to conduct special request studies and turning movement counts.
37	Oklahoma	International Road Dynamics - AVC and WIM station installation and maintenance GeoDecisions - Database and GIS Development for data dissemination
38	Oregon	Wegehaupt, Gerald Quality Counts  We use our Metropolitan Planning Organizations (MPO)and our Rural Planning Organizations (RPO) to collect traffic data for us. These organizations receive funding through their United Planning and Work Programs to perform this task. We also have a statewide traffic counting services that is used to collect traffic data. This contract can be used by any governmental agency to collect traffic counts. Vendors submit bids based on the boundaries of the Department's Engineering Districts. Vendors have the option to bid on as many of the Engineering Districts that they choose. Each traffic counting season we send a request to each vendor on the contract for a quote on the number of traffic counts in that Engineering District. Quotes per count cannot exceed the bid on the contract. We select vendors based on these quotes. Currently, we are using three vendors from this contract: Tri-state, Count Electronics and McMahon Associates, Inc.
39	Pennsylvania	
40	Rhode Island	<b>No Response</b>
41	South Carolina	N/A
42	South Dakota	<b>No Response</b>
43	Tennessee	Kimley-Horn and Associates, Inc. Consultant (Highway-Rail crossing Counts) Sain Associates,Inc. Others as needed.
44	Texas	<b>No Response</b>
45	Utah	<b>No Response</b>
46	Vermont	N/A
47	Virginia	Digital Traffic Systems, Inc. The Traffic Group, Inc. Tri-State Traffic Data
48	Washington	N/A
49	West Virginia	The Traffic Group
50	Wisconsin	N/A
51	Wyoming	<b>No Response</b>

DOT representatives were asked to provide a Yes or No response to whether or not their DOT has a formal quality control inspection program. The overall purpose of a quality control inspection program would be to check the quality of a contractor's data or fieldwork. The question results reveal the need for more management resources to inspect the quality of a contractor's work. Since travel monitoring programs are required to produce the most accurate data as possible, a travel monitoring program with formal inspection program activities only adds credence to the overall data quality produced by the State DOT.

Approximately **39%** of DOT respondents said they have a formal inspection program in place to check the quality of a contractor's data or fieldwork and **20%** of respondents said they do not have a formal inspection program in place at this time.

For DOT's that do not have a contractor that collects data, this question is not applicable which is represented by 41% of respondents. Figure 2 below shows the summary of results as well as percentages of responses while Table 5 below provides detailed responses from DOT representatives.

**Figure 2 - Inspection Program**

If contracted staff, does the DOT have a formal inspection program to check the quality of contractor data and/or fieldwork?			Response Percent	Response Count
N/A			41.5%	17
No			19.5%	8
Yes			39.0%	16
<b>answered question</b>				<b>41</b>

Detailed responses show a few unique results worth highlighting. For example, the Colorado DOT rides along with the contractor during some inspections while periodically and randomly conducting other inspections. In Maryland, a certified Professional Engineer (PE) is required to sign off on all finalized traffic counts. In Pennsylvania, their MPO traffic data collection contracts require the traffic count to be validated prior to issuing a vendor payment.

**Table 5 - Inspection Program Details**

#	State Name	If contracted staff, does the DOT have a formal inspection program to check the quality of contractor data and/or fieldwork? Yes (please explain)
1	Alabama	N/A
2	Alaska	Yes
3	Arizona	No
4	Arkansas	No
5	California	N/A
6	Colorado	The DOT does a ride-a-long inspection with the contractor as they set out counters to check for accurate location and layout. The DOT does this at the start of the season to assure that new hire contractor personal know the process. The DOT does periodic field inspection of setout equipment to assure that the count is in the correct location and that the equipment is set out correct for the type of count taken at the location. The DOT tries to do these inspections once a week or every other week.
7	Connecticut	N/A
8	Delaware	<b>No Response</b>
9	District of Columbia	N/A
10	Florida	Traffic count/classification machines for portable sites are certified and signed off on. Permanent installations are check by field technicians.
11	Georgia	All incoming data is tested using our QC program.
12	Hawaii	No Comments added
13	Idaho	N/A
14	Illinois	We get the raw information from the contractor and it goes through the same QA/QC as if IDOT performed the counts. Normally, the consultants additional QA/QC will eliminate bad count data before it is submitted to IDOT.
15	Indiana	Traffic counts are reviewed for completeness and accuracy by two members of the staff. In the near future, the counts will be submitted electronically and there will be many electronic checks for completeness and accuracy.
16	Iowa	N/A
17	Kansas	N/A
18	Kentucky	Data is validated and processed in-house. We compare the data to prior year's data and request a recount if the discrepancy is too great.

**Table 5 – Inspection Program Details – Continued**








#	State Name	If contracted staff, does the DOT have a formal inspection program to check the quality of contractor data and/or fieldwork? Yes (please explain)
19	Louisiana	No
20	Maine	<b>No Response</b>
21	Maryland	1. Our HPMS data collection field crews audit the traffic counts during execution. 2. We require all counts to be reviewed and certified by a Maryland licensed P.E. 3. Random equipment validation spot checks
22	Massachusetts	N/A
23	Michigan	N/A
24	Minnesota	N/A
25	Mississippi	An MDOT employee must be present during all phases of construction. In addition, a continuous 10 day polling acceptance and verification must be approved for new ATR site installation.
26	Missouri	N/A
27	Montana	<b>No Response</b>
28	Nebraska	<b>No Response</b>
29	Nevada	N/A
30	New Hampshire	We review the counts for consistency with previous counts. Has developed an in house program to flag problem data.
31	New Jersey	No
32	New Mexico	NM State Standards applies to all data
33	New York	Both our CC and SC contractors are paid on days of acceptable counts. If a short count is not accepted by my staff, the contractor must take another count at his expense. For the CC contractors, they are paid on actual days of acceptable counts, it is up to the contractor to maintain the sites in proper working order to be paid.
34	North Carolina	<b>No Response</b>
35	North Dakota	<b>No Response</b>
36	Ohio	Data collected by the contractor is reviewed by office staff prior to any payment. All recounts completed prior to payment. Random field inspections completed by office manager.
37	Oklahoma	No
38	Oregon	No
39	Pennsylvania	Our traffic counting partnership with the MPOs and RPOs dates back to 1980s. If there is a question concerning the data after it is processed through the Department's mainframe computer system, this system has edits programmed into it that a count must pass before it is accepted, the MPO or RPO will be contacted about the count. One of the options available to the Department's traffic analyst would be to have the count reset. We have a slightly different process in place for counts taken by vendors from our Traffic Counting Services contract. After a vendor submits a count to the Department, we have 30 days to process the count and determine the quality of the data. These counts are uploaded to the same mainframe computer program as the counts taken by the MPOs and RPOs. If the traffic analyst makes the determination that the data is bad, the vendor is notified. The contract states that vendors are not paid for data we do not accept. The only way for the vendor to be paid for this count is to retake it.
40	Rhode Island	<b>No Response</b>
41	South Carolina	N/A
42	South Dakota	<b>No Response</b>
43	Tennessee	No
44	Texas	<b>No Response</b>
45	Utah	<b>No Response</b>
46	Vermont	N/A
47	Virginia	Inspections are conducted on contract work.
48	Washington	N/A
49	West Virginia	No
50	Wisconsin	N/A
51	Wyoming	N/A

\*\*Note – Respondents were allowed to add responses to this question without restrictions and therefore some text responses are longer than others

## 5. Short-term Programs – Program Management, Operations, and Staffing

The on-line survey requested that DOT respondents provide information related to their short-term traffic counting programs. Each respondent was asked to indicate what days of the week the DOT collected short-term traffic counts. As expected, all the respondents who answered the question indicated their Agency collects short-term traffic counts on Tuesday, Wednesday, and Thursday. However, **94%** of respondents collect short-term traffic counts on Monday and approximately **15%** collect traffic counts on Saturday and Sunday. This implies non-standard traffic data collection business practices. Some reasons for these non-standard business practices include counting in areas affected by irregular traffic patterns such as recreational, seasonal, and other geographic specific reasons. Figure 3 shows the short-term traffic data collection day of the week results.

**Figure 3 - Short-Term Traffic Data Collection Days**

What days of the week do you collect short-term traffic counts?			
		Response Percent	Response Count
Monday		93.5%	43
Tuesday		100.0%	46
Wednesday		100.0%	46
Thursday		100.0%	46
Friday		39.1%	18
Saturday		15.2%	7
Sunday		15.2%	7
<i>answered question</i>			<b>46</b>

In another survey question, respondents were asked if their DOT collects short-term traffic counts all year around. Results showed that approximately **59%** collect traffic counts year around. Differences in short-term traffic data collection days are attributed to DOT geographic location, weather, number of centerline miles to sample, and recreational differences. Figure 4 shows the responses.

**Figure 4 - Short-term Traffic Data Seasons**

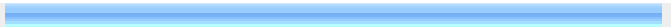

Do you collect short-term traffic counts all year around?			
		Response Percent	Response Count
No		41.3%	19
Yes		58.7%	27
<i>answered question</i>			<b>46</b>

Figure 4 is a summary of traffic data seasons while detailed responses are shown in Table 6 – Short-term Traffic Data Season. Detailed results indicate a difference in business practices for defining a count season. Some DOT's do not define count seasons and others define a count season from a given starting and ending month. The responses to this question are different depending on the geographic location of the DOT. In addition, the count season can vary within the Agency depending on the location and size of the DOT. One of the key factors to these differences is the variation in climate depending on the geographic location.

**Table 6 – Short-term Traffic Data Season Details**

#	State Name	Yes or No, Do you collect Short Term Counts all year around? If so, please explain.
1	Alabama	We do not define count seasons.
2	Alaska	No. Seasonal counts from May to September, weather permitting
3	Arizona	All weeks/months of year except last half of December and first half of following January
4	Arkansas	Months are used, not seasons.
5	California	Short term are collected every month
6	Colorado	No
7	Connecticut	No
8	Delaware	<b>No Response</b>
9	District of Columbia	No
10	Florida	January 2nd (or first weekday after New Year's Day) through November 15th (our field data collection cut-off date).
11	Georgia	We generally count January-October. Normally within a 12-month period. For Contractor is a 12-month period for selected state and county routes. For HDOT survey unit, it's a different cycle per islands (Oahu is every year and the neighbor islands on a two-year cycle). Oahu and Hawaii are surveyed during even number years, and Maui, Kauai, Molokai and Lanai are surveyed together in same year for with Oahu during the odd year
12	Hawaii	
13	Idaho	No
14	Illinois	April - October.
15	Indiana	We count the same all year. (The explanation box would seem more appropriate for the "no" response).
16	Iowa	No
17	Kansas	Count by Fiscal Year
18	Kentucky	No
19	Louisiana	Winter (November, December, January and February), Spring (March and April) Summer (May, June, July and August) and Fall (September and October)
20	Maine	No
21	Maryland	No
22	Massachusetts	We count all year if weather conditions allow.
23	Michigan	No
24	Minnesota	No
25	Mississippi	MDOT conducts short-term traffic counts January-November
26	Missouri	Yes. April thru November.
27	Montana	<b>No Response</b>
28	Nebraska	No
29	Nevada	Varies by Geographic and climatic region.
30	New Hampshire	No
31	New Jersey	January through Thanksgiving, weather permitting. Also through December 15, if necessary.
32	New Mexico	All months of the year
33	New York	No
34	North Carolina	We factor data by day of week and month. We collect counts year round and do not have seasons. We do not collect data on holidays or during events (weather, sports, social, etc.).
35	North Dakota	No
36	Ohio	80% of district offices collect during peak summer time period...May - October. 20% of district offices collect all year round.
37	Oklahoma	All seasons
38	Oregon	No
39	Pennsylvania	No
40	Rhode Island	<b>No Response</b>
41	South Carolina	No. Count year is January-October.
42	South Dakota	April to Oct
43	Tennessee	All months of the year.
44	Texas	<b>No Response</b>
45	Utah	<b>No Response</b>
46	Vermont	No
47	Virginia	February through November (Thanksgiving). Use monthly factors.



**Table 6 – Short-term Traffic Data Season Details – Continued**

#	State Name	Yes or No, Do you collect Short Term Counts all year around? If so, please explain.
48	Washington	We collect HPMS March - November. We ramp balance in December - February.
49	West Virginia	March thru October
50	Wisconsin	Yes (Very few Nov – Mar)
51	Wyoming	Manual counts done 4 times a year by calendar quarter. Urban coverage counts done March - May. Statewide coverage counts done June - September. Special studies done anytime the weather allows.

Additional short-term program questions asked in the survey were related to the quantity of travel monitoring sites. Results are displayed in Table 7 by type of monitoring site. For example, the range of portable volume count sites from all respondents includes the lowest of **300** total sites in Vermont to the highest of **80,000** including local roads in Virginia. This variation in number of monitoring sites implies non-standard business practices across DOT Agencies.

Results displayed in Table 7 shows that not all DOT Agencies collect portable classification bin counts and a small number of states collect portable WIM data. There are a number of DOT respondents that indicated their Agency did not support portable classification or WIM data collection in the field due to the reliability, quality, and lack of technological capabilities for collecting these types of portable travel monitoring data. This implies a need to study more portable travel monitoring technologies and data processing procedures to provide a valuable solution for collecting portable classification and WIM data.

Several DOT’s monitor traffic for a variety of reasons that increase or decrease the overall total number of monitoring stations. For example, DOT’s add monitoring stations to comply with FHWA requirements, to provide pavement design engineers with data, to support environmental impact and other studies, as well as other reasons specific to the Agency. Without standard short-term data collection site selection industry practices, a State DOT is left to estimate the number of sites based on a number of different reasons such as Agencies priorities and adequate spatial geographic coverage.

Although specific site selection questions were not asked of DOT’s, the results shown in Table 7 indicate a need to further investigate site selection differences. Future surveys could ask site selection questions that may include; does the DOT follow standard site selection business processes, how are sites selected, when are sites taken off or added to the counting schedule, what criteria is used to evaluate site suitability, and does the DOT consider the number of staff when adding or deleting sites and if so describe this criterion.

**Table 7 – Short-term Traffic Data Quantity of Sites**

#	State Name	SHORT-TERM PROGRAM TRAFFIC COUNTING QUESTIONS How many...							
		total portable volume count sites	annual portable volume count sites	total portable classification axel count sites	annual portable classification axel count sites	total portable classification bin count sites	annual portable classification bin count sites	total portable WIM count sites	annual portable WIM count sites
1	Alabama	8,500	5,000	No Response	No Response	No Response	No Response	No Response	No Response
4	Alaska	5,600	2,000	0	0	200	100	0	0
2	Arizona	1200	1200	200	200	200	200	0	0
3	Arkansas	8,200	8,200	1,200	1,200	0	0	0	0
5	California	16,500	5,500	varies	No Response	No Response	No Response	0	0
6	Colorado	2200 average annually 3 year cycle	700 average annually 3 year cycle	1000 average annually 3 year cycle	300 average annually 3 year cycle	1000 average annually 3 year cycle	300 average annually 3 year cycle	35 average annually 5 year cycle	none
7	Connecticut	9600	3200	240	80	60	60	90	30
8	Delaware	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response
9	District of Columbia	100	100	0	0	0	0	4	4
10	Florida	6529	6529	3036	3036	2830	2830	0	0
11	Georgia	18,000	10,300	n/a	n/a	1,100	1,100	90	30 (3 year cycle)
12	Hawaii	2,052	1005 in 2006	810	398 in 2006	No Response	No Response	No Response	No Response
13	Idaho	unknown	2500 average	unknown	200 average	0	0	0	0

Table 7 – Short-term Traffic Data Quantity of Sites – Continued

#	State Name	SHORT-TERM PROGRAM TRAFFIC COUNTING QUESTIONS How many...							
		total portable volume count sites	annual portable volume count sites	total portable classification axel count sites	annual portable classification axel count sites	total portable classification bin count sites	annual portable classification bin count sites	total portable WIM count sites	annual portable WIM count sites
14	Illinois	10000	10000	5000 (we use length based classification, not axle)	5000 (we use length based classification, not axle)	0	0	0	0
15	Indiana	10337	3445	24118	8040	0	0	0	0
16	Iowa	11200	2800	31600	7900	0	0	0	0
17	Kansas	30,000	11,000 (includes off State System)	No Response	No Response	1000	300	90	25
18	Kentucky	13,500	5,000	No Response	No Response	No Response	No Response	No Response	No Response
19	Louisiana	55,000	0	55,000	0	300	0	100	0
20	Maine	4100	3800	0	0	150	145	0	0
21	Maryland	2031	Approx 677	1609	Approx 536	0	0	0	0
22	Massachusetts	No Response	No Response	No Response	No Response	No Response	No Response	0	0
23	Michigan	5080	2540	1100	550	0	0	0	0
24	Minnesota	32000	10000	1200	200	0	0	0	0
25	Mississippi	9,000	~3,000	~3,000	~1,000	n/a	n/a	~200	~70
26	Missouri	12,000	4,000	3,000	No Response	1,000	No Response	No Response	No Response
27	Montana	4000	3000	No Response	No Response	No Response	No Response	No Response	No Response
28	Nebraska	Approximately 8000	Approximately 4200	Nearly all are axle counts	Nearly all are axle counts	Very limited portable classification	Very limited portable classification	75	33
29	Nevada	4,000	2,500	240	80	240	80	90	30
30	New Hampshire	6000	2000	300	100	No Response	No Response	No Response	No Response
31	New Jersey	4,879	about one-third of above	1,204 (including 194 manual)	about one-third of above	no length bin class at this time	see above	No portable	No portable
32	New Mexico	13366	2000	0	0	33% of total counts sites	33% of total annual counts	0	0
33	New York	28,150 highway segments in NYS have station numbers assigned, this includes on and off state system. There are a total of 9,900 short count segments (both on state and HPMS) counted on a 3 year cycle	6200	28,150 highway segments in NYS have station numbers assigned, this includes on and off state system highways	1700	N/A	N/A	0	0

**Table 7 – Short-term Traffic Data Quantity of Sites – Continued**

#	State Name	SHORT-TERM PROGRAM TRAFFIC COUNTING QUESTIONS How many...							
		total portable volume count sites	annual portable volume count sites	total portable classification axel count sites	annual portable classification axel count sites	total portable classification bin count sites	annual portable classification bin count sites	total portable WIM count sites	annual portable WIM count sites
34	North Carolina	42,000	25,000	0	0	1,000	500	0	0
35	North Dakota	2495	2495	302	302	No Response	No Response	0	0
36	Ohio	3,460	1/3 of Total	10,259 (13 vehicle classifications)	1/3/of Total	0	0	0	0
37	Oklahoma	17,000	8,500	10	10	0	0	0	0
38	Oregon	4500	1500	300	100	0	0	0	0
39	Pennsylvania	19,565	4,550	8,385	1,950	0	0	0	0
40	Rhode Island	1000	1000	300	300	0	0	0	0
41	South Carolina	18,000	12,000	300	100	No Response	No Response	90	30
42	South Dakota	5810	varies different cycles around 2000	584	584	584	584	0	0
43	Tennessee	14,519	12,173 (Active Stations)	609	203	0	14	94	31
44	Texas	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response
45	Utah	No Response	No Response	No Response	No Response	No Response	No Response	No Response	No Response
46	Vermont	300	No Response	No Response	No Response	700	No Response	No Response	No Response
47	Virginia	80,000 - Local roads	14000 - Local Roads	11000	3600	6000	2000	0 - I don't believe portable WIM is reliable	0
48	Washington	1992	664	810	270	?	?	0	0
49	West Virginia	11000	3600	No Response	No Response	14400	480	0	0
50	Wisconsin	25,600	5,000 - 9,000	460	155	0	0	0	0
51	Wyoming	8000	3180	600	120	0	0	0	0

**6. Permanent/Continuous Count Programs – Program Management, Operations, and Staffing**

The on-line survey requested that DOT respondents provide information related to their Agencies permanent traffic counting program. One of the questions asked was related to the number of permanent traffic counting sites by type of data collected.

Response results show a direct relationship between the number of permanent traffic counting sites within a DOT and the number of centerline miles of roadway managed by the Agency. This correlation implies the larger the travel monitoring program, the more travel monitoring activities required such as maintaining more Automated Traffic Recorder (ATR) sites. This is evident upon reviewing the results where a total of 7 States that have over 200 total ATR permanent/continuous sites with 5 of these States requiring a large travel monitoring program with over 10,000 centerline miles of roadway to manage.

Following this correlation, additional results show a total of 8 States have more than 100 volume and classification ATR's and 6 out of 8 of these States are the same States referenced as having over 200 total ATR permanent/continuous sites requiring a larger travel monitoring program. Interestingly only 3 States (California, Indiana, and New Jersey) have greater than 50 permanent/continuous WIM ATR sites. Differences in the number of sites can be attributed to geographic location, the amount of truck traffic within a state, climate, local political priorities, and other reasons.

Although survey results illustrate a correlation between the number of permanent traffic counting sites within a DOT and the number of centerline miles of roadway managed, questions were not asked to determine if there is a standard method for determining the total number of ATR sites. Additional research and survey questions could provide additional insight for determining ATR quantities and site selection criterion. Examples of site selection may include determining the number of ATR

sites by functional classification, centerline mile, or Highway Performance Monitoring System (HPMS) segment break of roadway.

In the permanent count program results (Table 8), the highest and lowest numbers are highlighted. The range of total permanent sites from all respondents includes the lowest of **31** total sites in Tennessee to the highest of **2,728** in California.

**Table 8 – Number of Permanent Traffic Count Sites**

Permanent/Continuous Traffic Program Counting Questions How many...					
#	State Name	total ATR (permanent/continuous) sites	volume only ATR (permanent/continuous) sites	volume and classification ATR (permanent/continuous) sites	WIM ATR (permanent/continuous) sites
1	Alabama	115	92	20	3
2	Alaska	100	60	40	10
3	Arizona	100	5	95	0
4	Arkansas	60	10	1	49
5	California	<b>2728</b>	1710	1854	97
6	Colorado	106	4	85	17
7	Connecticut	40	16	24	0
8	Delaware	No Response	No Response	No Response	No Response
9	District of Columbia	0	15	No Response	4
10	Florida	298	76	188	34
11	Georgia	313	147--with plans to upgrade these to class	166	0
12	Hawaii	26	18	8	7
13	Idaho	203	57	125	21
14	Illinois	85	45	40	1
15	Indiana	125	3	71	51
16	Iowa	156	47	146	35
17	Kansas	110	90	12	8
18	Kentucky	78	No Response	No Response	No Response
19	Louisiana	63	63	0	0
20	Maine	70	44	14	12
21	Maryland	79 of which 11 are down	17	51	6 of which 5 are down
22	Massachusetts	212	212	0	4
23	Michigan	145	105	6	39
24	Minnesota	76	46	30	7
25	Mississippi	77	5	57	15
26	Missouri	80	22	45	13
27	Montana	No Response	No Response	No Response	No Response
28	Nebraska	61	13	48	0
29	Nevada	110	104	2	4
30	New Hampshire	55	55	No Response	3
31	New Jersey	171	90	13	68
32	New Mexico	148	75	54	19
33	New York	176	62	86	22
34	North Carolina	130	85	4	45
35	North Dakota	48	12	48	12
36	Ohio	200	30	125 (70 Length, 55 Axle Class)	45
37	Oklahoma	83	0	62	21
38	Oregon	172	139	11	22
39	Pennsylvania	81	63	5	13

**Table 8 – Number of Permanent Traffic Count Sites – Continued**

#	Permanent/Continuous Traffic Program Counting Questions How many...				
	State Name	total ATR (permanent/continuous) sites	volume only ATR (permanent/continuous) sites	volume and classification ATR (permanent/continuous) sites	WIM ATR (permanent/continuous) sites
40	Rhode Island	No Response	41	0	7
41	South Carolina	149	3	146	16
42	South Dakota	65	29	21	15
43	Tennessee	31	17	14	0
44	Texas	No Response	No Response	No Response	No Response
45	Utah	95	22	70	3
46	Vermont	65	61	4	16
47	Virginia	330	20	300	10
48	Washington	160	2	124	34
49	West Virginia	47	47	47	29
50	**Wisconsin	276	233	43	21
51	Wyoming	113	52	52	9

\* Note this question was a 4-part question and results show a No Response if any part of the question was skipped. Also, responses with a zero were given by the DOT AGENCY respondent. Respondents were allowed to enter only limited amount of text in their answers.

\*\*Wisconsin indicated (21 permanent installations, 2 counted continuously, collection devices rotate between the other sites

## 7. Permanent/Continuous Count Programs

Questions in the on-line survey included software, hardware, and technology questions related to a DOT’s continuous count program. The type and amount of software, hardware and other technology tools that a DOT has utilizes is a good predictor of travel monitoring program size. The more funding and staff an Agency has access to, the more technology the DOT can implement.

Although most DOT’s use a standard polling software for gathering traffic data from permanent traffic counters, there are limited options for using standard or off-the-shelf software products for processing the travel monitoring data. Without standard data processes and electronic processing tools, ensuring traffic data within every State DOT Agency is processed with the same parameters is nearly impossible. This indicates a need for standardized software products and business practices surrounding the finalization and utilization of travel monitoring data processing software.

### 7.1 Automated Polling Software Summary

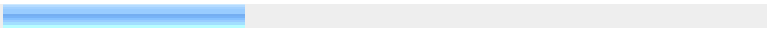


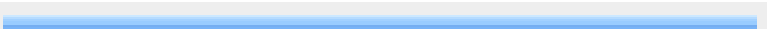
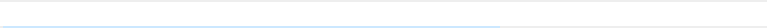
DOT respondents were specifically asked to indicate what polling software they utilize to download permanent traffic data. Polling activities appear to be standardized for the most part. Only a couple of DOT respondents utilize their own in-house software solution for polling ATR’s.

Most DOT’s use polling software that is driven by the type of hardware purchased which includes a proprietary vendor specific software solution. **48%** of respondents indicated the DOT utilizes Peek’s TOPS software product to download permanent traffic data. Also **48%** of respondents indicated the DOT utilizes IRD’s i-Analyze, RoadReporter, Trafman, and Telecom-TT-Link software products.

A number of software and hardware related questions were asked in the survey. However, more research is necessary to capture information related to installation, configuration, and implementation of software and hardware systems utilized. Additional survey questions could provide a greater understanding of how DOT’s are integrating, implementing, and providing access to hardware and software technologies in their traffic data processing and dissemination activities.

Figure 5 shows the specific responses to the automated polling software question.

**Figure 5 - Automated Polling Software Responses Summary**

What automated polling software do you use to download permanent traffic data?			Response Percent	Response Count
Centurion			15.9%	7
<b>TOPS (Peek)</b>			<b>47.7%</b>	21
ECM (wEiCoMe)			4.6%	2
<b>IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)</b>			<b>47.7%</b>	21
Other (please specify)			31.8%	14
			<b>answered question</b>	<b>44</b>

**7.2 Automated Polling Details**

Each individual DOT representative was given a chance to indicate what automated polling software their Agency utilizes. Results of this question show that most respondents indicated their Agency utilizes some form of automated polling software. Table 9 shows a list of the responses indicating the polling software utilized by DOT's to download permanent traffic data.

**Table 9 – Automated Polling Software Products**

#	State Name	What automated polling software do you use to download permanent traffic data?
1	Alabama	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link), TOPS (Peek), DataCollector from Wavetronix
2	Alaska	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link), TOPS (Peek)
3	Arizona	TOPS (Peek)
4	Arkansas	TOPS (Peek)
5	California	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link), TOPS (Peek), PAT Reporter
6	Colorado	Centurion, ECM (wEiCoMe)
7	Connecticut	TOPS (Peek)
8	Delaware	<b>No Response</b>
9	District of Columbia	Centurion, IRD (I-Analyze, Trafman, Telecom-TT-link),
10	*Florida	Custom written
11	Georgia	TOPS (Peek)
12	Hawaii	TOPS (Peek), IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)
13	Idaho	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)
14	Illinois	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)
15	Indiana	Centurion, IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)
16	Iowa	TOPS (Peek)
17	Kansas	Centurion, IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link), ECM (wEiCoMe)
18	Kentucky	TOPS (Peek)
19	Louisiana	TOPS (Peek)
20	Maine	Peek TDP, but will upgrade to TOPS
21	Maryland	TOPS (Peek)
22	Massachusetts	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)
23	Michigan	In-house written application
24	Minnesota	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)
25	Mississippi	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link), TOPS (Peek)
26	Missouri	TOPS (Peek), IRD (I-Analyze)
27	Montana	<b>No Response</b>
28	Nebraska	TT-Link, Trafman
29	Nevada	TRADAS from Chaparral
30	New Hampshire	<b>No Response</b>
31	New Jersey	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link), TOPS (Peek)
32	New Mexico	TDP (Peek)
33	New York	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)
34	North Carolina	TOPS (Peek)

\*FDOT offered to share their software with other states in need of polling software

**Table 9 – Automated Polling Software Products - Continued**

State Name	What automated polling software do you use to download permanent traffic data?	
35	North Dakota	TOPS (Peek)
36	Ohio	Centurion
37	Oklahoma	TOPS (Peek)
38	Oregon	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link), Translink
39	Pennsylvania	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)
40	Rhode Island	<b>No Response</b>
41	South Carolina	Traffic Polling and Analysis System (TPAS) developed by Northrop Grumman Corporation.
42	South Dakota	TOPS (Peek)
43	Tennessee	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link), TOPS (Peek)
44	Texas	<b>No Response</b>
45	Utah	<b>No Response</b>
46	Vermont	<b>No Response</b>
47	Virginia	TOPS (Peek)
48	Washington	Centurion, IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)
49	West Virginia	PAT
50	Wisconsin	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link), Other TDP (Peek)
51	Wyoming	Centurion, IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)

Results from the automated polling question indicate the majority of DOT's use automated polling software from vendors that is typically packaged with the purchase of traffic counting hardware. This indicates standard software tools are used for getting traffic data from the hardware in the field to the central traffic data repository where the data would then need to be processed. The Florida DOT (FDOT) and Michigan DOT indicated their Agencies use custom written (in-house) software applications for polling.

DOT respondents were given an opportunity to indicate if their DOT utilizes other software for automated polling. Even with a few additional responses as shown in Table 10, a majority of DOT's use standard software products to poll ATR sites.

**Table 10 – Other Automated Polling Software Products**

#	State Name	Other Software for Automated Polling (please specify)
1	Alabama	DataCollector from Wavetronix
2	Alaska	N/A
3	Arizona	N/A
4	Arkansas	N/A
5	California	PAT Reporter
6	Colorado	N/A
7	Connecticut	N/A
8	Delaware	<b>No Response</b>
9	District of Columbia	N/A
10	Florida	Custom written
11	Georgia	We have a vendor (mid western consulting) who provides us with a web site for displaying data. The web site still has bugs in it and we are tweaking the bugs.  Microsoft EXCEL macros: VTC Surveys and COUNT-3 (Lotus Macros): Volume Surveys and PAT America DAW software: Truck weight surveys on PAT America equipment and FHWA Traffic Volume Trends (TVT): Volume data from CTM sites and PETRA – VTC surveys
12	Hawaii	
13	Idaho	N/A
14	Illinois	Internal ACCESS developed database
15	Indiana	N/A
16	Iowa	Currently in-house automation transitioning to TRADAS
17	Kansas	N/A
18	Kentucky	Peek TDP
19	Louisiana	N/A
20	Maine	Microsoft Excel
21	Maryland	N/A

**Table 10 – Other Automated Polling Software Products - Continued**





#	State Name	Other Software for Automated Polling (please specify)
22	Massachusetts	N/A
23	Michigan	We developed the software ourselves.
24	Minnesota	N/A
25	Mississippi	N/A
26	Missouri	N/A
27	Montana	N/A
28	Nebraska	All written in-house
29	Nevada	TRADAS from Chaparral
30	New Hampshire	Software program developed in house
31	New Jersey	In-house mainframe and TRADAS
32	New Mexico	TRADAS developed by Chaparral
33	New York	N/A
34	North Carolina	N/A
35	North Dakota	in house product
36	Ohio	N/A
37	Oklahoma	N/A
38	Oregon	N/A
39	Pennsylvania	N/A
40	Rhode Island	N/A
41	South Carolina	N/A
42	South Dakota	N/A
43	Tennessee	Advanced traffic Data Analysis Management (ADAM)
44	Texas	<b>No Response</b>
45	Utah	N/A
46	Vermont	N/A
47	Virginia	N/A
48	Washington	Internal Mainframe Legacy System
49	West Virginia	PAT
50	Wisconsin	N/A
51	Wyoming	RFP in progress

**7.3 Data Collection Interval**

Another question in the survey included the request to provide information about data collection intervals. These data collection interval questions were meant to provide an indication of how each DOT filters, combines, and processes data from a continuous counting station.

DOT representatives were asked what their Agency data collection intervals were and **80%** of respondents indicated they collect data at 60 minute intervals. Another **17%** of respondents indicated the DOT collects data at 15 minute intervals. See the response in Figure 6 for specific details. This variation in data collection intervals indicates yet another non-standard business practice within the data collection and processing of travel monitoring data.

**Figure 6 - Data Collection Interval Percentages**

If the DOT collects permanent / continuous ATR data, at what interval does the DOT collect data?			Response Percent	Response Count
N/A			0.0%	0
15 minute			17.4%	8
30 minute			2.2%	1
<b>60 minute</b>			<b>80.4%</b>	<b>37</b>
Other (please specify)			13.0%	6
<b>answered question</b>				<b>46</b>

**8. Year-end Processing of Traffic Data**



At the end of each traffic data collection calendar year, each DOT is required to produce a number of statistics for the Highway Performance Monitoring System (HPMS) report as well as other internal reports. Travel monitoring data collected throughout the year is used to calculate Average Annual Daily Traffic (AADT) numbers, volume to capacity (V/C) ratios, and other critically important traffic statistics. Therefore, a number of questions in the on-line survey were related to year-end processing of traffic data. The responses for these questions can be found below.

### 8.1 Automated Procedures for Data Processing

When asked if the DOT currently utilizes automated procedures to finalize monthly and year-end traffic data, **83%** of the respondents indicated their Agency does not have fully automated procedures (from beginning to the end).

Additionally, of the DOT Agencies (17%) who utilize automated procedures for monthly and year-end traffic data processing were asked to indicate what software was utilized for this activity. Results showed that of the almost 63% of DOT's that use automated procedures, a customized product has been developed specifically for the Agencies' use. Only 11% of respondents indicated their DOT utilizes an off-the-shelf product. These results again imply a need to build standard software tools for monthly and year-end traffic data processing. Comparing data across State DOT's is difficult due to differences in how data processing software is implemented. Additional research could provide strengths and weaknesses of using customized in-house software products versus off-the-shelf solutions. In general, DOT's require longer timeframes to build software and have a difficult time retaining qualified staff to maintain software but an off-the-shelf solution can limit the DOT's ability to control software development processes.

**Figure 7 - Monthly and Year-end Data Processing Software Summary**

What software do you use for processing monthly and year end traffic data?			
		Response Percent	Response Count
	N/A	0.0%	0
	<b>Customized Product,</b>	<b>63.0%</b>	<b>29</b>
	Off-the-Shelf,	10.9%	5
	Vendor Specific Product	32.6%	15
	Other (please specify)	34.8%	16
<b>answered question</b>			<b>46</b>

Figure 7 shows a summary of the monthly and year-end traffic data processing software and Table 11 shows the details of data processing software utilized by DOT Agencies. Every DOT respondent was given the opportunity to specify other software used for processing monthly and year-end traffic data which is shown in the Other (please specify) column below. Individual responses can be found in Table 11.

**Table 11 – Data Processing Software Details**

#	State Name	What software do you use for processing monthly and year end traffic data?			
		Customized Product	Off-the-Shelf	Vendor Specific Product	Other (please specify)
1	Alabama	X			
2	Alaska	X			Tradas
3	Arizona			X	
4	Arkansas	X			
5	California	X			
6	Colorado	X		X	
7	Connecticut	X			

**Table 11 – Data Processing Software Details – Continued**

#	State Name	What software do you use for processing monthly and year end traffic data?			
		Customized Product	Off-the-Shelf	Vendor Specific Product	Other (please specify)
8	Delaware	No Response	No Response	No Response	No Response
9	District of Columbia		X		
10	Florida	X			
11	Georgia	X		X	We have a vendor (mid western consulting) who provides us with a web site for displaying data. The web site still has bugs in it and we are tweaking the bugs.
12	Hawaii	X	X	X	
13	Idaho	X			
14	Illinois	X			Internal ACCESS developed database
15	Indiana			X	
16	Iowa				Currently in-house automation transitioning to TRADAS
17	Kansas	X	X		
18	Kentucky	X			
19	Louisiana			X	
20	Maine			X	Microsoft Excel
21	Maryland	X			
22	Massachusetts			X	
23	Michigan	X			We developed the software ourselves.
24	Minnesota	X		X	
25	Mississippi	X			
26	Missouri			X	
27	Montana	No Response	No Response	No Response	No Response
28	Nebraska	X			All written in-house
29	Nevada			X	
30	New Hampshire				Software program developed in house
31	New Jersey				In-house mainframe and TRADAS
32	New Mexico	X		X	TRADAS developed by Chaparral
33	New York	X			
34	North Carolina	X			
35	North Dakota				in house product
36	Ohio	X			
37	Oklahoma	X	X		
38	Oregon	X			
39	Pennsylvania	X			
40	Rhode Island	No Response	No Response	No Response	No Response
41	South Carolina	X			In -house and contractor
42	South Dakota	X			
43	Tennessee			X	Advanced traffic Data Analysis Management (ADAM)
44	Texas	No Response	No Response	No Response	No Response
45	Utah	No Response	No Response	No Response	No Response
46	Vermont	X			
47	Virginia	X			
48	Washington				Internal Mainframe Legacy System
49	West Virginia			X	
50	Wisconsin	X			Tradas
51	Wyoming				RFP in progress






Reviewing the data processing question results in Table 11, shows that most DOT's are using a customized product as opposed to a few DOT Agencies using an off-the-shelf product. This response that indicates most DOT's are using their own software solutions indicating non-standard business practices and methodologies in processing monthly and year-end traffic

data. Several responses illustrate the non-standard software solutions utilized in various DOT's including Microsoft Excel, Microsoft Access, legacy mainframe software, TRADAS, and other customized technology solutions. These non-standard information solutions make it difficult at best (unfeasible at worst) for State DOT's to share data for the purpose of comparing, validating and verifying travel monitoring data. In general, State DOT's want the ability to review travel monitoring data (traffic counts, truck percentages, weight-in-motion, and other data) collected from inside their state to the state-line border and inside other state boundaries. As the federal regulating authority, FHWA coordinates with State DOT's is to help in collecting and providing the most accurate travel monitoring data as possible. Therefore, FHWA has a strong interest in helping to provide states with this capability. If all state travel monitoring data were in the same format using the same software solution or if all data were integrated (data that could be shared in multiple formats) across states, validation of data would be much easier.

There were 12 DOT responses that indicated their DOT utilize a vendor-specific product. Further research and survey questions need to be developed in order to adequately compare DOT Agencies' in-house products. Further research could also provide strengths and weaknesses of each technology solution. For example, answers to questions related to how much time, funding, and staff resources were required for implementing an in-house solution versus an off-the-shelf or vendor-specific product could shed light on a stronger technology solution versus a weaker solution. A stronger solution might require half the cost and time it takes to implement and a weaker solution and could potentially take many more resources and double the funding to complete. CDOT and other DOT's, are in support of further software and hardware implementation research as DOT's struggle to make informed decisions on how to update older systems such as upgrading existing systems or purchasing off-the-shelf/vendor specific products.

State DOT's were also asked to provide the types of data processing programming languages used to develop customized, off-the-shelf, or other types of software products. Figure 8 shows the percentages of data processing programming languages by type of software programming language. The results of this summary table imply a non-standard practice of using many different types of software programming languages. Since there is not one standard, choosing a software programming language platform is difficult and sharing software with other State DOT's can be a challenge.

**Figure 8 - Summary of Data Processing Software Programming Platforms**

If automated processing software, please specify software platform used.			
		Response Percent	Response Count
Visual Basic		36.8%	14
Java		10.5%	4
C++		13.2%	5
.NET		5.3%	2
<b>Other (please specify)</b>		<b>63.2%</b>	24
<i>answered question</i>			<b>38</b>

DOT respondents had the opportunity to provide more detailed information about other types of data processing software programming languages. The detailed responses can be found in Table 12 below.

**Table 12 – Detailed Data Processing Programming Languages**

#	State Name	If automated processing software, please specify software platform used.				
		Visual Basic	Java	C++	.NET	Other (please specify)
1	Alabama	X				Oracle SQL
2	Alaska					Natural and Adabas, Oracle
3	Arizona	X				
4	Arkansas					datacom (main frame app)
5	California		X			
6	Colorado	X				
7	Connecticut	X				
8	Delaware					No Response

**Table 12 – Detailed Data Processing Programming Languages – Continued**

#	State Name	If automated processing software, please specify software platform used.				
		Visual Basic	Java	C++	.NET	Other (please specify)
9	District of Columbia					No Response
10	Florida			X		
11	Georgia	X				We still use VMS FORTRAN on our mainframe computer to process/QC traffic data.
12	Hawaii					Modified New England Traffic Monitoring Software (NE TMS)
13	Idaho			X		
14	Illinois					No Response
15	Indiana					Not sure
16	Iowa					Currently mainframe transitioning to Oracle database .NET framework
17	Kansas	X				C
18	Kentucky					Mainframe
19	Louisiana					No Response
20	Maine					No Response
21	Maryland					Stored procedures in the database
22	Massachusetts					No Response
23	Michigan	X				
24	Minnesota					No Response
25	Mississippi					MicroSoft Visual FoxPro
26	Missouri					Windows
27	Montana					No Response
28	Nebraska	X				
29	Nevada					Oracle
30	New Hampshire					Microsoft Access
31	New Jersey					I don't know
32	New Mexico					oracle
33	New York					Oracle, MS-DOS
34	North Carolina	X	X			
35	North Dakota					in house
36	Ohio		X			
37	Oklahoma	X				
38	Oregon					FoxPro; Building SQL system now
39	Pennsylvania				X	COBOL programs on Department's mainframe computer
40	Rhode Island					No Response
41	South Carolina	X		X		Visual FoxPro
42	South Dakota	X				
43	Tennessee					Oracle
44	Texas					No Response
45	Utah					No Response
46	Vermont					No Response
47	Virginia	X				
48	Washington			X		
49	Wisconsin	X	X	X	X	Oracle
50	West Virginia					Vendor Software
51	Wyoming					No Response

Examining the results of Table12, a total of 14 DOT's use Visual Basic, 4 use Java, 5 use C++, 2 uses .NET. Several other responses indicated their DOT uses other platforms such as FoxPro, Oracle, MS-DOS, COBOL, C, Mainframe, Fortran, etc. This huge variation in responses implies and illustrates the differences in business practices and information solutions implemented across the DOT's. This non-standard practice ultimately costs tax payers more money by requiring each State DOT to build their own customized software to process standard data that could be standardized for each State DOT. Future software applications could provide a multi-State information solution with standard software product tools which would also support standardized DOT business practices.



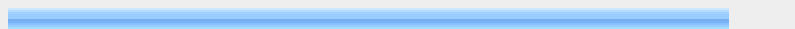
Another survey question asked DOT's to provide information related to automated travel monitoring program items. Specifically, DOT respondents were given a drop-down menu that asked each DOT to select a yes or no response to whether or not their Agency has developed any customized code for items such as AADT, DD, ADT, DHV, etc. A total of 46% of the DOT representatives indicated their DOT has customized code and 54% of respondents indicated they do not have any customized code written for any traffic monitoring program items (See Figure 9).

Although 54% of Agencies have automated travel monitoring program items, most DOT's do not have their entire monthly or year-end process automated as stated earlier. In fact, only 4 Agencies indicated their DOT has all program items automated.

Reviewing travel monitoring data for accuracy, applying factors to large traffic datasets, and calculating data from raw traffic data counts can be an extremely time consuming and labor intensive process. Most DOT's will take three to six months to complete year-end processing of travel monitoring data.

Automated tools help to speed up the data processing but steps in the year-end finalization of data can be fragmented due to the lack of fully integrated software tools and information solutions. Agencies are challenged with having to learn a number of different software tools in order to finalize the year-end travel monitoring data.

**Figure 9 - Automated Travel Monitoring Program Item Summary**

Do you currently have contractors or vendors that are writing customized code for any traffic monitoring program items?			Response Percent	Response Count
Yes			45.7%	21
No			54.4%	25
If Yes, who is the contractor or vendor?			45.7%	21
<b>answered question</b>				<b>46</b>

DOT's that have customized code were asked specifically to provide information on which travel monitoring program items are currently automated. Table 13 summarizes the type of travel program monitoring items that each DOT has an automated software solution.

**Table 13 – Automated Travel Monitoring Program Item Details**

#	State Name	Select items that are automatically generated or use automated software to calculate the following traffic monitoring program items											
		N/A	AADT	DD	ADT	DHV	ESAL	AADT Single Trucks	AADT Combination Trucks	Seasonal Factors	Axle Adjustment Factors	Other (please specify)	
1	Alabama												We adjust 7 day counts directly to AADT. The factors for each time period counted are generated by in house programs written in Quick Basic. Programs to automate axle correction and AADT development are currently being written and should be completed within the next year.  K & D Factors  AADT is only calculated if certain business rules are met. Accuracy needs to be manually verified.
2	Alaska		X	X	X	X				X			
3	Arizona		X					X	X	X	X		
4	Arkansas		X							X	X		
5	California		X					X	X	X			
6	Colorado		X	X		X	X	X	X				
7	Connecticut		X		X		X	X	X	X	X		

Table 13 – Automated Travel Monitoring Program Item Details – Continued





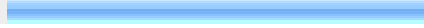
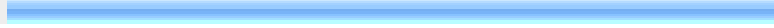
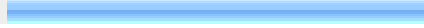



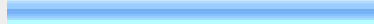
#	State Name	Select items that are automatically generated, or use automated software, to calculate the following traffic monitoring program items											
		N/A	AADT	DD	ADT	DHV	ESAL	AADT Single Trucks	AADT Combination Trucks	Seasonal Factors	Axle Adjustment Factors	Other (please specify)	
8	Delaware												No Response
9	District of Columbia												No Response
10	Florida		X	X	X	X	X	X	X	X	X	X	We generally roll up class data as a "truck percentage". Bins 4-13 are considered to be "heavy trucks".  All of the checked items are calculated in our internally developed ACCESS database  We use an Oracle 10 database with stored procedures and crystal reports for the reporting  We calculate CADT, but not broken down by single/combo. We also generate Overweight Trucks reports.  Daily Adjustment Factors  No Response  Seasonal factors are generated iteratively with automated output and manual intervention. Daily factors Growth factors  Peak Hour % No Response No Response No Response  Day of Week Factors, MADT, MADW,MAWDT,MAWET,AADW, AAWDT,AAWET,ANNUAL AND MONTHLY SPEED,CLASS AND WIM STATISTICS.
11	Georgia		X	X			X			X	X		
12	Hawaii		X		X								
13	Idaho		X		X								
14	Illinois		X		X			X	X	X			
15	Indiana		X	X	X	X				X			
16	Iowa		X		X		X			X	X		
17	Kansas		X				X			X	X		
18	Kentucky		X							X			
19	Louisiana	X											
20	Maryland		X	X	X			X	X	X	X		
21	Maine												
22	Massachusetts				X								
23	Michigan		X			X	X			X	X		
24	Minnesota	X											
25	Mississippi		X	X	X	X	X			X	X		
26	Missouri		X	X	X	X		X	X	X	X		
27	Montana												
28	Nebraska		X		X	X	X	X	X	X	X		
29	Nevada		X		X	X	X			X	X		
30	New Hampshire		X	X	X	X	X			X	X		
31	New Jersey		X				X				X		
32	New Mexico		X		X	X	X	X	X	X	X		
33	New York		X		X								
34	North Carolina		X	X	X	X				X	X		
35	North Dakota		X		X		X	X	X	X	X		
36	Ohio		X	X	X	X	X	X	X	X	X		
37	Oklahoma	X											
38	Oregon					X		X	X	X	X		
39	Pennsylvania		X		X		X	X	X	X	X		
40	Rhode Island											No Response	
41	South Carolina		X		X		X	X	X	X	X		
42	South Dakota		X	X	X	X	X	X	X	X	X		
43	Tennessee		X	X	X	X	X	X	X	X	X		
44	Texas											Peak Hour %	
45	Utah											No Response	
46	Vermont											No Response	
47	Virginia		X		X		X	X	X	X	X		
48	Washington		X		X	X	X	X	X	X	X		
49	West Virginia		X		X		X	X	X	X	X		
50	Wisconsin		X			X	X				X		
51	Wyoming	X											

Results from Table 13 show that the DOT's do not typically automate the same program items. This shows another non-standard travel monitoring business practice. Only Florida, Ohio, South Dakota and Tennessee indicated their Agency automates every program item. These results imply a fragmented information solution implementation that is not fully integrated and does not follow standard business practices or software solutions across DOT Agencies.

## 9. Traffic Data Collection Equipment

The on-line survey also included a number of questions related to the types of traffic data collection equipment utilized at each DOT. Figure 10 summarizes DOT responses including response percentages. A DOT can use more than one type of traffic data collection equipment and therefore each Agency could select more than one type of equipment or contractor. Response percentages show a variety of responses with Peek and Diamond as the two most utilized traffic collection equipment. Detailed responses related to traffic data collection equipment can be found in Table 14.

**Figure 10 - Traffic Data Collection Equipment Summary**

What type of traffic collection equipment do you (or your contractors) currently use?			
		Response Percent	Response Count
Peek		69.6%	32
Diamond		58.7%	27
Metro Count		17.4%	8
Mitron		8.7%	4
Wavetronic		26.1%	12
IRD		52.2%	24
PAT		26.1%	12
EMC		0.0%	0
Metter-Toledo		0.0%	0
Jamar		45.7%	21
Time Mark		17.4%	8
Nu Metrics		13.0%	6
Other (please specify)		23.9%	11
		<b>answered question</b>	<b>46</b>

**Table 14 – Traffic Data Collection Equipment Detail**

#	State Name	What type of traffic collection equipment do you (or your contractors) currently use?												
		Peek	Diamond	Metro Count	Mitron	Wavetronic	IRD	PAT	EMC	Metter-Toledo	Jamar	Time Mark	Nu Metrics	Other (please specify)
1	Alabama	X	X			X								Micros RacTel
2	Alaska	X									X		X	
3	Arizona	X												
4	Arkansas	X				X	X							
5	California	X	X				X	X						
6	Colorado		X	X	X						X			
7	Connecticut	X	X			X	X				X			
8	Delaware													No Response
9	District of Columbia		X				X							
10	Florida	X	X	X	X	X		X			X	X		
11	Georgia	X		X										
12	Hawaii	X		X			X	X			X			DCMS-Econolite Control Products, Inc
13	Idaho		X				X							ECM
14	Illinois				X								X	
15	Indiana		X				X	X					X	
16	Iowa	X				X								
17	Kansas		X				X	X			X		X	RTMS
18	Kentucky	X									X			
19	Louisiana	X	X				X					X		
20	Maine	X												
21	Maryland	X		X	X		X				X	X		We use PEEK in our permanent sites but allow consultants to use any counter type for portables.
22	Massachusetts						X							
23	Michigan		X					X			X			Testing Wavetronics and TIRTL
24	Minnesota	X				X	X					X		
25	Mississippi	X		X			X	X			X			
26	Missouri	X	X			X	X				X	X	X	
27	Montana													No Response
28	Nebraska	X	X			X					X			Video camera
29	Nevada		X				X	X			X			Golden River
30	New Hampshire		X								X			
31	New Jersey	X					X				X			
32	New Mexico	X					X							
33	New York	X		X			X				X			Smartek and 3M Micro-Loops
34	North Carolina	X	X			X					X			
35	North Dakota	X	X				X	X			X			
36	Ohio	X	X											
37	Oklahoma	X	X				X							
38	Oregon	X	X				X					X		170 Signal Controllers
39	Pennsylvania	X	X			X	X	X			X	X		
40	Rhode Island													No Response
41	South Carolina	X	X											



**Table 14 – Traffic Data Collection Equipment Detail – Continued**

#	State Name	What type of traffic collection equipment do you (or your contractors) currently use?												
		Peek	Diamond	Metro Count	Mitron	Wavetronic	IRD	PAT	EMC	Metter-Toledo	Jamar	Time Mark	Nu Metrics	Other (please specify)
42	South Dakota	X	X			X	X	X						
43	Tennessee	X	X								X		X	RTMS
44	Texas													No Response
45	Utah													No Response
46	Vermont										X			
47	Virginia	X	X											
48	Washington		X				X							
49	West Virginia			X										
50	Wisconsin	X				X		X				X		
51	Wyoming		X											

Results from Table 14 illustrate a lack of standardization and utilization of data collection equipment used by states. This variety of equipment can make it difficult to share data across states.

**9.1 Non-intrusive Traffic Counting Equipment**

Each DOT representative was asked to provide a response to whether or not their DOT uses non-intrusive traffic counting equipment. Responses indicated that **65%** of DOT's do not use non-intrusive traffic counting equipment whereas **35%** of respondents do use them. This again shows the differences in type of traffic counting equipment utilized. Several states mentioned their concerns with non-intrusive traffic counting technology such as reliability and the lack of traffic counting functionality and accuracy of data collected.

Several non-intrusive traffic counting studies are currently underway, such as the Minnesota DOT (MNDOT) Non-intrusive Technology (NIT) Pooled Fund Study, as well as several states testing non-intrusive technologies. Specific detailed responses from each state can be seen in Table 15.

**Table 15 - Non-intrusive Traffic Counting Equipment Usage**

#	State Name	Does the DOT use non-intrusive traffic counting equipment?	
		No	Yes (please specify type of technology utilized)
1	Alabama		SmartSensor by Wavetronic
2	Alaska	X	
3	Arizona	X	
4	Arkansas		Wavetronics Smart Sensor
5	California		Limited use of radar, testing infra red
6	Colorado		The DOT has radar station for ATRs
7	Connecticut	X	
8	Delaware		No Response
9	District of Columbia		RTMS
10	Florida		Wavetronics, RTMS
11	Georgia		We are migrating away from RTMS technology. It is not reliable.
12	Hawaii	X	
13	Idaho		Radar
14	Illinois		TIRTL-Traffic Infrared Traffic logger We have two ATR sites with the TIRTL and plan on many more.
15	Indiana	X	
16	Iowa		Digital Microwave Radar
17	Kansas		Radar
18	Kentucky		NILAD and RADAR

#	State Name	Does the DOT use non-intrusive traffic counting equipment?	
		No	Yes (please specify type of technology utilized)
19	Louisiana		Radar
20	Maine	X	
21	Maryland		Consultants use the TIRTL and are researching the PEEK Axle light
22	Massachusetts	X	
23	Michigan		We are currently testing Wavetronics and TIRTL for portable collection. We utilize data from Michigan Intelligent Transportation Center and Traffic.com
24	Minnesota		TIRTL, infrared axle sensors Wavetronix, radar RTMS, radar
25	Mississippi	X	
26	Missouri		Wavetronix, Axle Light
27	Montana		<b>No Response</b>
28	Nebraska		Wavetronics radar detection
29	Nevada	X	
30	New Hampshire		Experimenting with Wavetronix radar device for volume, speed, and length based vehicle classification
31	New Jersey	X	
32	New Mexico		camera sites radar sites
33	New York		Smartek Acoustic Sensor and 3M micro- loops
34	North Carolina		Wavetronics Radar, TIRTL Infrared
35	North Dakota	X	
36	Ohio	X	
37	Oklahoma	X	
38	Oregon		One Wavetronix being tested
39	Pennsylvania		We are currently testing the Wavetronics Smartsensor
40	Rhode Island		<b>No Response</b>
41	South Carolina		Testing a portable trailer with radar type counter
42	South Dakota		Wavetronic
43	Tennessee		Numetric Groundhogs RTMS
44	Texas		<b>No Response</b>
45	Utah		<b>No Response</b>
46	Vermont	X	
47	Virginia		Wavetronix HD Sensor RTMS from EIS
48	Washington		RTMS (Microwave), ITERIS Advantage (Optical) and TIRTL (Infrared)
49	West Virginia	X	
50	Wisconsin		Wavetronix
51	Wyoming	X	

## 10. Software Systems

DOT respondents were asked to comment on their software systems including their documentation practices, publishing feasibility, and integration capabilities. Figure 11 shows the percentage of DOT's that have fully automated or integrated software systems.

Figure 11 - Integration/Automation of Data Processing, Polling, and Publishing Software

Are any of the following software systems fully automated and/or integrated?			
	Yes	No	Response Count
Processing software and Data Publishing Software	24.4% (10)	75.6% (31)	41
Polling software and Processing Software	37.2% (16)	62.8% (27)	43
Polling software and Publishing Software	17.5% (7)	82.5% (33)	40
		<i>answered question</i>	<b>44</b>

State DOT's that indicated their Agency had fully automated and/or integrated software systems were then asked to fully describe automated and/or integrated software systems. If a DOT did not have fully automated or integrated software systems, a No Response was indicated in the table below. Table 16 shows the individual DOT responses.

**Table 16 – Data Processing, Polling, and Publishing Software Integration Details**

#	State Name	If Yes on any, please describe
		Open-Ended Response
1	Alabama	Vendor supplied polling software. Data is processed and checked manually and stored on mainframe. Reports generated from mainframe for submittal to FHWA and mailing.
2	Alaska	TOPS (PEEK)
3	Arizona	<b>No Response</b>
4	Arkansas	<b>No Response</b>
5	California	Polling and Processing for WIM data only
6	Colorado	Business process have been documented and charted. Software is in the process of being documented. Contract specifications are documented
7	Connecticut	<b>No Response</b>
8	Delaware	<b>No Response</b>
9	District of Columbia	<b>No Response</b>
10	Florida	Automated polling, conversion from binary to ASCII, loading and editing.
11	Georgia	We are in the processing of migrating to a new system being developed by Northrop Grumman. Once this is done, we hope to be "fully automated" or closer to it.
12	Hawaii	The Hawaii Department of Transportation (HDOT) traffic program business processes, software/hardware, etc., is described in the Hawaii Traffic Monitoring System (H-TMS) document which is updated every three years and submitted to FHWA. The H-TMS is intended to be a systematic process for the collection, analysis, summary, and retention of highway related user and vehicular traffic data for the HDOT. The H-TMS is based on the requirements prescribed in the 23CFR, Part 500 Subpart B- Traffic Monitoring System, effective January 21, 1997 and the Traffic Monitoring Guide, dated January 2001. The intent of HDOT is to continually make revisions to the H-TMS to reflect the timely needs and requirements of HDOT while conforming to the FHWA requirements. Additionally, H-DOT has developed contract specifications (or service contracts) for the operation and maintenance of its Portable Count Program, Continuous Traffic Monitoring Program, Digital Videolog Program (roadway inventory data) and Coordinated Data System/Geographic Information System (CDS/GIS) which is the central data repository and foundation for HDOT RIS system.
13	Idaho	Our processing software also produces monthly and annual reports.
14	Illinois	<b>No Response</b>
15	Indiana	<b>No Response</b>
16	Iowa	<b>No Response</b>
17	Kansas	---
18	Kentucky	<b>No Response</b>
19	Louisiana	<b>No Response</b>
20	Maine	<b>No Response</b>
21	Maryland	Processing software and Data Publishing Software- stored procedures to populate report tables then exported through Adobe Acrobat or Crystal Reports
22	Massachusetts	<b>No Response</b>
23	Michigan	Our short term and PTR(ATR) data processing software also archives data to the Corporate database and produces reports. The Polling software also processes data for the various databases for each data type.
24	Minnesota	No
25	Mississippi	<b>No Response</b>
26	Missouri	<b>No Response</b>
27	Montana	<b>No Response</b>
28	Nebraska	Polling software generates "ASCII with labels - Old Style" (Diamond output format), then our own software reads those text files, reformats data, and populates station-specific files that are used for viewing, editing, reporting, and converting data to any necessary format.

**Table 16 – Data Processing, Polling, and Publishing Software Integration Details – Continued**

#	State Name	If Yes on any, please describe	
		Open-Ended Response	
29	Nevada	Tradas from Chapparral polls and processes	
30	New Hampshire	<b>No Response</b>	
31	New Jersey	All are semi-automated but several manual processes persist.	
32	New Mexico	TDP (polling) TRADAS (processing and Publishing)	
33	New York	We use TRAFMAN to poll our continuous count sites and download the data. The data is loaded into a consultant produced computer application called TCE (CC) and data integrity checks are performed. The data is then loaded into another consultant produced computer application called HDMS where our data is stored. HDMS does not calculate factors such as the axle adjustment factors or the seasonal adjustment factors. Due to limitations in our HDMS software we are currently considering purchasing TRADAS.	
34	North Carolina		<b>No Response</b>
35	North Dakota		In house software
36	Ohio		<b>No Response</b>
37	Oklahoma		<b>No Response</b>
38	Oregon		Currently in development.
39	Pennsylvania		Processing of all short term traffic counting is fully automated by using software developed by consultants or within the Roadway Management System (RMS). I am not sure what is meant by data publishing. Polling and processing software is fully automated. The software was developed by a vendor for the Department. Polling software and publishing software: The polling software is automated. I am not sure what is meant by data publishing.
40	Rhode Island		<b>No Response</b>
41	South Carolina	<b>No Response</b>	
42	South Dakota	<b>No Response</b>	
43	Tennessee	Integrated.	
44	Texas	<b>No Response</b>	
45	Utah	<b>No Response</b>	
46	Vermont	<b>No Response</b>	
47	Virginia	Honestly, the question was confusing as written. We have automation in all those areas.	
48	Washington	Vendor software (IAnalyze, TRAFMAN/Centurion Gold)	
49	Wisconsin	Polling utilizes Vendor specific software, while processing is by Tradas.	
50	West Virginia	Thru vendor software polling and processing is accomplished	
51	Wyoming	<b>No Response</b>	

Responses in Table 16 show there are a number of different software solutions that provide states with fully integrated traffic processing software. There are no standard software solutions and only a few DOT's indicated a similar type of software solution. Approximately 18 DOT's have a No Response which implies a huge opportunity to introduce improved and integrated electronic software solutions.

### 10.1 Geographic Information Systems (GIS)

Questions related to Geographic Information Systems (GIS) were asked of each State DOT. Survey respondents also provided details on how their GIS tools are currently being utilized. Figure 12 and Table 17 show responses to the GIS questions asked.

**Figure 12 - Percentage of DOT's with GIS**



Does the DOT use GIS?			
		Response Percent	Response Count
No		11.4%	5
Yes		88.6%	39
<i>answered question</i>			<b>44</b>

Figure 12 shows that approximately 87% of all DOT's have a GIS. Using GIS software products and tools can provide DOT's with additional visual and graphical representations of travel monitoring results. DOT's often use mapping software to develop quality checks, spatial traffic data references and final map products.

**Table 17 – GIS Software Details**

#	State Name	If Yes, is GIS used for:	
		Display of Traffic Data (Stations, Volume, etc.), describe	Processing of Traffic Data, Publishing of Traffic Data, Other Please specify and describe
1	Alabama	Volume and related data entered into GIS application.	GIS application is used to push traffic data to our WEB page, the various management systems in place
2	Alaska	Yes	Yes
3	Arizona	In development	In development
4	Arkansas	<b>No Response</b>	Traffic data and truck percent maps and location maps
5	California	<b>No Response</b>	<b>No Response</b>
6	Colorado	Traffic count station locations, traffic volume by segment	Traffic volume map
7	Connecticut	no	no
8	Delaware	<b>No Response</b>	<b>No Response</b>
9	District of Columbia	Yes	No processing, Yes Publishing
10	Florida	Real-time polling system	Traffic DVD
11	Georgia	Display of Traffic Data and other data such as FC maps	QC of Traffic Data--we verify through the GPS data that the data collector collected the data on the correct location. Processing of Traffic Data, Publishing of Traffic Data, Other Please specify and describe - HDOT GIS system uses an Internet based website technology and includes the following features:-HPMS Data-Mileage-Milepoint-Roadway Project Data-Roadway Inventory-Traffic Data-NHS Map-Bridge Location-Pavement Markings-Traffic Stations Locations
12	Hawaii	Yes	
13	Idaho	<b>No Response</b>	<b>No Response</b>
14	Illinois	All ADTs are displayed on interactive web-based application on IDOT web site	Yes
15	Indiana	Counts and locations can be obtained by clicking on the map	Map will be on website within next year
16	Iowa	<b>No Response</b>	<b>No Response</b>
17	Kansas	Flow Map	Flow Map, ADT updates for HPMS
18	Kentucky	Mapping traffic count stations	<b>No Response</b>
19	Louisiana	<b>No Response</b>	<b>No Response</b>
20	Maine	<b>No Response</b>	Providing estimates as well as actual counts for all roads within the system
21	Maryland	just station locations	N/A
22	Massachusetts	Stations	<b>No Response</b>
23	Michigan	Used to display ATR locations, short count locations, AADT and CADT estimates.	<b>No Response</b>
24	Minnesota	Displaying traffic data	Publish on ArcIMS website
25	Mississippi	Display of Hurricane Evacuation Sites, Special Mapping Projects	Data Verification, LRS Maintenance
26	Missouri	Yes	Yes to Display, No Processing, Yes Publishing
27	Montana	<b>No Response</b>	<b>No Response</b>
28	Nebraska	not at this time	not at this time
29	Nevada	<b>No Response</b>	<b>No Response</b>
30	New Hampshire	Location of stations and AADT's on highway segments	<b>No Response</b>
31	New Jersey	Display of stations and volumes	<b>No Response</b>
32	New Mexico	Stations site locations IMS application used to display off system traffic counts as points and AADT's as line events. Using Identify button and selecting a station allows the user to view and download latest traffic data	Processing of traffic data (identifying sites) GIS is used in coordination with other programs for analysis to meet their goals in using geographically referenced traffic counts to plan, regulate and meet other statewide transportation needs.
33	New York		
34	North Carolina	ArcGIS Shapefiles for map generation and viewing on computer.	ArcGIS Shapefiles are distributed to customers that use GIS.
35	North Dakota	locations of the traffic counts in the field and maps	<b>No Response</b>
36	Ohio	Generate Traffic Volume maps using Geo Media. Display count stations.	<b>No Response</b>

**Table 17 – GIS Software Details – Continued**

#	State Name	If Yes, is GIS used for:	
		Display of Traffic Data (Stations, Volume, etc.), describe	Processing of Traffic Data, Publishing of Traffic Data, Other Please specify and describe
37	Oklahoma	Yes - Web portal displays data, volume, truck percentages, etc.	Yes - publishing of AADT official maps are thru GIS mapping procedures.
38	Oregon	flow maps, ATR locations	<b>No Response</b>
39	Pennsylvania	Traffic Monitoring System (used by DOT traffic analysts)	Traffic Information System (TIS) used to edit ATR data, TMS and iTMS
40	Rhode Island	Internet Traffic Monitoring System (iTMS) website used by the public to access traffic data	<b>No Response</b>
41	South Carolina	<b>No Response</b>	Yes Display, No Processing, No Publishing
42	South Dakota	Yes	Yes
43	Tennessee	Yes - Website	<b>No Response</b>
44	Texas	<b>No Response</b>	<b>No Response</b>
45	Utah	<b>No Response</b>	<b>No Response</b>
46	Vermont	<b>No Response</b>	<b>No Response</b>
47	Virginia	Yes	No
48	Washington	Not yet but soon	Not yet but soon
49	West Virginia	<b>No Response</b>	<b>No Response</b>
50	Wisconsin	Yes	Yes Display, No Processing, Yes Publishing
51	Wyoming	<b>No Response</b>	<b>No Response</b>

**10.2 Software Requirements**

State DOT’s provided information related to software requirements documentation. The key to building and upgrading software solutions is having adequate documentation for existing or future software systems. A total of 21 States either skipped the questions or indicated their DOT does not have any software documentation. This implies a lack of resources available to document existing systems. Each individual response can be found in Table 18.

**Table 18 – Software Requirements Documentation**

#	State Name	Does the DOT have formal requirements documentation for the following?						If Yes to any above, please specify or explain
		Business Processes? If yes please specify - Yes	Business Processes? If yes please specify - No	Software / Hardware? If yes please specify - Yes	Software / Hardware? If yes please specify - No	Contract Specifications? If yes please specify - Yes	Contract Specifications? If yes please specify - No	
1	Alabama		No		No		No	<b>No Response</b> State Traffic Operation Manual and HAS Traffic Monitoring System software documentation, State of Alaska Department of Administration ETS (Enterprise Technology Services) standards, State of Alaska, Department of Administration ETS Task Order System ETS and Administrative Services procurement rules, regulations, and procedures. We have a contract to purchase Traffic count equipment and a contract to purchase for the WIM.
2	Alaska	Yes		Yes		Yes		
3	Arizona		No		No		No	<b>No Response</b>
4	Arkansas		No		No		No	<b>No Response</b>
5	California	Yes		Yes			No	<b>No Response</b> Business process have been documented and charted. Software is in the process of being documented. Contract specs are documented
6	Colorado	Yes		Yes		Yes		
7	Connecticut		No		No	Yes		Under DAS contracting procedures
8	Delaware							<b>No Response</b>

Table 18 – Software Requirements Documentation – Continued

#	State Name	Does the DOT have formal requirements documentation for the following?						If Yes to any above, please specify or explain  Open-Ended Response
		Business Processes? If yes please specify - Yes	Business Processes? If yes please specify - No	Software / Hardware? If yes please specify - Yes	Software / Hardware? If yes please specify - No	Contract Specifications? If yes please specify - Yes	Contract Specifications? If yes please specify - No	
9	District of Columbia		No		No		No	<p>Procedures, business plan, handbooks We are in the process of developing business processes/software/hardware requirements for the NG project. The Hawaii Department of Transportation (HDOT) traffic program business processes, software/hardware, etc., is described in the Hawaii Traffic Monitoring System (H-TMS) document which is updated every three years and submitted to FHWA. The H-TMS is intended to be a systematic process for the collection, analysis, summary, and retention of highway related user and vehicular traffic data for the HDOT. The H-TMS is based on the requirements prescribed in the 23CFR, Part 500 Subpart B- Traffic Monitoring System, effective January 21, 1997 and the Traffic Monitoring Guide, dated January 2001. The intent of HDOT is to continually make revisions to the H-TMS to reflect the timely needs and requirements of HDOT while conforming to the FHWA requirements. Additionally, H-DOT has developed contract specifications (or service contracts) for the operation and maintenance of its Portable Count Program, Continuous Traffic Monitoring Program, Digital Videolog Program (roadway inventory data) and Coordinated Data System/Geographic Information System (CDS/GIS) which is the central data repository and foundation for HDOT RIS system.</p> <p><b>No Response</b></p> <p>IDOT is being ISO certified for all processes. We put our traffic contract specs on the PTB (Professional Transportation bulletin) when needed.</p> <p>Contracts specify count requirements, what is expected of them, and what we will provide to them.</p> <p>---</p> <p><b>No Response</b></p> <p><b>No Response</b></p>
10	Florida	Yes		Yes		Yes		
11	Georgia		No		No		No	
12	Hawaii	Yes		Yes		Yes		
13	Idaho		No		No		No	
14	Illinois	Yes			No	Yes		
15	Indiana		No		No	Yes		
16	Iowa		No		No		No	
17	Kansas		No	Yes		Yes		
18	Kentucky		No		No		No	
19	Louisiana		No		No		No	

Table 18 Software Requirements Documentation – Continued

#	State Name	Does the DOT have formal requirements documentation for the following?						If Yes to any above, please specify or explain
		Business Processes? If yes please specify - Yes	Business Processes? If yes please specify - No	Software / Hardware? If yes please specify - Yes	Software / Hardware? If yes please specify - No	Contract Specifications? If yes please specify - Yes	Contract Specifications? If yes please specify - No	
20	Maine		No		No		No	<p><b>No Response</b> Business Processes for Traffic Monitoring are documented Available on our website(www.marylandroads.com) under TMS consultant information.</p> <p><b>No Response</b></p> <p><b>No Response</b></p> <p>No</p> <p><b>No Response</b></p> <p>Based on federal requirements</p> <p><b>No Response</b></p> <p><b>No Response</b></p> <p><b>No Response</b></p> <p><b>No Response</b></p> <p>NJ Treasury's Office of Information Technology has requirements for processes, hardware and software. Contract specifications have requirements within the Professional Services process. Contract counts must be in accordance with the NM State Standards</p> <p>Business Processes: Engineering Instruction and Bulletins Software / Hardware: Included in the Maintenance Contracts Contract Specifications: Maintenance Contracts that are performance based</p> <p><b>No Response</b></p> <p>in house procedures</p> <p>Documentation for TKO software used to process permanent count data. All DOT contract specifications are documented.</p> <p><b>No Response</b></p> <p>The business process is behind, awaiting a description of how we use the new software. The first phase of the software project included a specification of data and process. We have contract specifications for the classifiers we recently purchased, the interval counters in process, and the contract with the counting company. Software/Hardware: Documentation provided by the vendor as required by the DOT. Contract Specifications: Required by Commonwealth purchasing procedures and guidelines</p> <p><b>No Response</b></p> <p>Have wrote traffic manuals</p> <p>Manual &amp; Vendor provided.</p>
21	Maryland	Yes			No	Yes		
22	Massachusetts		No		No		No	
23	Michigan		No		No		No	
24	Minnesota		No		No		No	
25	Mississippi		No		No		No	
26	Missouri	Yes			No		No	
27	Montana							
28	Nebraska		No		No		No	
29	Nevada		No		No		No	
30	New Hampshire		No		No		No	
31	New Jersey	Yes		Yes		Yes		
32	New Mexico		No		No	Yes		
33	New York	Yes		Yes		Yes		
34	North Carolina		No		No		No	
35	North Dakota	Yes		Yes			No	
36	Ohio		No	Yes		Yes		
37	Oklahoma		No		No		No	
38	Oregon		No	Yes		Yes		
39	Pennsylvania		No	Yes		Yes		
40	Rhode Island							
41	South Carolina		No		No		No	
42	South Dakota	Yes		Yes		Yes		
43	Tennessee	Yes		Yes			No	



**Table 18 – Software Requirements Documentation – Continued**

#	State Name	Does the DOT have formal requirements documentation for the following?						If Yes to any above, please specify or explain
		Business Processes? If yes please specify - Yes	Business Processes? If yes please specify - No	Software / Hardware? If yes please specify - Yes	Software / Hardware? If yes please specify - No	Contract Specifications? If yes please specify - Yes	Contract Specifications? If yes please specify - No	Open-Ended Response
44	Texas							<b>No Response</b>
45	Utah							<b>No Response</b>
46	Vermont							<b>No Response</b>
47	Virginia		No		No	Yes		Again, the question is confusing. We have established contract specifications for data collection.
48	Washington		No		No		No	<b>No Response</b>
49	West Virginia		No		No		No	<b>No Response</b>
50	Wisconsin	Yes		Yes		Yes		The business process was fully documented in 1990 prior to replacing antiquated mainframe processing systems- documentation has not been updated. Software and Hardware systems were fully documented in the RFP issued in 1991-2 which resulted in the purchase of Tradas from Chaparral Systems Corp
51	Wyoming		No		No		No	<b>No Response</b>

**10.3 Software Diagrams**

DOT Agency Representatives were also asked if their DOT has developed any software system diagrams. Each individual response can be found in Table 19.

**Table 19 – Software System Diagrams**

#	State Name	Does the DOT have any system diagrams for the following?								If Yes to any, please specify or explain
		Business Processes? - Yes	Business Processes? - No	Software? - Yes	Software? - No	Hardware? - Yes	Hardware? - No	Databases? - Yes	Databases? - No	Open-Ended Response
1	Alabama		No		No		No		No	<b>No Response</b>
2	Alaska		No		No		No	Yes		The state has system diagrams for the WIM data warehouse.
3	Arizona		No		No		No		No	<b>No Response</b>
4	Arkansas		No		No		No		No	<b>No Response</b>
5	California		No		No		No		No	<b>No Response</b>
6	Colorado	Yes		Yes		Yes		Yes		See 27
7	Connecticut		No		No		No		No	<b>No Response</b>
8	Delaware									<b>No Response</b>
9	District of Columbia		No		No		No		No	<b>No Response</b>
10	Florida		No	Yes			No	Yes		Some software documentation for end-of-year processing, polling, editing.
11	Georgia		No		No		No		No	All these activities are under development.
12	Hawaii	Yes		Yes		Yes		Yes		See 27
13	Idaho		No		No		No		No	<b>No Response</b>
14	Illinois		No		No		No		No	<b>No Response</b>
15	Indiana		No		No		No		No	<b>No Response</b>

Table 19 – Software Systems Diagram – Continued

#	State Name	Does the DOT have any system diagrams for the following?								If Yes to any, please specify or explain
		Business Processes? - Yes	Business Processes? - No	Software? - Yes	Software? - No	Hardware? - Yes	Hardware? - No	Databases? - Yes	Databases? - No	
16	Iowa	Yes		Yes			No	Yes		Business Processes as they relate to software on the legacy mainframe system are well documented in text, flowcharts, and examples. The TRADAS system provides diagrams and table layouts for non-proprietary sections of the database.
17	Kansas		No		No		No		No	---
18	Kentucky		No		No		No		No	<b>No Response</b>
19	Louisiana		No		No		No		No	<b>No Response</b>
20	Maine		No	Yes			No	Yes		We recently completed the mapping of our processing for all data - will begin steps to hire a consultant to develop a comprehensive processing/storage/reporting software.
21	Maryland		No		No		No		No	<b>No Response</b>
22	Massachusetts		No		No		No		No	<b>No Response</b>
23	Michigan	Yes			No		No	Yes		Business process diagram needs updating. Database diagram is the corporate database. We have a flow diagram that shows process, systems and software.
24	Minnesota	Yes		Yes			No	Yes		
25	Mississippi		No		No		No		No	<b>No Response</b>
26	Missouri		No		No		No		No	
27	Montana									<b>No Response</b>
28	Nebraska			Yes				Yes		Flow chart diagrams are included in our TMS documentation as we deem necessary and helpful.
29	Nevada		No		No		No		No	<b>No Response</b>
30	New Hampshire		No		No		No		No	<b>No Response</b>
31	New Jersey		No		No		No		No	<b>No Response</b>
32	New Mexico		No		No		No		No	<b>No Response</b>

Table 19 – Software Systems Diagram – Continued

#	State Name	Does the DOT have any system diagrams for the following?								If Yes to any, please specify or explain
		Business Processes? - Yes	Business Processes? - No	Software? - Yes	Software? - No	Hardware? - Yes	Hardware? - No	Databases? - Yes	Databases? - No	
33	New York		No		No		No		No	<b>No Response</b> We have some documentation of database development.
34	North Carolina	<b>No Response</b>		<b>No Response</b>		<b>No Response</b>		Yes		flow charts, graphs, tables
35	North Dakota	Yes		Yes		Yes		Yes		
36	Ohio		No		No		No	Yes		TKO Database GIS Database Warehousing models for all enterprise data including AADT's and Volume groups thru HPMS
37	Oklahoma		No		No		No	Yes		
38	Oregon		No		No		No		No	<b>No Response</b> Business Processes: Flow charts exist for the Roadway Management System (RMS), Traffic Monitoring System (TMS) and Internet Traffic Data Upload System (iTDUS). Software: Any software designed for the traffic counting program has been documented. Part of the documentation process includes system diagrams. Databases: All databases designed for the traffic counting program has been documented. Part of the documentation process includes system diagrams.
39	Pennsylvania	Yes		Yes			No	Yes		
40	Rhode Island									<b>No Response</b>
41	South Carolina		No		No		No		No	
42	South Dakota		No		No		No		No	<b>No Response</b>
43	Tennessee		No		No		No		No	<b>No Response</b>
44	Texas									<b>No Response</b>
45	Utah									<b>No Response</b>
46	Vermont									<b>No Response</b>
47	Virginia		No		No		No		No	<b>No Response</b> We conducted data modeling sessions to document our procedures and work flow. We also have mainframe documentation.
48	Washington	Yes		Yes		Yes		Yes		

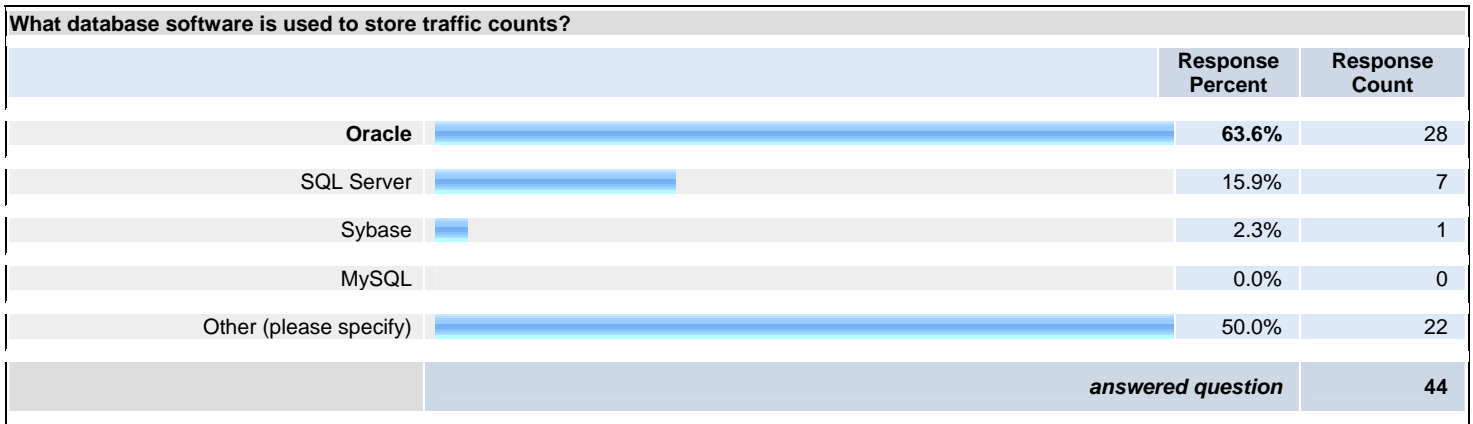
**Table 19 – Software Systems Diagram – Continued**

#	State Name	Does the DOT have any system diagrams for the following?								If Yes to any, please specify or explain
		Business Processes? - Yes	Business Processes? - No	Software? - Yes	Software? - No	Hardware? - Yes	Hardware? - No	Databases? - Yes	Databases? - No	
49	West Virginia		No		No		No		No	<b>No Response</b> Hardware is maintained by corporate IS who maintains to total architecture plan and diagram. Database design is proprietary property of Chaparral Systems who provide us the information needed to operate the system and query data outside of their interface.
50	Wisconsin		No		No	Yes		Yes		
51	Wyoming		No		No		No		No	<b>No Response</b>

**10.4 Databases**

The on-line survey also asked DOT's about their Agency's database software used to store traffic counts. The responses are summarized in Figure 13.

**Figure 13 - Database Software Summary**



Each DOT respondent had the opportunity to provide information on their Agencies database software. Individual DOT results can be found in the Table 20.

**Table 20 – Database Software Summary**

#	State Name	What database software is used to store traffic counts?			
		Oracle	SQL Server	Sybase	Other (please specify)
1	Alabama	Oracle			VSAM file on mainframe. Will be converted to Oracle within the year
2	Alaska	Oracle			Natural and Adabas for the Highway Analysis System-the State's legacy integrated database system that includes the Traffic Monitoring System.
3	Arizona	Oracle			
4	Arkansas				dat com (main frame)
5	California	Oracle			
6	Colorado	Oracle			
7	Connecticut				Ascii
8	Delaware				<b>No Response</b>
9	District of Columbia	Oracle	SQL Server	Sybase	MySQL
10	Florida	Oracle			IBM mainframe DB2
11	Georgia				VMS Flat File.....(we are migrating away from this) We plan on using Oracle in the future.
12	Hawaii	Oracle			
13	Idaho	Oracle			
14	Illinois		SQL Server		ACCESS
15	Indiana	Oracle			
16	Iowa	Oracle			Mainframe flat files transitioning to Oracle
17	Kansas	Oracle			
18	Kentucky				Mainframe
19	Louisiana		SQL Server		
20	Maine				Microsoft Access
21	Maryland	Oracle			
22	Massachusetts				Microsoft Access
23	Michigan	Oracle			Visual Foxpro
24	Minnesota	Oracle			Rbase, MS Access
25	Mississippi				Visual Foxpro
26	Missouri	Oracle			
27	Montana				<b>No Response</b>
28	Nebraska		SQL Server		db2
29	Nevada	Oracle			
30	New Hampshire				Microsoft Access
31	New Jersey	Oracle			Mainframe legacy systems
32	New Mexico	Oracle			
33	New York	Oracle			
34	North Carolina	Oracle			MS Access
35	North Dakota	Oracle	SQL Server		
36	Ohio			Sybase	Permanent Counts - Sybase. Short Term Counts - Paradox/Access
37	Oklahoma	Oracle			Access
38	Oregon		SQL Server		FoxPro
39	Pennsylvania	Oracle			
40	Rhode Island				<b>No Response</b>
41	South Carolina	Oracle			
42	South Dakota		SQL Server		
43	Tennessee	Oracle			
44	Texas				<b>No Response</b>
45	Utah				<b>No Response</b>
46	Vermont				<b>No Response</b>
47	Virginia	Oracle			
48	Washington				Mainframe system
49	West Virginia		SQL Server		
50	Wisconsin	Oracle			Wisconsin DOT is currently in a program to upgrade the majority of our volume only ATR locations to collect class data. With the expansion of this program we will turn on features in Tradas that will generate Class specific Seasonal and Day of Week factors for the production of class specific Truck AADT for the generalized classes of Motor Cycles, Passenger Vehicles, Single Unit Trucks and Multi-Unit Trucks.
51	Wyoming	Oracle			

Results from Table 20 illustrate a variety of different database systems utilized, from mainframe to FoxPro to MS Access. This implies a lack of standardize software systems utilized with different programming languages and different business practices to maintain each system.

## **11. FHWA – Travel Monitoring Analysis System (TMAS) and Future Software Tools**

When the travel monitoring program survey was conducted, standard FHWA travel monitoring software tools for providing feedback to State Agencies through a Graphical User Interfaces (GUI's) were non-existent. In September, 2007, FHWA released the first version of a standard software product (called the Travel Monitoring Analysis System (TMAS)) that includes the ability to upload automatic traffic recorded (ATR) data only. This product provides DOT's with immediate electronic feedback through the TMAS GUI's and allows for additional quality assurance and quality checking (QA/QC) of travel monitoring data during the data uploading process. State DOT's should anticipate future FHWA TMAS software releases that will encourage and support State DOT's in sharing data and processing monthly and yearly travel monitoring data. Future releases of the TMAS software will also provide software tools for short-duration traffic counts and weigh-in-motion (WIM) data.

The TMAS product is a good start at building a standardize tool for State DOT's but additional functionality is required prior to enabling this product to standardize State DOT management, software, and business process practices. Once a State DOT's data is uploaded using the TMAS product, uploaded data is immediately committed to the national travel monitoring database. A State DOT uploads data, TMAS executes QA/QC checks, and data that does not pass the TMAS QA/QC checks is then rejected without any functionality to override the rejected data (this functionality is coming soon in future TMAS software releases.) State DOT's need standardized software tools that allow data to be pre-processed prior to uploading data using the TMAS product and committing the data to the national travel monitoring database. State DOT's are obligated to check data prior to uploading data through the TMAS. With additional standardized pre-processing tools, States DOT's can improve the accuracy and quality of data.

## **12. Conclusion**

In summary, responses from DOT representatives indicate travel monitoring program operations, software platforms, and program management activities vary depending on the DOT Agency. Some DOT travel monitoring programs are centrally organized and some DOT's have distributed management and responsibilities.

Operationally, most state travel monitoring programs require from one to twenty staff members including both internal and outsourced staff. The range of centerline miles of roadway managed by DOT's is from 940 miles in Hawaii to the highest in New York with 115,000 miles. The number of centerline miles managed by a DOT is an indicator of travel monitoring program size. The more centerline miles managed, the larger the travel monitoring program which ultimately requires more staff members, more hardware/software, and more standardized business processes to effectively and efficiently manage travel monitoring program activities.

When DOT's outsource traffic data collection activities, data quality can be managed by performing on-site inspections. Only 36% of DOT respondents indicated having a formal inspection program and 22% of respondents indicated not having a formal inspection program. Some DOT's stated a heavy reliance on the contractor or other agency partners to provide quality data. Other DOT Agencies perform random quality checks as often as possible. Some DOT's collect data in-house and therefore responded as not-applicable to this question. These results indicate the strong need for more standardization in data collection business process activities as well as the need for more staff and resources to provide higher quality data through formal inspection program activities.

Short-term traffic count data can vary depending on the time, day of the week, and season in which the traffic data is collected. There are obvious and expected operational patters when DOT's collect short-term data but there are also some differences. For example, all DOT respondents indicated collecting short-term traffic counts on Tuesday, Wednesday, and Thursday. However, 93% collect short-term counts on Monday, 42% collect short-term traffic counts on Friday, and 15% of respondents collect data on Saturday and Sunday. As expected, 39% of DOT respondents specified partial year data collection activities which indicate geographic and regional differences such as weather conditions and larger or smaller spatial areas to cover.

Survey results showed an extremely high variability in number of both permanent and short-term count stations. Specifically the number of short-term count stations varied from 300 sites in Vermont and up to 80,000 sites in Virginia. The number of permanent stations varied from 31 sites in Tennessee to the highest of 2,728 sites in the state of California. Many different factors could account for a high variability in number of permanent and short term sites, such as the amount of funding available, number of resources available, etc. This could potentially indicate a need for more standardization in travel monitoring program site selection and required number of sites to obtain the most accurate and statistically valid data as possible.

Travel monitoring technology related question results indicated most DOT's have advanced technologies in place but several DOT's indicated they are currently working on updating, upgrading, or documenting their hardware and software technology solutions. Most DOT's have automated polling technologies in place and 87% of DOT Agencies have GIS tools to support part of their traffic program business processes and other activities. Although only 87% of DOT's indicated their DOT has a GIS, more DOT's may have a GIS that is not used in the travel monitoring program.

As expected, only 7% of respondents indicated using an off-the-shelf software solution for monthly and year-end data processing of traffic counts which indicates limited existing off-the-shelf software choices for travel monitoring program managers. An overwhelming 66% of DOT's indicated using a customized product for processing monthly and year-end traffic data and of these 66%, there are a variety of software programming platforms used such as Visual Basic, Java, C++, and .NET. This lack of standard software electronic tools, processing techniques, and business processes ultimately costs more money by having each DOT develop their own customized product to produce the same type of traffic count data. In the past, attempts have been made to pool DOT funds and develop standardized electronic software solutions. However, these pooled fund projects do not provide simplistic and integrated software solutions that can be implemented within all DOT's due to customization and specific proprietary software platform requirements. Attempting to share data across DOT's is difficult at best when using different software platforms.

In conclusion, there is a strong need for developing standardized traffic processing software that can integrate state travel monitoring data. It is important for DOT's to work together, along with organizations such as the FHWA and AASHTO, to develop standardized business processes, tools, and resources. Standardizing travel monitoring program activities can provide the consistency as well as support for increasing travel monitoring data quality. Existing federal guidelines provide a foundation for developing DOT Agency implementation standards that can ultimately provide standardized travel monitoring program references and improve overall management, operational, and technology solution activities for DOT's. More research needs to be conducted in the future and continuous surveys need to be conducted to gather current travel monitoring program information. This information needs to be accessible by DOT's to enhance future travel monitoring programs and provide decision makers with the knowledge to manage efficient and fully integrated travel monitoring programs.

## 13. Appendix and Acknowledgement

### 13.1 On-line Survey Questions

An on-line survey was developed to gather information related to State DOT Travel Monitoring programs. This survey was developed by CDOT with the help of FHWA. Below is a list of the 35 on-line questions. For individual survey responses, please contact the author directly.

#### 1. GENERAL QUESTIONS - Contact Information

1. State Name:
2. General Contact Information  
State Traffic Monitoring Program Contact Name:  
State Contact Title :  
State Contact Phone Number :  
State Contact E-mail :

#### 2. PROGRAM MANAGEMENT, OPERATIONS, and STAFFING QUESTIONS

3. Total number of State employees, (Full-time employees (FTE's)), contractors, or consultants, required to manage (or currently in charge of managing) the federally mandated traffic monitoring program? Select Options Below, Delete others

State Agency: Data Collection – None, 1 to 5, 6 to 10, 11 to 20, 21 to 50, 50 to 100  
State Agency: Data Processing - None, 1 to 5, 6 to 10, 11 to 20, 21 to 50, 50 to 100  
State Agency: Data Dissemination - None, 1 to 5, 6 to 10, 11 to 20, 21 to 50, 50 to 100  
Outsourced: Data Collection - None, 1 to 5, 6 to 10, 11 to 20, 21 to 50, 50 to 100  
Outsourced: Data Processing - None, 1 to 5, 6 to 10, 11 to 20, 21 to 50, 50 to 100  
Outsourced: Data Dissemination - None, 1 to 5, 6 to 10, 11 to 20, 21 to 50, 50 to 100

4. If contracted staff used, please specify name(s) of contractor(s)/consultant(s) Name of contactor(s)/consultant(s) :
5. If contracted staff, does the DOT have a formal inspection program to check the quality of contractor data and/or fieldwork? Yes or No

#### 6. SHORT-TERM PROGRAM TRAFFIC COUNTING QUESTIONS How many...

total portable volume count sites :  
annual portable volume count sites :  
total portable classification axel count sites :  
annual portable classification axel count sites :  
total portable classification bin count sites :  
annual portable classification bin count sites :  
total portable WIM count sites :  
annual portable WIM count sites :

#### 7. PERMANENT / CONTINUOUS TRAFFIC PROGRAM COUNTING QUESTIONS How many...

total ATR (permanent/continuous) sites :  
volume only ATR (permanent/continuous) sites :  
volume and classification ATR (permanent/continuous) sites :  
WIM ATR (permanent/continuous) sites :

8. What days of the week do you collect short-term traffic counts? Select from:  
Saturday Sunday Monday Tuesday Wednesday Thursday



9. Do you collect short-term traffic counts all year around? Yes or No

If yes, please specify your count season dates or seasons: example: summer (June, July, and August) :

10. How many total centerline miles of roadway are managed by the DOT?

### 3. SOFTWARE, HARDWARE, AND TECHNOLOGY QUESTIONS

11. Do you have automated polling for your permanent / continuous ATR stations?

Yes or No

12. If the DOT collects permanent / continuous ATR data, at what interval does the DOT collect data? Select all that apply: N/A, 15 minute, 30 minute, 60 minute, other(please specify)

13. Do you have automated procedures for monthly and year-end traffic data processing? Yes or No

14. What software do you use for processing monthly and year end traffic data? Select all that apply: N/A, Customized Product, Off-the-shelf, Vendor Specific Product, Other (please specify):

15. What automated polling software do you use to download permanent traffic data? Select all that apply: Centurion, TOPS (Peek), ECM(wELCoMe), IRD (I-Analyze, Road Reporter, Trafman, Telecom-TT-link), Other (Please Specify)

16. What type of traffic collection equipment do you (or your contractors) currently use? Select all that apply: Peek, Diamond, Metro Count, Mitro, Wavetronic, IRD, PAT, EMC, Metter-toledo, Jamar, Time Mark, Nu Metrics, Other (please specify)

17. If automated processing software, please specify software platform used.

Select all that apply: Visual Basic, Java, C++, .NET, Other (please specify)

18. Do you currently have contractors or vendors that are writing customized code for any traffic monitoring program items? Yes or No

If Yes, who is the contractor or vendor:

19. Please select any items that are automatically generated, or use automated software, to calculate the following traffic monitoring program items:

N/A

AADT

DD

ADT

DHV

ESAL

AADT Single Trucks AADT

AADT Combination Trucks

Seasonal Factors

Axle Adjustment Factors

Other (please specify) :

20. Does the DOT use non-intrusive traffic counting equipment? Yes or No

If Yes, please specify type of technology utilized:

21. Are any of the following software systems fully automated and/or integrated? Processing software and Data Publishing Software – Yes or No  
Polling software and Processing Software - Yes or No  
Polling software and Publishing Software – Yes or No

22. If Yes on any, please describe

23. Does the DOT use GIS? Yes or No

24. If Yes, is GIS used for:

Display of Traffic Data (Stations, Volume, etc.): Yes or No

Processing of Traffic Data: Yes or No

Publishing of Traffic Data: Yes or No

Other Please specify and describe:

25. Has the DOT documented traffic program business processes? Yes or No

26. Does the DOT have formal requirements documentation for the following?

Business Processes? Yes or No : If yes please specify :

Software / Hardware? Yes or No : If yes please specify :

Contract Specifications? Yes or No: If yes please specify :

27. If Yes to any above, please specify or explain

28. Does the DOT have any system diagrams for the following?

Business Processes? Yes or No

Software? Yes or No

Hardware? Yes or No

Databases? Yes or No

29. If Yes to any, please specify or explain

30. What database software is used to store traffic counts?

Select all that apply:

Oracle

SQL Server

Sybase

MySQL

Other (please specify)

#### 4. FEEDBACK

31. Please provide any relevant survey feedback in the box below such as other available on- line survey result links, etc.:

#### 13.2 Acknowledgements

This report and all results presented would not be possible without adequate participation from State DOT travel monitoring representatives. CDOT would like to thank all participating DOT travel monitoring representatives.