




Memorandum

Subject: **INFORMATION:** Implementation of Section 1517 of
the 2012 Moving Ahead for Progress in the 21st
Century Act (MAP-21) Mapping

Date: March 10, 2015

In Reply

Refer to: HIPA-10

From: 
Walter C. Waidelich
Associate Administrator for Infrastructure

To: Division Administrators
Federal Lands Highway Directors

The purpose of this memorandum is to provide general guidance and information regarding the provisions in Section 1517 of the 2012 Moving Ahead for Progress in the 21st Century Act (MAP-21) pertaining to mapping. This memorandum updates the March 24, 1998 memorandum regarding implementation of Section 321 of the 1995 National Highway System Designation Act.

23 U.S.C. 306(a) provides: "In carrying out the provisions of this title, the Secretary shall, whenever practicable, authorize the use of photogrammetric methods in mapping and the utilization of commercial enterprise for such services." The MAP-21 amended Section 306 to require the Secretary to "... conduct a survey of all States to determine what percentage of projects carried out under title 23, United States Code, in each State utilize private sector sources for surveying and mapping services." Neither the original or amended Section 306, nor any other Federal law or regulation, mandates the use of private sector sources for surveying and mapping. Nevertheless, there is significant potential and capacity within the surveying and mapping private sector that can assist State and local governments meet their needs in those areas.

This memorandum summarizes the results of the recently completed survey and encourages States to engage, to the maximum extent practicable, private sector sources for surveying and mapping services for Federal-aid projects [as specified in 23 U.S.C. 306(b)] and provides guidance to address annual monitoring of these services.

On August 7, 2014, FHWA sent a survey (see attached) to the Chief Executive Officer of the State Transportation Agencies (STA) in each of the 50 States, the District of Columbia and Puerto Rico. The survey responses indicated the following:

- 34 of the 52 STAs utilize private sector sources for more than 50 percent of their projects. No STA reported that they used only in-house forces for surveying and mapping.
- Massachusetts, Missouri, New Jersey and Puerto Rico reported that nearly 100 percent private sector forces are utilized for surveying and mapping services.

- 47 STAs said that they maintain the in-house capability to perform surveying and mapping services, with 34 STAs maintaining photogrammetric capabilities.
- 38 STAs indicated that they were moving toward a greater use of private sector forces for mapping and photogrammetric services. 10 STAs plan to maintain their current mix of in-house and private sector sources.
- 30 STAs indicated that their State has a standard operating procedure that establishes surveying standards and specifications on when is it considered practicable to contract surveying and mapping work to private sector sources. Additionally, the survey indicated that STAs consider aerial mapping and LiDAR to be the most practicable service to be accomplished by the private sector.

The table below identifies mapping and photogrammetric services and the number of STAs that maintain in-house capabilities for each service based on results of the survey.

<u>SERVICE</u>	STAs with in-house capabilities	<u>SERVICE</u>	STAs with in-house capabilities
Aerial photography	14	Hydrography	15
Aerial digital data collection	8	Image processing	17
Airborne GPS services	5	Orthophoto production (digital and conventional)	26
Boundary (cadastral) surveying	40	Photogrammetric mapping	27
Cartographic services	27	Photo processing	9
Charting	2	Planimetric mapping	32
Digitizing	18	Remote sensing	11
Engineering surveying	40	Right-of-way surveying	42
GIS consulting and implementation	23	Terrestrial or close range photogrammetry	5
GPS surveying	42	Topographic mapping	40
Geodetic surveying	38	Scanning	26

Full results from the survey can be found on the Office of Program Administration’s Consultant Services website at: <http://www.fhwa.dot.gov/programadmin/consultant.cfm>

In summary, the performance of surveying and mapping activities are commercial activities similar to engineering and architectural consultant services. The benefits of private sector services in the engineering and design areas are widely recognized as providing value to the STAs by providing technical expertise and resources, which may be difficult or expensive for the STAs to maintain in-house. The technology in the field of photogrammetry and mapping is very sophisticated and potentially expensive to maintain a high level of expertise in-house. A qualified and capable private sector exists that can provide STAs with these services.

We ask that Divisions monitor the States use of private sector sources for mapping and surveying as part of the annual stewardship and oversight activities. STAs should be encouraged to periodically evaluate the potential for engaging private sector sources for surveying and mapping services and to report significant changes in their practices to FHWA.

Please contact John McAvoy, Acting Consultant Services Program Manager, 360-619-7591, John.McAvoy@dot.gov with any questions regarding this survey.

Survey Questions

Section 1517 of MAP-21 & 23 U.S.C. 306

1. **How are surveying and mapping activities for projects carried out under Title 23, United States Codes, accomplished in your State? Use the table below to furnish the number of projects according to the mechanism by which the surveying and mapping services were secured, and by Federal Fiscal Year?**

Note: For the purpose of answering this question, the “projects carried out under Title 23, United States Code” is to be interpreted as projects authorized in FHWA’s Fiscal Management Information System (FMIS). For projects that span multiple Federal Fiscal years, just report them once under the year which they were originally authorized in FMIS.

Number of projects carried out under Title 23, United States Codes, according to the mechanism by which the surveying and mapping services were secured, and by the Federal Fiscal Year					
Mechanism used to provide surveying and mapping services	Federal Fiscal Year				
	2009	2010	2011	2012	2013
Number of projects where only STA In-house Forces were used to accomplish the surveying and mapping services under one project number.					
Number of projects where other State Government Agency Forces were used to accomplish the surveying and mapping services under one project number.					
Number of projects where STA In-house Forces and other State Government Agency Forces were used to accomplish the surveying and mapping services under one project number.					
Number of projects where only Private Sector Sources were used to accomplish the surveying and mapping services under one project number.					
Number of projects where Private Sector Sources and STA In-house Forces were used to accomplish the surveying and mapping services under one project number.					
Number of projects where Private Sector Sources and other State Government Agencies Forces were used to accomplish the surveying and mapping services under one project number.					
Number of projects where Private Sector Sources combined with STA In-house and other State Government Agency Forces were used to accomplish the surveying and mapping services under one project number.					
Other (Please Describe):					

Survey Questions

Section 1517 of MAP-21 & 23 U.S.C. 306

8. If your State answered yes to Question # 2, please indicate below (by checking the boxes) the services for which your State maintains in-house capabilities.

<input type="checkbox"/> aerial photography	<input type="checkbox"/> hydrography
<input type="checkbox"/> aerial digital data collection	<input type="checkbox"/> image processing
<input type="checkbox"/> airborne GPS services	<input type="checkbox"/> orthophoto production (digital and conventional)
<input type="checkbox"/> boundary (cadastral) surveying	<input type="checkbox"/> photogrammetric mapping
<input type="checkbox"/> cartographic services	<input type="checkbox"/> photo processing
<input type="checkbox"/> charting	<input type="checkbox"/> planimetric mapping
<input type="checkbox"/> digitizing	<input type="checkbox"/> remote sensing
<input type="checkbox"/> engineering surveying	<input type="checkbox"/> right-of-way surveying
<input type="checkbox"/> GIS consulting and implementation	<input type="checkbox"/> terrestrial or close range photogrammetry
<input type="checkbox"/> GPS surveying	<input type="checkbox"/> topographic mapping
<input type="checkbox"/> geodetic surveying	<input type="checkbox"/> scanning
<input type="checkbox"/> Other (please describe):	

STATE RESPONSES TO SURVEY QUESTIONS - - Section 1517 of MAP-21 and 23 U.S. C. 306

1. How are surveying and mapping activities for projects carried out under Title 23, United States Codes, accomplished in your State? Use the table below to furnish the number of projects according to the mechanism by which the surveying and mapping services were secured, and by Federal Fiscal Year?																																								
STATE	Number of projects where ONLY STA In-house Forces were used to accomplish the surveying and mapping services under one project number					Number of projects where OTHER State Government Agency Forces were used to accomplish the surveying and mapping services under one project number					Number of projects where STA In-house Forces AND State Government Agency Forces were used to accomplish the surveying and mapping services under one project number					Number of projects where ONLY Private Sector Sources were used to accomplish the surveying and mapping services under one project number					Number of projects where Private Sector Sources AND STA Inhouse Forces were used to accomplish the surveying and mapping services under one project number					Number of projects where Private Sector Sources and OTHER State Government Agencies Forces were used to accomplish the surveying and mapping services under one project number					Number of projects where Private Sector Sources COMBINED with STA In-house AND other State Government Agency Forces were used to accomplish the surveying and mapping services under one project number									
	YEAR ->	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013				
Alabama	Alabama Replied: "ALDOT did not include any information for question 1. It would take substantially longer than 24 hours (several weeks but most likely several months) to provide the specified information. ALDOT uses the private sector to provide aerial photography and mapping and has no desire to perform such services in-house. ALDOT, as well as cities and counties, uses consultants as needed for conventional surveying."																																							
Alaska	8	16	21	34	35	0	0	0	0	0	0	0	0	0	0	12	14	19	23	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Arizona	19	21	26	25	35	0	0	0	0	0	0	0	0	0	0	6	20	10	13	16	5	7	5	3	2	0	0	0	0	0	0	0	0	0	0					
Arkansas	30	28	30	35	31	0	0	0	0	0	0	0	0	0	0	11	25	16	15	16	33	47	20	32	33	0	0	0	0	0	0	0	0	0	0					
California	349	251	378	245	230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	318	163	220	259	228	0	0	0	0	0	0	0	0	0	0					
Colorado	Colorado does not track the information needed to fully answer Question #1.																																							
Connecticut	25	21	29	30	34	0	0	0	0	0	0	0	0	0	0	7	6	8	9	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Delaware	36	36	29	46	14	0	0	0	0	0	36	36	29	46	14	Delaware has no records of the number of projects where private sector sources were used for surveying/mapping services.																								
District of Columbia	N/A	N/A	N/A	5	6	N/A	N/A	N/A	5	6	N/A	N/A	N/A	5	6	N/A	N/A	N/A	10	12	N/A	N/A	N/A	10	12	N/A	N/A	N/A	10	12	N/A	N/A	N/A	10	12					
Florida	27	10	14	30	31	0	0	0	0	0	0	0	0	0	0	149	115	124	174	140	69	63	104	86	91	0	0	0	0	0	0	0	0	0	0					
Georgia	N/A	N/A	N/A	639	438	0	0	0	0	0	0	0	0	0	0	N/A	N/A	N/A	210	129	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Hawaii	Hawaii used Army Corps of Engineers for 1 project in 2009																																							
	5	6	6	6	8	0	0	0	0	0	0	0	0	0	0	9	2	6	5	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Idaho	24	23	43	25	12	0	0	0	0	0	0	0	0	0	0	41	17	46	35	50	15	9	6	2	1	0	0	0	0	0	0	0	0	0	0					
Illinois	89	63	54	47	42	1	1	0	0	0	0	0	0	0	0	86	71	74	64	75	165	103	106	68	99	0	0	0	0	0	4	1	0	0	1					
Indiana	Indiana does not track the information needed to fully answer Question #1.																																							
Iowa	56	36	38	45	45	0	0	0	0	0	0	0	0	0	0	19	10	22	11	11	3	2	3	1	2	0	0	0	0	0	0	0	0	0	0					
Kansas	20	27	27	24	39	0	0	0	0	0	0	0	0	0	0	30	39	67	49	36	0	1	0	1	3	0	0	0	0	0	0	0	0	0	0					
Kentucky	Kentucky: The number 36 in the first 5 columns is based on an average for 12 districts																																							
	36	36	36	36	36	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10	7	8	9	8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A					
Louisiana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	30	38	31	10	1	2	7	6	6	0	0	0	0	0	8	32	44	37	16					
Maine	17	52	47	54	82	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	10	20	12	20	27	0	0	0	0	0	0	0	0	0	0					
Maryland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	14	19	16	11	23	14	15	28	17	0	0	0	0	0	0	0	0	0	0					
Massachusetts	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	180	118	88	93	97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Michigan	219	189	153	157	84	0	0	0	0	0	0	0	0	0	0	30	50	68	89	114	9	28	29	25	20	0	0	0	0	0	0	0	0	0	0					
Minnesota	12	25	53	51	86	0	0	0	0	0	0	0	0	0	0	14	7	7	2	1	2	0	13	17	23	0	0	0	0	0	0	0	0	0	0					
Mississippi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	17	17	17	14	0	0	0	0	0	0	0	0	0	0					
Missouri	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	10	14	19	8	0	0	0	0	0	0	0	0	0	0	0	0					
Montana	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	90%	90%	90%	90%	90%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A					
Nebraska	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	6	0	0	0	0	0	0	0	0	0	15	0					

STATE RESPONSES TO SURVEY QUESTIONS - - Section 1517 of MAP-21 and 23 U.S. C. 306

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YEAR ->	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013										
Nevada	3	5	2	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	26	13	15	8	0	0	0	0	0	0	0	0	0	0					
New Hampshire	NHDOT has not used photogrammetric mapping for federally funded projects. The scale of projects in the State's ten year transportation plan does not justify the cost of photogrammetric mapping. The Department has piloted the use of photogrammetric mapping for a state-aid highway project in 2011, using the 2010 statewide orthoimagery. The use of the photogrammetric mapping for this project was limited based on the resolution of the available orthoimagery.																																												
New Jersey	1%	1%	1%	1%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	95%	96%	98%	96%	97%	4%	3%	1%	3%	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%					
New Mexico	14	19	16	18	20	0	0	0	0	0	0	0	0	0	0	46	65	58	46	53	60	84	74	64	73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
New York	All photogrammetric survey and mapping projects progressed by the department has at least one Private Sector component thus the zeroes (*) in the table. All (**) photogrammetric aerial photography and scanning are done by Private Sector Sources. Private Sector Sources are used for projects that have photogrammetric surveying and mapping as part of Design Build Contracts, Consultant Management Contracts, Term Agreement for Survey Services and Regional Design Services Agreements. A limited in-house photogrammetric mapping capability is maintained to perform quality control, develop specifications, respond to emergencies and provide mapping.																																												
New York	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100%	100%	100%	100%	100%	0	0	0	0	0	0	0	0	0	0					
North Carolina	140	117	153	94	103	0	0	0	0	0	0	0	0	0	0	89	65	66	38	64	96	202	306	195	171	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
North Dakota	141	125	139	78	69	0	0	0	0	0	0	0	0	0	0	168	150	111	174	138	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Ohio	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A					
Oklahoma	N/A	N/A	N/A	N/A	N/A	0	0	0	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Oregon	270	247	276	310	291	0	0	0	0	0	0	0	0	0	0	5	7	17	11	12	168	136	123	123	152	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Pennsylvania	389	240	222	168	223	0	0	2	3	0	0	0	2	3	0	434	303	207	269	255	71	24	29	28	142	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Puerto Rico	1	5	0	0	2	0	0	0	0	0	0	0	0	0	0	3	0	2	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Rhode Island	27	15	28	29	15	0	0	0	0	0	0	0	0	0	0	22	15	15	8	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
South Carolina	85%	84%	83%	83%	81%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	15%	16%	17%	17%	19%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%					
South Dakota	6	4	4	4	3	0	0	0	0	0	0	0	0	0	0	99	139	149	141	113	3	4	1	3	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Tennessee	13	14	5	1	1	0	0	0	0	0	0	0	0	0	0	2	0	10	12	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Texas	Texas: 3 surveys per year for Off-System Bridge Program																																												
Texas	164	202	236	242	375	7	3	10	7	17	0	0	0	0	0	460	516	660	654	982	53	58	74	73	108	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Utah	Utah does not specifically track the information needed to easily answer Question #1. (it would take a substantial effort)																																												
Vermont	Vermont: 1 LiDAR acquisition project performed by private sector for each of the last 3 years																																												
Vermont	90	130	132	112	150	1	1	1	1	1	91	131	133	113	151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Virginia	15	9	13	8	22	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	12	18	36	24	12	25	17	26	11	20	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A					
Washington	127	89	61	125	45	0	0	0	0	0	0	0	0	0	0	4	2	6	5	4	3	1	3	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
West Virginia	85% Survey/ 10% Mapping	90%/1 0%	90%/1 0%	90%/1 0%	90%/1 0%	2%	2%	2%	2%	2%	0	0	0	0	0	10%/8 5%	10%/9 0%	10%/9 0%	10%/9 0%	10%/9 0%	35%	35%	35%	35%	35%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%										
Wisconsin	Wisconsin: The number of projects shown which utilized private sector sources may be low. Some projects may have included subcontracts for survey within other contracts, such as design contracts. These were not tracked and are not reflected in the results shown here.																																												
Wisconsin	151	105	146	90	83	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	28	42	67	35	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Wyoming	23	19	31	9	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	85	52	51	51	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

SURVEY QUESTIONS - - Section 1517 of MAP-21 and 23 U.S. C. 306

STATE	2. Does your State Transportation Agency maintain in-house capability for mapping and photogrammetric services?	3. Is your State Transportation Agency moving towards greater or lesser use of private sector for mapping and photogrammetric service?	4. Does your State Transportation Agency have a Standard Operating Procedure that establishes surveying standards and specifications on when is it considered practicable to contract surveying and mapping work to private sector sources? a) If yes, what are the criteria factors used in determining practicability? b) If not, what methods or activities has your State taken to encourage the use of the private sector in performing these services since 1998?	5. What research needs has your State Transportation Agency identified in surveying and mapping instrumentation and procedures and technology transfer?	6. What type of technical guidance, coordination, and administration of surveying and mapping activities would your state will be interested in receiving?	7. What mapping and photogrammetric services does your State Transportation Agency consider to be the most practicable service to be accomplished by the private sector?
AL	No. ALDOT maintains in-house conventional surveying only. We also use consultants for conventional surveying as needed.	Use private sector for mapping and photogrammetric services.	No. All mapping and photogrammetric services are contracted out. Conventional survey work is contracted out if in-house forces cannot perform the work due to time schedules.	Currently developing research project to document procedures and best practices for utilizing 3-d data for use in survey, preliminary design, visualization, and final design.	Documentation and procedures to assist in developing man-day estimates for acquiring digital imagery and LIDAR data.	Aerial photography and LIDAR
AK	Yes. Alaska does employ surveyors.	Alaska is trending towards using more private sector resources for design and construction services, including mapping and photogrammetry, when needed.	No. Because of declining positions within the Department, Alaska has had to contract out considerably more design and construction services to the private sector, including surveying and mapping work.	Development of policy and procedures regarding GPS control. (http://www.dot.state.ak.us/stwddes/research/assets/pdf/fhwa_ak_rd_10_11.pdf)	Machine control, such as intelligent compaction, standards. Use of drones and LIDAR for project design and construction.	Aerial or satellite LIDAR and photography.
AZ	Yes.	We will continue to use the private sector for survey and mapping services while maintaining core competencies in-house.	Yes. Criteria factors which determine practicability include but are not limited to the following: project deadlines, scheduling, availability of private sector, need for specialized equipment, experience, cost and quality of service, in-house workload.	The increase use of LiDAR to prepare mapping.	Standard Operating Procedures for UAS (Un-manned Aerial Systems) and mobile scanners. Updating the use of GPS criteria to allow for GPS derived elevations and the Standard Operating Procedures for this process.	Aerial Photography, Film Processing, Photogrammetric Scanning, Photogrammetric Mapping, Mobile Scanning, Aerial LiDAR, and development of new programs to process cloud information.
AR	Yes	We are utilizing private sector surveying and mapping firms more than we have in the past	Yes. We utilize surveying consultant that have been pre-certified based on project schedules and availability or in-house forces	We continually monitor and adopt new technologies like digital imagery and LiDAR as they become commercially available.	We rely on reports and information from TRB and other professional organization publications.	Mapping from Airborne, Mobile LiDAR or other new technologies that have not become fully developed.
CA	Yes. Caltrans performs the majority of its surveying and mapping services in-house; e.g., basic control surveys, engineering surveys, right of way surveys, construction surveys, etc., but also utilizes private sector surveying services through Architectural & Engineering (A&E) on-call contracts on an as needed basis, and through some project specific contracts. Caltrans maintains some in-house photogrammetric mapping services, but relies 100% on the private sector for services such as: <ul style="list-style-type: none"> • Large format vertical aerial film-based photography • Aerial digital sensor imagery • Image processing • Wet-lab film processing • Film reproductions • Aerial Light Detection And Ranging (LiDAR) • Airborne GPS services 	Possibly greater. Several factors may contribute to this including an expected high attrition rate of in-house Transportation Surveyors over the next few years due to the retirement of the "baby boomers." A&E contracts provide consultants who can augment state staff and provide access to new specialized remote sensing technologies to handle variations in project workload and meet expedited project schedules.	No. Technical surveying standards and specifications are maintained in the Caltrans Surveys Manual. These standards apply for all Caltrans surveys whether conducted by in-house forces or the private sector for projects on the state transportation system. No directions provided in the Caltrans Surveys Manual to determine when it is practicable to contract work to the private sector. (http://www.dot.ca.gov/hq/row/landsurveys/SurveysManual/Manual_TOC.html) The California Legislature sets an upper limit for the use of private sector consultants as a percentage of overall resources to manage capital projects (recently 10% for the Caltrans capital program) 1. California is also subject to collective bargaining agreements that define staffing policies. The use of consultants is guided by California Government Code, Article 4, Personal Services Contracts [19130-19135]. (http://www.leginfo.ca.gov/cgi-bin/displaycode?section=gov&group=19001-20000&file=19130-19135) Legislative support for practices such as design-build has led to greater use of consultants on those projects. (http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201320140AB401)	<ul style="list-style-type: none"> • Aerial LiDAR element extraction for design scale mapping • Merging Mobile Terrestrial Laser Scanning (MTLS) with Aerial LiDAR data sets • MTLS for design scale mapping pavement elevations • Large geospatial dataset management • Utilizing Continuously Global Positioning System (CGPS) ground base stations for Airborne GPS • Utilizing Unmanned Aircraft Systems (UAS) • Advanced Modeling Techniques for Enhanced Constructability Review • Upgrading Roadway and Roadside Visual Image and Attribute Data Collection and Distribution 	<ul style="list-style-type: none"> • A state-wide digital elevation model (DEM) for advanced planning and hydrology analysis. • Acquisition and implementation of high accuracy Spatial Data Infrastructure (SDI) core data and technologies to support transportation decision making. • Use of mobile mapping technologies for transportation asset management. • The application of geospatial technologies for Intelligent Transportation Systems, connected vehicles and supporting the development of the digital transportation infrastructure. 	<ul style="list-style-type: none"> • Flying (aerial photography/photogrammetry) and remote sensing data capture. • Staff augmentation. <p>See report: "Balancing Workload and Resources in Capital Programs: A Survey of Practices in Caltrans and Selected State Departments of Transportation" http://www.dot.ca.gov/newtech/researchreports/reports/2013/final_report_task_2484.pdf</p>

SURVEY QUESTIONS - - Section 1517 of MAP-21 and 23 U.S. C. 306

STATE	2. Does your State Transportation Agency maintain in-house capability for mapping and photogrammetric services?	3. Is your State Transportation Agency moving towards greater or lesser use of private sector for mapping and photogrammetric service?	4. Does your State Transportation Agency have a Standard Operating Procedure that establishes surveying standards and specifications on when is it considered practicable to contract surveying and mapping work to private sector sources? a) If yes, what are the criteria factors used in determining practicability? b) If not, what methods or activities has your State taken to encourage the use of the private sector in performing these services since 1998?	5. What research needs has your State Transportation Agency identified in surveying and mapping instrumentation and procedures and technology transfer?	6. What type of technical guidance, coordination, and administration of surveying and mapping activities would your state will be interested in receiving?	7. What mapping and photogrammetric services does your State Transportation Agency consider to be the most practicable service to be accomplished by the private sector?
CO	<p>Survey Department Answers: Mapping = Yes, by traditional radial survey methods. Photogrammetric= No, all photogrammetric surveys, LiDAR surveys, or other remote sensing surveys (airborne or ground based) are done by contractors.</p> <p>GIS Department Answers: CDOT does general mapping and cartography using GIS software. We do some limited digitizing of aerial imagery and orthophotos. This work is not typically for specific design or construction projects.</p> <p>No in-house photogrammetry in the traditional sense where stereo plotters or softcopy photogrammetry are used.</p>	<p>Survey Department Answers: Greater, all photogrammetric, LiDAR surveys, or other remote sensing surveys (airborne or ground based) are done by private sector services.</p> <p>GIS Department Answers: For GIS-related mapping, CDOT is moving more towards the private sector when desktop and web applications need to be developed.</p>	<p>Survey Department Answers: Yes GIS Department Answers: No Survey Department Answers: When the scope and size of the project exceeds our in-house staffing limits or our existing technological capabilities. GIS Department Answers: Commercial GIS software has been purchased, and private software contractors have been utilized for GIS desktop and web application projects.</p>	<p>Survey Department Answers: LiDAR and other remote sensing data collection, data processing and CAD integration (the production of 3-D planimetric linework) for design surveys that are repeatable and meet our horizontal and vertical tolerance requirements.</p> <p>Global Navigation Satellite System (GNSS, i.e. GPS) Real Time Reference Networks (RTRN) data use and integration with other survey data such as traditional radial survey data, Real Time Kinematic (RTK) and remote sensing data such as photogrammetric and LiDAR (airborne or ground based).</p>	<p>Survey Department Answers: LiDAR data collection, data processing and CAD integration (the production of 3-D planimetric linework for CAD) for design surveys that are repeatable and meet our horizontal and vertical tolerance requirements. Global Navigation Satellite System (GNSS, i.e. GPS) Real Time Reference Networks (RTRN) data use and integration with other survey data such as traditional radial survey data, Real Time Kinematic (RTK) and remote sensing data such as photogrammetric and LiDAR (airborne or ground based).</p> <p>GIS Department Answers: CDOT is informally coordinating through the FHWA Volpe Center's "GIS In Transportation" coordination and outreach efforts.</p>	<p>Survey Department Answers: - Topographic surveys for design (i.e. traditional radial survey methods) - LiDAR data collection and data processing (airborne or ground based) - Photogrammetric (airborne or ground based) - Other remote sensing data collection and data processing</p> <p>GIS Department Answers: Aerial imagery, orthophoto, and roadway imagery acquisition; GIS desktop and web application development; general GIS consulting.</p>
CT	<p>Yes, though we use a Task Based consultant photogrammetrist</p>	<p>Moving toward more consulting</p>	<p>Yes. Large projects or safety sensitive projects get mapped using photogrammetry and accuracy checked/edited by State Forces. Small projects are surveyed on the ground and only get contracted out if State Forces are unable to meet the project schedule.</p>	<p>Formal research is on-going for our joint University of CT/CTDOT Real-time GNSS network. Other formal research has been related to datum transformations and other geodetic system improvements. For instrumentation, research is less formal and performed in conjunction with professional organization publications (such as NSPS) and periodical reviews / vendor demonstrations. CTDOT has initiated procedures with our photogrammetric consultant in the use of very high density, low altitude aerial LiDAR surveys married to conventionally compiled planimetric features and break line data.</p>	<p>How to minimize survey control and maintain accuracy using mobile LiDAR/imagery. New automatic extraction routines/applications for point cloud data being brought into MicroStation/InRoads CAD packages. How to best prepare for the planned NGS roll-out of a new coordinate system in 2022.</p>	<p>Large mapping projects or projects that need to be surveyed remotely due to safety concerns.</p>
DE	<p>In-house mapping - no photogrammetric</p>	<p>Lesser - we use the private sector only to supplement in-house staff</p>	<p>Yes. Following standards set forth under a C\SM NSPS</p>	<p>We're always looking to learn about technological advances that help us get more accurate data or allow us to work faster</p>	<p>Guidance on new technology and its applicability to surveys for transportation projects</p>	<p>None</p>
DC	<p>All mapping and photogrammetry work has been, and will continue to be, delivered by private sector firms.</p>	<p>Currently all mapping and photogrammetric services are being delivered by private sector firms. There are no plans to change the current approach.</p>	<p>Yes. All surveying and mapping work is contracted to private sector sources.</p>	<p>DDOT has not identified research needs in surveying and mapping instrumentation and procedures and technical transfer.</p>	<p>DDOT has established technical guidance and procedures and currently has not identified additional needed support.</p>	<p>All surveying and mapping work is contracted to private sector sources</p>

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STATE	2. Does your State Transportation Agency maintain in-house capability for mapping and photogrammetric services?	3. Is your State Transportation Agency moving towards greater or lesser use of private sector for mapping and photogrammetric service?	4. Does your State Transportation Agency have a Standard Operating Procedure that establishes surveying standards and specifications on when is it considered practicable to contract surveying and mapping work to private sector sources? a) If yes, what are the criteria factors used in determining practicability? b) If not, what methods or activities has your State taken to encourage the use of the private sector in performing these services since 1998?	5. What research needs has your State Transportation Agency identified in surveying and mapping instrumentation and procedures and technology transfer?	6. What type of technical guidance, coordination, and administration of surveying and mapping activities would your state will be interested in receiving?	7. What mapping and photogrammetric services does your State Transportation Agency consider to be the most practicable service to be accomplished by the private sector?
FL	<p>We perform high altitude aerial mapping to support the State of Florida needs for Orthophotography in counties and areas of the State not collected through other agency efforts.</p> <p>We additionally support needs for emergency management and FDOT in disaster assessment and mapping. FDOT performs no corridor photogrammetric mapping on FMIS projects. Consultants perform all collection, processing, and mapping phases.</p>	<p>FDOT anticipates to keep the current mix of consultant and STA efforts. Note: a) Currently all services for photogrammetric services are conducted by consultants. b) Projects that are a mix of consultant and STA are generally due to FDOT conducting the primary network control (geodetic) in an effort to advance project timelines in preparation of consultant's efforts for topographic mapping services. c) STA staff also perform early additional field and office work to support advanced acquisition efforts in support of Right-of-Way parcel mapping.</p>	<p>Yes. FDOT develops and maintains procedures and manuals that support, Location (Design Support) Surveys, Aerial Surveying and Mapping, and R/W Mapping. FDOT additionally has criteria standards for CAD, Quality Control, Management of Traffic (MOT), and Safety. Numerous on line resources and face to face support and training are available to all STA and Consultants whether they are actively conducting work or desire to work for FDOT in the future.</p>	<p>We feel that adequate advanced technology mapping and processing systems are offered by our consultants to address technology needs for FMIS projects. Our STA R&D efforts are to study systems that help us to manage completed project information internally or other mapping data for Emergency Management, other State Agency Support, and information shared with the public. One future need that needs to be addressed is the FAA to rule for Unmanned Aerial Systems. This technology or mapping perhaps offers the best cost and safety benefit for Transportation to be seen in some time. Efforts need to be made with the FAA to develop rules, procedures, and monitoring so that consultants can offer these services.</p>	<p>We would like to see adequate funding and support for National Geodetic Survey (NGS) to continue some degree of services for horizontal and vertical control monumentation, height modernization, and for a dedicated NGS Advisor for Florida to coordinate with all of our State Agencies who require Surveying and mapping support.</p>	<p>All photogrammetry, remote sensing (LiDAR) hydrographic, design, and R/W mapping on projects that would be considered outside of minor surveying mapping efforts.</p>
GA	Yes.	Greater	<p>Yes. • GDOT Survey Manual • GDOT Standard Specifications • Prequalification of consultants in the following classes: o 5.01 Land Surveying o 5.02 Engineering Survey o 5.03 Geodetic Survey o 5.04 Aerial Photography o 5.05 Photogrammetry o 5.06 Topo Remote Sensing o 5.07 Cartography o 5.08 SUE</p>	<p>The only research needs that we have identified for surveying that might apply here would be a Height Modernization program to establish new vertical monuments statewide. This would be done with a combination of high accuracy leveling, GPS occupations, and Gravity observation measurements. It would also require funding for a National Geodetic Survey Advisor.</p>		<p>All. We currently maintain internal staff numbers and skill sets capable of delivering 33% of work load. With a plan to outsource the remainder.</p>
HI	Our State Transportation Agency maintains in-house capacity for mapping or survey sources but not photogrammetric services	We are moving towards greater use of private sector mapping because we do not have the capability for photogrammetric service	Yes. We look at the capacity of our in-house staff to complete work by the deadline. If projects are designed by the private sector Consultants, they generally perform survey/mapping with private sector sources	None	None	Photogrammetric services and any in-house staff does not have the capacity to complete.
ID	No.	Greater use of private sector	No. Redution in staff forces due to attrition	Mobile laser scanning to identify potential problems areas for landslides. Satellite-based radar to identify potential problem areas for creep or mass movement.		Aerial Mapping

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IL	Yes, we have a Surveying Section; n each district and an Aerial Surveys Section at our Central Office.	Greater, as reflected in our answer to Question#1 we have been steadily increasing our use of the private sector for mapping and photogrammetric service.	No. Our staffing levels of surveyors have decreased since 1998 therefore necessitating the increased use of private sector surveyors.	Currently we are researching 3d laser scanners, mobile mapping technology and Light Detection and Ranging technology on the basis of accuracy, efficiency and applicability to IDOT's mapping and surveying operations.	IDOT; s always open to receiving technical guidance and also open to a discussion on the appropriate roles for government and private sector coordination and/or administration of surveying and mapping activities.	Currently our photogrammetric data collection is performed by a single prop airplane with a film camera. Any photogrammetric data collection outside of those capabilities is acquired by private mapping companies. This would include all digital photography and LIDAR remote sensing. During heavy mapping seasons we commonly contract with private mapping companies for any work that we do not have the staff levels to complete within deadlines.
IN	Yes, minimally staffed and equipped capability to provide/ensure QA/QC of photogrammetric products and services provided by private sector; develop and implement policies, procedures, and standards regarding statewide aerial imaging and photogrammetric processes; provide imaging, scanning and mapping services, as needed, with all aerial acquisition services provided by private sector.	There is a greater emphasis on utilizing private sector services	Yes. Our standard operating procedure is to have private sector provide survey when private sector is providing design and vice-versa. We typically only perform in-house design for small projects and for road resurface overlay type projects. We vary from standard procedure when we have survey capacity beyond that needed to support in-house design and when survey needs to start sooner than we can get a design consultant on board.	Feasibility and implementation of new coordinate reference system utilizing low distortion projection system definitions; Laser mobile mapping standards and applications; n transportation; UAS (unmanned aerial systems) applications; n transportation activities.	Cost-benefit analysis of private sector vs. in-house surveying and photogrammetric mapping services. Documented guidance for applications and utilization of UAS for transportation activities.	Aerial imagery acquisition; Photogrammetric mapping of large scale projects and short turn-around requiring significant staffing availability; Projects requiring combination of terrestrial and aerial LiDAR scanning together with traditional aerial imaging and/or ground survey.

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STATE	2. Does your State Transportation Agency maintain in-house capability for mapping and photogrammetric services?	3. Is your State Transportation Agency moving towards greater or lesser use of private sector for mapping and photogrammetric service?	4. Does your State Transportation Agency have a Standard Operating Procedure that establishes surveying standards and specifications on when is it considered practicable to contract surveying and mapping work to private sector sources? a) If yes, what are the criteria factors used in determining practicability? b) If not, what methods or activities has your State taken to encourage the use of the private sector in performing these services since 1998?	5. What research needs has your State Transportation Agency identified in surveying and mapping instrumentation and procedures and technology transfer?	6. What type of technical guidance, coordination, and administration of surveying and mapping activities would your state will be interested in receiving?	7. What mapping and photogrammetric services does your State Transportation Agency consider to be the most practicable service to be accomplished by the private sector?
IA	<p>Yes. Iowa DOT staff collects engineering/topographic survey data and photogrammetric mapping to support the planning and design of proposed transportation improvement projects. In addition to in-house survey capabilities, the Iowa DOT contracts a significant amount of survey work, aerial imagery acquisition, airborne LiDAR and mobile mapping to private consultants.</p> <p>The Iowa DOT central office currently has a staff of 19 individuals devoted to survey and photogrammetric services. Each of the Iowa DOT's 6 district offices have approximately 3 to 4 individuals devoted to boundary/right-of-way surveying.</p>	<p>The trend has been toward a gradual increase in the use of the private sector for the collection of engineering/topographic survey. The trend has been gradual in large part because although the Iowa DOT has experienced survey staffing reductions, the productivity of the remaining staff has been significantly increased due to technological advances in both the collection equipment and the processing software. Over the past 10 years there has been little or no change in the percentage of work contracted to the private sector in the area of photogrammetric services. Iowa DOT relies on the expertise offered by private consultants to broaden capabilities to include the acquisition and processing of airborne LIDAR and implementing advancements in aerial imagery technology.</p>	<p>The Iowa DOT has survey standards and specifications which can be found in Chapter 40, Design Survey Specifications, of the Iowa DOT Design Manual. The following is a link to that document: (http://www.iowadot.gov/design/dmanual/manual.html?reload). However, this document does not address the decision process to be used to determine when a survey project will be completed by Iowa DOT staff or a consultant.</p> <p>The primary factor in determining survey/photogrammetry work assignments is the project delivery schedule that is established for all projects in the Iowa DOT's development program. Every effort is made to maximize the number of survey/photogrammetry projects that are accomplished by Iowa DOT staff, but when the workload exceeds internal resources or the workforce is not sufficient to meet completion dates, then consultants are contracted for the work. To facilitate this process, the Iowa DOT maintains a number of 'on-call' survey consultants and one aerial services/photogrammetry consultant that can be called upon to accomplish multiple assignments.</p> <p>The use of the private sector has been significant in being able to deliver the Iowa DOT's transportation program since that time. Numerous private sector firms have been involved on a project-by-project basis as well as a large number of projects completed through the 'on call' consultant contracts. In addition to assisting in the development of standard projects, and providing expertise in implementing new technologies, the Iowa DOT has encouraged the use of consultants to pursue unique services such as SUE (Subsurface Utility Engineering), railroad data collection and performing aeronautical surveys.</p>	<p>The Iowa DOT has a need to better understand and leverage LiDAR derived point cloud data. Specifically there is a need to identify the best practices for data extraction from a point cloud to meet the needs of highway planners and designers.</p>	<p>The Iowa DOT is open to receiving technical guidance in all areas of data collection. Although we have been collecting survey data for many years, there are always ways to improve the applications of our resources and improve processes. The following are two specific areas where we would be interested in receiving technical guidance:</p> <ul style="list-style-type: none"> • Develop a better understand of the advantages and challenges associated with conducting a statewide height modernization project. • Subsurface utility surveying includes a number of advanced technologies for locating facilities beyond 'pot-holing' utilities for direct survey observations. Technical guidance is needed in understanding those methods as well as understanding when those various options are appropriate to use. 	<p>The following is a list of the most practical services to be provided by the private sector:</p> <ul style="list-style-type: none"> • Subsurface Utility Surveying • Aerial Imagery for Photogrammetry • Aerial LiDAR • Mobile LiDAR • Railroad Surveys
KS	Yes	Greater	<p>No, depends on availability/schedule b) None needed</p>	General business applications	Mobile LIDAR	Aerial photography and LIDAR
KY	No. Mapping and Photogrammetric services are assigned to 3 consultants on a rotational basis.	Greater because of Mobile Mapping.	Yes. Size and scope of the project. KYTC does not have a Mapping and Photogrammetric section so it is contracted out.	Unmanned Aerial Systems. However, the FAA has 6 test sites for research and we are waiting for the findings.	None.	Airborne LiDAR. Kentucky currently has a statewide initiative. KYTC is a major partner in this effort.
LA	Yes.	Greater	Yes. Experience, Workload, Location, Capabilities.	LIDAR (Airborne, Terrestrial and Mobile), The accuracies and costing, Is the cost prohibitive?	Fixed wing, Mobile, and terrestrial LIDAR	Fixed wing, Mobile, rotor wing, and terrestrial LIDAR and property surveying and mapping
ME	No.	All mapping and photogrammetric services are provided by consultants	Yes. MaineDOT has survey efforts broken into its five maintenance regions. Some of the regions have limited staff and nearly all the topographic survey is done by consultants. In other regions consultants are used during peak demands to help level workloads. Also some projects are best surveyed or mapped with technologies or expertise beyond our current capabilities.	Tripod mounted laser scanning Vehicle mounted mobile laser scanning Helicopter mounted low altitude laser scanning 3-D Modeling	3-D Modeling and Machine Control	Aerial Photogrammetry
MD	<ul style="list-style-type: none"> • Mapping_ yes • Photogrammetry - no 	Greater	Yes. Based on available resources, scope, schedule, and size of assignment.	Scanning Technology	<ul style="list-style-type: none"> • LIDAR/Scanning • Options for data management for scanning (very large files lend to storage issues) • Drones 	<ul style="list-style-type: none"> • Photogrammetry • Scanning/LIDAR • Large projects on major routes

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STATE	2. Does your State Transportation Agency maintain in-house capability for mapping and photogrammetric services?	3. Is your State Transportation Agency moving towards greater or lesser use of private sector for mapping and photogrammetric service?	4. Does your State Transportation Agency have a Standard Operating Procedure that establishes surveying standards and specifications on when is it considered practicable to contract surveying and mapping work to private sector sources? a) If yes, what are the criteria factors used in determining practicability? b) If not, what methods or activities has your State taken to encourage the use of the private sector in performing these services since 1998?	5. What research needs has your State Transportation Agency identified in surveying and mapping instrumentation and procedures and technology transfer?	6. What type of technical guidance, coordination, and administration of surveying and mapping activities would your state will be interested in receiving?	7. What mapping and photogrammetric services does your State Transportation Agency consider to be the most practicable service to be accomplished by the private sector?
MA	MassDOT maintains limited in-house capabilities to support mapping and photogrammetric services. The in-house aspects of these services are limited to setting the initial horizontal and vertical control for projects.	Since approximately the mid-1980's MassDOT has used private sector consultants for mapping and photogrammetric services. The predominant use of private sector consultants has not changed in that time.	No. All mapping and photogrammetric services are contracted to private sector sources. The MassDOT Architectural and Engineering Review Board routinely prequalifies architectural and engineering firms to provide services in various disciplines including surveying services.	The MassDOT CORS/Real-Time GNSS Network was identified in the mid-2000's. The MaCORS Network has been operating since August 2014.	Surveying and mapping technologies are changing. MassDOT has seen an increase in light detection and ranging (LiDAR) use for highway, rail, and bridge projects. Technical guidance on the use of LiDAR would be beneficial.	MassDOT currently uses statewide contracts for Total Station AutoCAD Base Plan services, Engineering Field Survey (construction layout) services, Layout Documentation Preparation services, and Photogrammetry services.
MI	Michigan Department of Transportation (MDOT) maintains limited in-house capability to perform mapping, primarily for the purposed of maintaining competency, executing special projects, pick-up mapping and developing innovative practices. MDOT does not maintain in-house capability for photogrammetric services.	MDOT has moved towards greater use of private sector mapping and photogrammetric services.	No. MDOT performed a structural re-organization in 2012, reducing the capability of performing in-house production survey activities. At that point in time, the Statewide Survey Crew was also moved away from production activities and re-allocated to other support efforts. The Central Office Survey Support Unit was also directed to increase emphasis on development and implementation of innovations in the areas of survey automation, geospatial data collaboration, design to field automation, AMG/AMC and GIS.	MDOT has not formally identified, to FHWA or AASHTO, the need for research in surveying and mapping instrumentation, procedures or technology transfer. MDOT has utilized limited State SPR funds to pilot and research Mass Geospatial Data Acquisition with mobile LiDAR.	None.	MDOT considers larger complex projects in heavy urban settings to be the most practicable to be accomplished by private sector sources. The specialized equipment, such as mobile LiDAR and other remote sensing technologies require large capital investment and dedicated specialized staff to use, which is not practical for a DOT to maintain. MDOT also considers projects of larger magnitude, such as county wide or state wide mass data acquisition practicable to be accomplished by private sector sources due to the need for specialized equipment and staff along with solutions for data management issues associated with mass data collection.
MN	The Department maintains in-house capability to provide those surveying and mapping services that are required on a frequent basis (see answer to question #8). This includes Design/Location surveys, Right of-Way/Cadastral surveys, topographic surveys, development of various survey imagery products, and right-of-way mapping. Most, if not all, of these services are augmented with private sector resources when demand levels exceed those capable of being serviced by Department forces. Those services that require specialized equipment or skills and are not required frequently enough to justify the cost of acquiring and maintaining them are 100% private sector. Examples include Aerial Data Collection and Mobile LiDAR Data Collection.	Shrinking operational budgets, loss of experience as retirements hit, and the resulting reduction in overall staffing levels leave no choice but to place greater reliance upon private sector resources.	No. Private sector surveying and mapping services are used when either the workload exceeds in-house capacity or the work requires specialized equipment/skills not available in-house. Several steps have been taken to facilitate the use of private sector surveying and mapping services. These include: 1) Specific appropriations to hire consultants; 2) Inclusion of consultant surveying and mapping services as part of the project cost—paying out of project funds; 3) Revision of the Department's Surveying & Mapping Manual to include an appendix on Contractor Construction Staking; 4) Creation of the Consultant Pre-Qualification Program to streamline the process for getting surveying and mapping consultants under contract.	i. Standards and procedures for using Unmanned Aerial systems; ii. Standards and procedures for using Terrestrial Mobile LiDAR; iii. Better integration of GIS and surveying and mapping; iv. New equipment and procedures for precise leveling across rivers and urban canyons; v. 3D design and model building for machine control. The Department engages in knowledge and technology transfer, both to and from the Department, in several ways. Department personnel are regular presenters at the State Professional Surveyors' Conference. The Department also sponsors an annual Survey Technical Workshop that is planned and attended by personnel from within and outside the Department. At the regional and national level Department personnel are involved in the Great Lakes Regional Height Modernization Consortium and the TRB A list, identifying surveying and mapping contacts for the other state DOTs was also created.	In addition to the items listed in #5 above, help in adjusting our statewide network of passive and active survey control as the National Geodetic Survey brings new datums and adjustments on line.	As previously noted, those services that require high cost equipment or specialized skills and are not required frequently enough to justify the equipment cost or maintain the skills in-house (aerial data collection, mobile LiDAR data collection). As long as the Department operates in a 2D design environment and specifies the printed plan as the controlling document for construction, creation of models for machine control with the attendant liability is best handled through private sector surveying and mapping services. Although Department construction contract administration personnel would prefer in-house survey crew on the job site, current funding mechanisms make construction staking a prime candidate for private sector survey crews. Work that involves the delineation of boundaries between private parties (replacing private boundary monuments destroyed during construction or creating registered land surveys for conveying property back to private ownership) is best handled by the private sector to keep the Department out of any future litigation between such parties.

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STATE	2. Does your State Transportation Agency maintain in-house capability for mapping and photogrammetric services?	3. Is your State Transportation Agency moving towards greater or lesser use of private sector for mapping and photogrammetric service?	4. Does your State Transportation Agency have a Standard Operating Procedure that establishes surveying standards and specifications on when is it considered practicable to contract surveying and mapping work to private sector sources? a) If yes, what are the criteria factors used in determining practicability? b) If not, what methods or activities has your State taken to encourage the use of the private sector in performing these services since 1998?	5. What research needs has your State Transportation Agency identified in surveying and mapping instrumentation and procedures and technology transfer?	6. What type of technical guidance, coordination, and administration of surveying and mapping activities would your state will be interested in receiving?	7. What mapping and photogrammetric services does your State Transportation Agency consider to be the most practicable service to be accomplished by the private sector?
MS	Mapping yes, Photogrammetric no	Lesser for Mapping, Greater for Photo	Yes. If we have the capabilities to perform the work in house then we do. If a specialty item such as aerial or LiDAR is needed we consult that work out. If our staff are fully loaded then we consult out.	We use the top of the line survey equipment as far as our traditional instruments and GPS. We would like to investigate how having our own mobile LiDAR capabilities could improve our work and cost efficiency.	None.	Anything to do with aerial surveys and LiDAR. We do not have those capabilities in house.
MO	No, photogrammetry unit was consulted out in 2010. MoDOT hasn't had a plane for over 15 years.	Greater	Yes. STIP - State Transportation Improvement Plan: • Purpose of the date • Value to the organization • Timeliness to deliver data to meet STIP schedule • Use of appropriate technology to be the most economical to meet the performance base specifications	None at this particular time. Pre-2010: Research was conducted for: • Use of GPS/GPS Network for or design & Construction applications • Use of LIDAR technology Today, MoDOT uses GPS/GPS network and LIDAR technology in our surveying/mapping practices	None. MoDOT is a lead state in survey and mapping practices. So often times the private sector lacks the expertise to provide technical guidance, coordination and administration of surveying and mapping practices/activities. Furthermore, MoDOT is a FHWA partner as a lead state for the Every Day Counts 2 initiatives utilizing these technologies	Data acquisition for or corridor mapping using LiDAR technology
MT	Yes. The Montana Department of Transportation maintains in-house capabilities for mapping and photogrammetric services.	The MDT has not made a concerted effort to move towards using either more or less private sector mapping and photogrammetric services. Instead, the MDT focuses on delivering the most cost effective mapping and photogrammetric solutions available for the benefit of the taxpayer. This has historically resulted in the use of both in-house and private sector services.	MDT does not have a documented Standard Operating Procedure that directs when we would use private services for surveying and mapping. MDT's use of private surveying and mapping services is driven by workload and technological capabilities.	MDT would support additional research pertaining to LiDAR data collection and processing. In addition, the MDT would support research for the development and implementation of RTNs (realtime kinematic global navigation satellite system network) for sparsely populated rural states.	MDT has not identified a need for additional technical guidance or coordination for survey and mapping activities at this time.	The MDT currently considers airborne LiDAR, mobile LiDAR, topographic survey (by GPS or traditional radial survey methods) and specialized remote sensing applications to be the most practicable mapping and photogrammetric services that can be accomplished by the private sector.
NE	Yes. NDOR does not maintain survey level aerial photo capability	Greater	No. We do not have a survey quality camera. All engineering level survey is completed by consultants.	None	None	Aerial engineering survey Mapping when in-house staff is sufficient
NV	Yes	Lesser use	Yes. Our department has surveying standards and specifications. However, for us scheduling and work load are the key factors we use for using vendor's. We have a plane that does our flights, but it also acts as a transporter for people, that's our biggest factor!	We are looking into drones/UAV's, mobile laser mapping and digital camera's for our plane.	Right now, it would more likely be the drone/UVA's technology.	The flights
NH	The Department does not have any in-house resource to develop photogrammetric mapping. We primarily rely on ground survey using in-house resources.	At this time the Department is not pursuing the use of photogrammetric mapping.	No Response Provided	No Response Provided	No Response Provided	No Response Provided

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NJ	Yes, the NJDOT maintains in-house field survey capabilities for base maps on projects where Aerial Mapping; s not an option.	At this point most of the base map preparation is performed by consultant services, approximately 95-98 %.	Yes. The criteria includes: • Size of the project(length in miles) • Safety requirements(DOT forces may not be available to provide required safety) • Location of project(proximity to main office in Trenton, or the 2 Regional offices)	None	Presentation on what other technologies are available to develop base maps and when to employ them.	Aerial Mapping and Mobil LIDAR
NM	Yes, we have five (5) survey field units statewide that support in-house mapping and in-house photogrammetric services.	Greater, we have augmented our capacity to support schedules and project lettings by increasing the use of private sector on-call services.	Yes. 1) Is the project an in-house design and do we have the capability to provide the service in-house? This is typical determined based on the methodology best suitable for the survey project. 2) Is the project going out to RFP or engineering services? If so, then the need for surveying and mapping services are included in the RFP. Surveying and mapping services for design projects are viewed as sub-services, and the DOT does not want to act as a sub to their service provider. 3) Can we support the production date based on project tracking and the current DOT survey schedule? Survey and mapping efforts for projects are based on production dates. 4) Do we have current on-call capacity to contract surveying and mapping work to private sector sources? 5) Standards and specifications along with operating procedures have been established within the DOT for surveying and mapping deliverables. These are provided to private sector sources; in order to standardize all surveying and mapping products being prepared and delivered by all sources.	Intelligent Compaction and 3D-Modeling for automated machine control applications, laser scanning, aerial based Lidar, and Virtual Reference Networks (VRN) for GPS.	Development of a statewide VRN to establish consistency and accuracy on the primary control networks statewide that are being utilized for the initial survey for design to surveying or construction (Continually constructing on the exact same coordinate system the project was designed on). Guidance on a statewide GIS to utilize as a tool to manage survey data and ROW maps for planning and research.	We consider aerial photo acquisition services to be the most practical service accomplished by the private sector. We employ this service for the development of topographic mapping to utilize in-house services for stereo compilation. If we cannot support a project schedule with only aerial photo acquisition services, request for full photogrammetric mapping service is made to be completed by a private sector source.
NY	Yes for the items listed in the response to Survey Question 8.	The trend over the years has been to use more private sector mapping and survey.	No. a) Since before 1998 the department has multiple Term Agreements for Survey Services that provide surveying and mapping and allow increased capacity based on capital program needs. b) Design build and consultant design contracts have surveying and mapping included with engineering design and construction.	Unmanned Aerial Vehicle use in Corridor Mapping.	National Geodetic Advisor.	Surveying and mapping beyond the limited capacity of the state work force and all aerial photography acquisition and scanning.
NC	Yes, in multiple organizational areas. There is not one survey/mapping group within NCDOT	Greater use of the private sector, where possible and feasible based on time, specific needs, etc.	No. • NCDOT funds and participates with other state agencies to pay the private sector to perform statewide surveying and mapping services • NCDOT provides in-house contracts for mapping/photogrammetry needs on an on-call basis at all times • NCDOT looks at and utilizes private industry to develop utilization of or newer, contract-provided technologies which can enhance NCDOT mapping/survey operations • NCDOT units responsible for surveying and mapping are actively "downsizing" through attrition and retirement • NCDOT units responsible for surveying and mapping were "downsized" in 2011 through a Reduction in Force.	2011 – Research on the uses of LiDAR in transportation-related mapping, including airborne (fixed and rotary wing) and terrestrial (static and mobile)(NC State University) 2014 – Uses of Unmanned Aerial Systems (UAV's) in transportation-related mapping/surveying applications (NC State University) 1990's – Uses of GPS in transportation-related mapping/surveying 1990's – Mapping Subsurface Utilities as a way to reduce utility relocation costs	None.	The Department prefers to limit those who place survey those who place survey control monumentation during initial ground surveys; this ensures a consistency of mapping from different sources. Beyond that, the services provided by the private sector may depend on availability of location, manpower, and specific technologies provided by the various private sector firms. The services likely to be contracted include: aerial digital data collection (LiDAR), remote sensing, terrestrial or close range photogrammetry, photogrammetric mapping, planimetric mapping, orthophoto production, right of way and boundary mapping, and construction stakeout.
ND	Yes.	Fluctuates as project numbers increase or decrease.	Nothing officially documented. Private sector sources are used on all types of projects. Private sector sources are used to supplement the state's workforce/staffing based on project delivery schedule and staff availability.	What is the best way to store and retrieve the massive amounts of data comprised of a LIDAR collected point clouds.	None.	GPS, LIDAR, Stereocompilation, analytics, ground survey, boundary survey, right of way, utility mapping, sign surveys, construction staking, cadd file creation and editing.

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OH	Yes. Ohio DOT maintains in house capabilities for these services	Ohio DOT not moving in either direction. Our program fluctuates from year to year based on funding and maintenance/preservation needs. Some years we have greater need for private sector services and some years there is less need.	We have implemented Task Order Contracts with consultants that provide these services so that we have the flexibility to contract work as our workload increases and needs arise.	Technology Transfer research for mobile mapping data to move data seamlessly through the DOT, from survey to design, asset management, and construction.	Use and benefits of mobile mapping data sharing between offices of a DOT.	Statewide data collection and to supplement data processing needs that exceed our capacity to accomplish timely.
OK	Yes.	Greater	No. When workload exceeds the capacity of our forces, private sector is called upon			Aerial, Mobile, & tripod mounted LiDAR mapping
OR	Yes.	Neither. Oregon DOT achieved a reasonably comfortable balance of in-house resources and private sector partners. Our expectation is to remain essentially static and maintain the status quo.	No. Oregon DOT uses the following criteria to trigger use of private sources for surveying and mapping services: • Projects in excess of 70% staffing target • Surges and peak workload • Specialty service for which we do not maintain in-house Expertise	After some discussion, this question left us with no clear consensus of what information FHWA is seeking.	Oregon DOT could benefit from information and training on advanced remote sensing technology, processing, and analysis. Additionally, the Department would like to see rapid advancements in rules and regulations to support broad use of unmanned aerial systems (UAS).	Oregon DOT, in cooperation with a multi-agency consortium, has seen tremendous success in wide-area high-altitude fixed-wing airborne LiDAR collection.
PA	Yes.	Pennsylvania recently passed a new transportation HB1060 significantly increasing annual transportation funds. PennDOT will not be increasing their in-house workforce; therefore, there will be greater need for private sector resources to complete surveys and mapping.	Yes. On a weekly basis workload is analyzed by management to determine if in-house staff can complete project(s) within due dates. If PennDOT's in-house workforce cannot complete project(s) on time, the project(s) are contracted to the private sector. Typically, major surveying, mapping projects are contracted to the private sector due to limited in-house resources. Smaller projects with short time schedules are typically performed in-house.	None at this time. We do maintain a training workgroup which identifies needs in the area.	None at this time. PennDOT enables employees to attend national surveying and mapping conferences, webinars, seminars and various training opportunities to stay abreast of the latest advances in surveying and mapping technologies.	Aerial photography, LIDAR (mobile and static) and real-time GPS statewide networks would be practical to be performed by the private sector due to start-up and maintenance expenses.
PR	Yes. PRHTA has land surveying parties mainly for construction purposes. However, are used also to gather data needed for design. Photogrammetric Services, PRHTA has historic data up to 2010, however new data is provided as required by private services.	PRHTA from the design viewpoint is moving toward greater private sector services especially for mapping. Any need for new photogrammetry services is fulfilled by the private sector.	Yes. The main criteria are the time period to obtain the required data. The data shall comply with requirements established by the state for PRHTA and all other Government Agencies for mapping information, such as use of NAD83 coordinates, etc.	To the best of our knowledge, no research has been performed in the PRHTA.	a. Assistance to develop a ROW Procedures Manual as an internal guidance document for the agency. b. Technical Guidance about: i. Specifications ii. Instrumentation iii. Surveying Methods iv. Horizontal and Vertical Control Procedures and Requirements c. Surveying Management v. Personnel vi. Coordination between Agency and Private Consultants vii. Data Transfer d. Contract Management viii. Proposal evaluations ix. Contract Adjudication x. Consultant's Qualifications	• Orthophotos • GIS for ROW, topography, horizontal and vertical control (benchmarks) and cadastral information • Mapping services for design purposes and construction as-built.

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RI	Yes, in-house capability including basic base mapping only such as drainage topo areas. Photogrammetric services are not available	Our survey section currently has four LSP so our mapping resources are limited. We currently have 15 on-call private firms as needed.	Contracting surveying and mapping is included in with the main designer selection procurement process. Each project size determines actual needs for private sector sources. RIDOT has 15 on-call private sector firms selected to perform survey services. RIDOT has not hired additional in-house staff.	RIDOT is preparing to include in-house equipment to utilize LiDAR as a future technology to advance the design in a more complete and thorough way of addressing existing conditions.	RIDOT will accept technical guidance on new "state of the art" equipment to keep up with the surveying industry. Equipment for LiDAR and GPS mapping is of great interest to RIDOT.	Aerial photography Surveying and mapping for larger projects Existing conditions survey for "on ground" and "in ground" for project baselines.
SC	Yes.	Due to Budget constraints, over the last several years, SCDOT is being asked to do more with less internal resources which precipitates a greater use of private sector resources.	Yes. Currently SCDOT considers two criteria when considering the use of private sector mapping and photogrammetric services. Those two criteria are (1) internal workload (2) technical expertise and capability.	SCDOT has recently expanded its use of aerial and mobile LiDAR on preconstruction design projects. We are currently investigating the application of these technologies for cross slope verification and quantity calculations.	SCDOT has not currently identified any areas of interest as it relates to technical guidance, coordination and administration of surveying and mapping activities.	SCDOT does not have the internal capability to perform remote sensing services such as conventional aerial photography, aerial LIDAR, Mobile LIDAR or the processing and mapping of the data which is collected by these methods. SCDOT considers remote sensing to be the most practicable service to be performed by the private sector.
SD	South Dakota DOT contracts out all photogrammetric services, but does have the in-house resources for mapping.	As South Dakota DOT does not have in-house resources for photogrammetric services, we continue to contract out all of those services - no change in private sector use. For mapping services, the South Dakota DOT has, out of workload necessity, contracted out a greater number of projects for mapping; although the great majority of projects are still handled in-house.	Except for photogrammetric surveys (no in-house resources), the South Dakota DOT does not pursue the use of private sector resources for surveying and mapping, for in-house projects, unless in-house resources are not available due to workload and/or project schedules. Local government agencies receiving matching funds from the South Dakota DOT contract out all design and surveying/mapping services. This is reflected in question #1. Generally, P&E for South Dakota DOT projects is funded with State funds; consequently the number of projects listed in #1 with STA only surveying/mapping resources is low.	None at this time.	None at this time.	Photogrammetric service as the South Dakota DOT does not have any of those resources in-house.
TN	Yes. In 2007 TDOT entered into a contract with the Tennessee Department of Finance and Administration to provide aerial imagery for maintenance of the Tennessee Base Mapping Program (TNBMP). The TNBMP is a multi-state agency effort that involves creating, managing, and displaying GIS data products (imagery, elevation, hydrography, parcels, administrative boundaries, etc.) to support a wide range of business applications. The most widely used GIS layer is the orthophotography developed by TDOT which is being used by over 200 staff in 15 different state agencies and the general public via public facing web applications.	The Department frequently uses the private sector services for aerial surveys and mapping. A recent trend of "lesser use" is related to fewer number of new start projects in the FFY2013 and 2014 budgets.	Yes. 1. The magnitude of the work involved for the project as compared to available Department resources. 2. The complexity of the work involved as compared to expertise available within TDOT. 3. The timeframe in which the work must be accomplished and the ability of TDOT to do the work on schedule.	None.	None.	Providing workforce when needed to meet scheduling requirements.

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TX	Yes, our agency maintains in-house capability for mapping and photogrammetric services.	Overall, our agency is moving towards greater use of the private sector for mapping and photogrammetric services.	No. Our agency has no standard operating procedures in place, however if funding becomes available and the need for assistance increases the use of the private sector may be encouraged to help our agency in-house forces perform these services.	> LIDAR technology; > Unmanned aerial vehicles (UAV's) and associated technology; and > GIS mapping services.	Our state would be interested in receiving the following: > GIS and LIDAR Data Processing mapping services. > Producing ROW maps for large scale projects and data acquisition for large digital terrain models and topographic maps. > Digital laser scanning training. > UAV (Unmanned aerial vehicle) technology > 3D Modeling technology	Our agency would consider the following to be the most practicable services to be accomplished by the private sector: > Mobile LIDAR Data collection and processing for large, remote projects in locations where a high degree of technology (hardware, software or Processing) is needed that have a short timeframe. > ROW mapping, planimetric mapping, aerial photographic data collection, engineering and topographic surveying, utility mapping or large aerial mapping projects. > Digital terrain modeling associated with survey and mapping services. > Horizontal and vertical control monumentation.
UT	The Utah department does very little mapping and photogrammetry. We estimate that 95% of this work is done by the private sector. *We are unable to provide #'s as requested in Question #1 due to the way we track project activities and project information.	We are mostly privatized and plan to continue this practice.	Yes. We use industry standards as a baseline as well as department standards	Given we use the private sector, we rely on them for innovation and technology transfer	Survey and mapping information related to 3D design	All

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VT	<p>VTrans maintains a Route Survey Section that contains traditional survey and geodetic survey capability. The Section provides design teams and right-of-way agents with precise site location information and an accurate three dimensional surface associated to state plane coordinates, resulting in a base design plan or Survey Plat for land records. The Geodetic Survey Section provides ground control for aerial mapping and LiDAR. The VTrans Mapping Section produces a series of standard map products and maintains GIS data layers to support these activities. The Section has the in-house capability and technology to develop data, perform analysis and produce large scale maps to support Agency activities. The Mapping Section is a stakeholder in statewide efforts to acquire orthophotography and LiDAR data through private sector contracting. The Mapping Section staff is comprised of 4 FTE's.</p>	<p>The Agency is working to acquire more LiDAR to support Agency efforts and is utilizing the private sector for this work. VTrans is working cooperatively with other stakeholders within Vermont, as the Federal, State, regional and local levels to acquire high resolution terrain data. There has been more of this activity over the last few years and increased budgets for the acquisition of LiDAR, increasing from a small share of \$15,000 in 2012 to \$100,000 in 2014. This is an increase in the use of the private sector. For the other mapping efforts, being cartography and map production, GIS analysis, data development and maintenance, this remains fairly constant and is performed with in-house staffing.</p>	<p>Route Survey utilizes a team decision process when considering the practicality of using consultants for specific projects. Route Surveying Standard Operating Procedures (SOPs) for field work are documented in individual section manuals that are available to the public via a agency web site. We require our private sector sources (consultants) to follow these SOPs when performing work for the agency. No, regarding the acquisition of orthophotography and LiDAR, there is no in-house capability, so all this work is performed by the private sector. There has been discussion in the past regarding adding the capability of LiDAR acquisition to VTrans, but this seems cost prohibitive and not the best allocation of resources. Continued use of private sector firms for the acquisition of high resolution orthophotography and LiDAR for mapping purposes is standard practice at VTrans.</p>	<p>Real Time Kinematic (RTK) surveying and standard practices of the agency. The Route Survey Section has realized the advantages and the disadvantages to this collection process and is working towards identifying procedures that will establish a standard for the agency and our consultants to follow. Resource grade mobile data collection devices and standard practices of DOT's of asset inventory and inspection is an area of interest within the GIS practitioners at VTrans.</p>	<p>Real Time Kinematic (RTK) surveying and standard practices of the agency. Route Survey Section is presently testing this type of equipment and will be working with our National Geodetic Survey (NGS) State Advisor, in order to refine agency procedures.</p>	<p>To support the work within the VTrans Mapping Section, the acquisition of high resolution orthophotography and LiDAR is better acquired and processed through the private sector than VTrans needing to maintain these capabilities. The continual evolution of technology and techniques, plus the high expense of the equipment make this far better to have the services contracted.</p>
VA	<p>Yes- Photogrammetry and surveying services</p>	<p>Greater as workloads permit, all of the photogrammetric flights are performed by private sector sources.</p>	<p>Yes. All of the photogrammetric flights are performed by private sector sources. Mapping Projects- handled on project by project specific basis as to whether it is considered practicable to contract surveying and mapping work to private sector sources. Surveying standards and specifications are noted in VDOT Survey Manual and contracting of services is highly dependent on scope of projects, state manpower levels, consultant ability to respond to workload, and project schedules for surveying and mapping services.</p>	<p>Photogrammetry & Surveying - Exposure to other software packages - Photogrammetric training availability - Need to update flight planning software - Digital camera imagery - LIDAR technology - Updating/modernization of aerial photography archive - Mobile LiDAR - Adoption of new technologies within Federal guidelines</p>	<p>Photogrammetry & Surveying - Exposure to other software packages - Photogrammetric training availability - Flight planning software - Digital camera imagery - LIDAR technology - Updating/modernization of aerial photography archive - Mobile LiDAR - Updated NGS control methodology</p>	<ul style="list-style-type: none"> · Aerial photography acquisition and QC/QA · Aerotriangulation QC/QA · Airborne LIDAR data collection and processing · Mobile Lidar collection and processing
WA	<p>Yes.</p>	<p>Greater. Our aerial photography section was eliminated. Many consultant designed projects utilize consultant mapping services. Design-Build projects also utilize private sector services.</p>	<p>Yes. Workload and expertise</p>	<p>Use of mobile LiDAR in data collection</p>	<p>None.</p>	<p>Exploring mobile LiDAR. Maybe use private sector to collect the data to avoid the expense of investing in the infrastructure.</p>
WV	<p>Yes for mapping, no for photogrammetric services</p>	<p>Greater</p>	<p>No. Use of statewide on-call contracts for Surveying and Mapping</p>	<p>None.</p>	<p>None.</p>	<p>Large scale aerial photography, LiDAR, remote sensing, low altitude mobile mapping</p>

SURVEY QUESTIONS - - Section 1517 of MAP-21 and 23 U.S. C. 306

STATE	2. Does your State Transportation Agency maintain in-house capability for mapping and photogrammetric services?	3. Is your State Transportation Agency moving towards greater or lesser use of private sector for mapping and photogrammetric service?	4. Does your State Transportation Agency have a Standard Operating Procedure that establishes surveying standards and specifications on when is it considered practicable to contract surveying and mapping work to private sector sources? a) If yes, what are the criteria factors used in determining practicability? b) If not, what methods or activities has your State taken to encourage the use of the private sector in performing these services since 1998?	5. What research needs has your State Transportation Agency identified in surveying and mapping instrumentation and procedures and technology transfer?	6. What type of technical guidance, coordination, and administration of surveying and mapping activities would your state will be interested in receiving?	7. What mapping and photogrammetric services does your State Transportation Agency consider to be the most practicable service to be accomplished by the private sector?
WI	Yes, for some services. See response to question #8.	Use of private sector for these services depends on workload. As work load increases, more private sector services are used.	Yes. Virtually all survey work is contracted at this time. We have standard operating procedures for mapping work that take into account the number and size of projects and their due dates. The amount of work contracted to the private sector is determined by the volume of work, in-house staff resources, and project deadlines.	Drones (UAS, UAV) Digital Imagery and LiDAR by UW Madison Analytical Triangulation research by UW Madison DTM to DTM _{earthwork} calculations by UW Madison Automated Machine Guidance (AMG) by UW Madison and road builders Wisconsin Height Modernization Program Initial Development (Passive Network & WISCORS) Transportation Project Plats Bridge clearance information developed with a consultant	Drones (UAS, UAV)	Services for which we don't have adequate in-house staff and/or equipment resources: Projects with tight deadlines Aerial LiDAR Large projects (such as county-wide and state-wide collection of imagery and LiDAR)
WY	Yes.	We are moving toward less use of the private sector since we are moving toward a larger portion of pavement preservation projects due to a lack of funding. Pavement preservation projects typically don't involve mapping and photogrammetric services.	No. We use private sector engineering and design related services "to the extent necessary or desirable" in support of ensuring that the agency is suitably equipped and organized to carry out the responsibilities of the Federal-aid highway program, as specified in 23 U.S.C. 302(a). In doing so, firms can submit statements of interest to provide the services. We tend to maintain in-house services to perform the work and keep core competencies. As the work load increases, so does the use of the private sector to augment peak demands that exceed our in-house abilities needing to meet the project schedule. Therefore, we typically have the private sector complete mapping supplements exceeding in-house capabilities. The same can be said for cadastral surveys. We typically have any hydrographic surveys or subsurface utility surveys for projects completed by the private sector.	We have not sponsored any research at the state level, but our State Photogrammetry and Surveys Engineer has long served on TRB Committee AFB80, including chairing the committee for 6 years. The committee transfers technology through research presentations and publications. Through TRB there are also research needs statements posted related to any geospatial issues related to design and construction. Additionally, our photogrammetry and surveys personnel participate in industry conventions, workshops, and users group meetings focused on surveying and mapping.	We don't believe guidance is necessary from the FHWA. The industry activities we are involved with are useful, but we are having some discussions about a formal position within the AASHTO structure. This would provide an opportunity for DOT surveying and mapping professionals to work on peer-driven guidance as a subset of the surveying and mapping industry.	The private sector is helpful to aid the DOT in performing work activities that exceed our capacity. Much of the land surveying and specialized work such as hydrographic surveys or subsurface utility surveys, or work exceeding our capacity are practicable to be accomplished by the private sector.

8. If your State answered yes to Question # 2, please indicate below (by checking the boxes) the services for which your State maintains in-house capabilities.																						
STATE	Aerial Photography	aerial digital data collection	airborne GPS services	boundary (cadastral) surveying	cartographic services	charting	digitizing	engineering surveying	GIS consulting and implementation	GPS surveying	geodetic surveying	hydrography	image processing	orthophoto production (digital and conventional)	photogrammetric mapping	photo processing	planimetric mapping	remote sensing	right-of-way surveying	terrestrial or close range photogrammetry	topographic mapping	Scanning
Alabama				X	X			X	X	X	X											
Alaska				X			X	X	X	X		X							X			
Arizona	X							X		X	X	X	X	X	X	X	X				X	X
Arkansas	X			X				X		X	X			X	X		X		X		X	X
California maintains in-house capabilities for Photogrammetric Aero-Triangulation (AT), Construction Surveying, Terrestrial Laser Scanning.																						
California				X	X		X	X	X	X	X	X		X	X		X	X	X		X	X
Colorado				X	X		X	X	X	X	X						X		X		X	
Connecticut				X			X	X		X	X						X		X		X	
Delaware				X	X			X		X	X								X		X	
District of Columbia																						
Florida		X		X	X			X	X	X	X		X	X	X		X	X	X		X	X
Georgia		X		X	X			X	X	X	X	X	X	X	X	X	X		X		X	X
Hawaii				X			X			X	X								X		X	X
Idaho																						
Illinois	X			X				X		X	X		X	X	X	X	X	X	X		X	
Indiana				X			X		X	X	X		X	X	X				X		X	
The Iowa DOT's in-house scanning capabilities are achieved through the use of one state-owned terrestrial static scanner. At least two of our on-call survey consultants are also deploying static scanners and that number is anticipated to increase in the near future. The Iowa DOT currently has one on-call consultant for mobile scanning and another for aerial scanning.																						
Iowa				X	X			X		X	X			X	X		X		X		X	X
Kansas				X				X		X	X				X		X		X		X	
Kentucky: The numbers and answers in question 1 are based on Federal participation. Design projects that have surveying and mapping built into the project proposal are not included in any of the supplied data.																						
Kentucky	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Louisiana	X			X	X			X		X	X		X	X								
Maine				X						X	X	X							X		X	
Maryland								X	X	X	X						X		X		X	
Massachusetts																						
Michigan				X	X			X	X	X	X						X		X		X	X
Minnesota				X	X			X	X	X	X	X	X	X	X		X		X		X	X
Mississippi				X	X		X	X	X	X	X								X		X	
Missouri																						
Montana	X	X		X	X		X	X		X	X	X	X	X	X	X	X	X	X		X	X
Nebraska	X			X	X	X		X		X	X			X	X		X		X		X	
Nevada	X			X	X		X	X	X	X	X	X		X	X		X	X	X	X	X	X
New Hampshire																						
New Jersey				X					X		X								X	X	X	
New Mexico				X	X	X	X	X		X	X		X	X	X		X		X		X	X
New York: These ensure the State's ability to perform quality control, better manage consultants respond to emergencies, develop performance measures, and provide a low-cost alternative to consultants.																						
New York				X				X		X				X	X		X		X		X	
North Carolina: 1. Cartographic surveys would include all engineering surveys used in the development of paper or digital plans for transportation related activities; right of way surveys would be a subset of boundary (cadastral) surveys; remote sensing includes aerial and terrestrial LiDAR 2. The NCDOT also prepares maps as exhibits for condemnation litigation (a portion of right of way mapping).																						
North Carolina	X		X	X	X			X	X	X	X	X	X	X	X	X	X	X	X		X	X
North Dakota	X			X	X		X	X	X	X	X		X	X	X				X		X	X
Ohio: Provide Real-Time GPS Network and continuously operating reference stations on the National Geodetic Survey CORS Network.																						
Ohio	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Oklahoma		X		X				X		X	X				X		X		X		X	X
Oregon				X	X		X	X		X	X			X	X		X	X	X		X	X
Pennsylvania	X			X	X			X		X	X			X	X		X		X		X	X
Puerto Rico									X										X		X	
Rhode Island				X				X	X	X	X								X		X	
South Carolina				X	X			X		X							X		X			X
South Dakota				X	X			X	X	X	X						X	X	X		X	
Tennessee has and maintains GNSS network for government and private entities.																						
Tennessee	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Texas: LiDAR collection and scanning. Note: The department contracts out the aerial digital imagery collection and airborne GPS and IMU data.																						
Texas	X	X	X	X	X		X	X		X	X		X	X	X	X	X		X		X	X
Utah				X				X											X			
Vermont				X			X	X	X	X	X						X		X		X	X
Virginia maintains in-house capabilities for Terrestrial laser scanning and flight/photography planning																						
Virginia				X				X		X	X	X	X	X	X	X	X		X		X	X
Washington				X	X		X	X		X	X	X	X	X	X		X		X	X	X	X
West Virginia								X		X									X			X
Wisconsin	X			X				X						X	X	X	X					X
Wyoming		X		X	X		X	X	X	X	X		X	X	X		X		X		X	