Final Report

Best Practices of MDOT's Survey Operation, Organization and Technology Implementation

Study No. 222

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16. Abstract

A critical activity performed by employees of the Mississippi Department of Transportation is surveying. Surveying in some instances needs to be performed in hazardous environments such as rugged terrain and high-speed traffic. New surveying technologies (i.e.: Global Positioning System) are increasingly being adopted by surveying units of departments of transportation around the nation, because it has demonstrated increased efficiency and cost savings in topographical surveys [Uddin 2008, Hall 2006, Krugler, 2006, NCHRP2004, MDOT2002].

MDOT employees use a wide range of surveying methods and technologies throughout the state. Surveying operations vary within MDOT from manual conventional surveying technology requiring large numbers of field personnel to GPS and robotic technologies that are faster and require fewer employees to deploy. The technology, methodology, standards, quality controls and delivered results of these surveying operations need to be catalogued and evaluated to determine the best operational approach to use for the range of surveying operations employed by MDOT.

In addition, surveying at the district level within MDOT is organized in many different ways. For example, in some districts surveying teams are centralized with most jobs filled by the main office while in other districts surveying tasks are spread among numerous field offices. These organizational strategies need to be studied to determine the most efficient organizational model/process for MDOT surveying operations.

Some MDOT locations have embraced modern surveying technologies such as GPS RTK systems, robotic total stations, automated field data collection and CADD modeling procedures with great success. Others have been slower to adopt the newest technology and have had less success in field deployment. A study is needed to determine the best adoption strategies including potentially targeted training, field demonstration, new equipment, phase in strategy and computerized work flow for most effectively rolling out new surveying technologies (ex: GPS) to all MDOT districts.

The overall goal of this project was to evaluate the surveying processes throughout MDOT to move toward providing electronic 3D surveys, improve accuracy and increase efficiency in MDOT survey efforts. This goal was achieved by targeting each district office to determine: (1) Best operational approach to use a range of surveying technologies, (2) Most effective organizational model/process to best utilize the newest surveying technologies; and (3) Best roll-out strategy which will help MDOT districts move to the most efficient surveying technology.

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FORWARD

This report provides a valuable resource regarding the evaluation of surveying processes to move towards providing electronic 3D surveys, improve accuracy and increase efficiency in survey efforts. This Mississippi Department of Transportation Study No. 222 "Best Practices of MDOT's Survey Operation, Organization and Technology Implementation" was conducted by the University of Southern Mississippi in collaboration with MDOT. This document will be of particular interest to individuals who plan and evaluate survey operations for transportation. Other audiences for this document include policymakers, transportation professionals, and students in related fields.

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EXECUTIVE SUMMARY

This document presents the results of evaluating MDOT's Survey Operation, Organization and Technology Implementation. The evaluation was based on (1) a nationwide literature review of surveying; (2) data obtained from the MDOT personnel and (3) a statistical analysis of the compiled data and the nationwide literature findings.

The results from the nationwide literature review indicated that the Federal Highway Administration (FHWA) recognizes the importance of increasing survey accuracy and several states are already using surveys technologies (i.e: GPS) and some of them have or are performing studies to evaluate these technologies. Some of these states embracing surveys technologies include: Alabama, Arkansas, California, Colorado, Connecticut, Florida, Idaho, Tennessee and Utah among others.

MDOT is also embracing survey technologies and the MDOT data was collected through written questionnaire from five groups: 1-Field Personnel (38 Responses of 39 Invitations – 97% Response Rate); 2- CADD Personnel (32 Responses of 32 Invitations – 100% Response Rate); 3- Management (64 Responses of 64 Invitations – 100% Response Rate); 4- Administration (18 Responses of 18 Invitations – 100% Response Rate) and 5- Internal Customers (9 Responses of 9 Invitations – 100% Response Rate) for a total of 161 responses totally 6502 questions answered.

The answers from the questionnaire were consolidated on three survey areas: 1 - Operational approach to use a range of surveying technologies, 2- Organizational structure to best utilize the newest surveying technologies; and 3- Roll-out strategy which would help MDOT districts move to the most efficient surveying technology.

The following is a summary of the results from the questionnaire in three areas:

1- Operational Approach: It was found that the majority of the field personnel believes that quality of the products should be the most important priority and that MDOT surveying should standards should exceed the professional surveying standards set forth by the Mississippi Board of Licensure for Professional Engineers and Surveyors. However, the management team was not sure if the current MDOT Survey Manual requirements are being met and there was no consensus on the accuracy level that could be achieved using various equipment and they. Additionally, the majority of the internal customers indicated that they were encountering problems in their division because of incomplete survey data and they were not receiving all the information required when surveys are originally submitted.

2- Organizational Structure:The majority of the field personnel indicated that MDOT should have a formal career path established for survey technicians. The Management team also indicated that MDOT should have formal career path established for survey technicians, inspections and construction personnel. However, the management team does not believe that the current State Personnel Board job classification adequately cover the surveying profession. CADD, field and management team agree that training is needed and should be required as part of their job classification. Furthermore, the majority of the management team indicated that their office does not have an established succession plan for retaining trained and qualified surveyors. The majority of the field and CADD personnel believe that

they have adequate staff to perform their necessary job functions. The majority of the administration, CADD and Internal customers indicated that there is effective communication. F

3- Survey Technologies: The majority of the CADD personnel responded that the their office is utilizing the most recent and updated applications provided by MDOT. However, the CADD personnel indicated that major changes are needed regarding training which contrast with the management team which indicated that few or some changes are needed on training. Furthermore, the administration answers did not show a consensus on the statement "MDOT staffs using modern surveying equipment are being trained to use this equipment properly and effectively.

To conclude, it is important to recognize that the findings in the three areas presented above are closely related. Therefore, positive actions and policies in any of the areas are very like to impact all three areas.

CHAPTER 1. BACKGROUND ON MDOT'S SURVEY OPERATION, ORGANIZATION AND TECHNOLOGY IMPLEMENTATION

1.1. PROBLEM STATEMENT

A critical activity performed by employees of the Mississippi Department of Transportation is surveying. Surveying in some instances needs to be performed in hazardous environments such as rugged terrain and high-speed traffic. New surveying technologies (i.e.: Global Positioning System) are increasingly being adopted by surveying units of departments of transportation around the nation, because it has demonstrated increased efficiency and cost savings in topographical surveys [Uddin 2008, Hall 2006, Krugler, 2006, NCHRP2004, MDOT2002].

MDOT employees use a wide range of surveying methods and technologies throughout the state. Surveying operations vary within MDOT from manual conventional surveying technology requiring large numbers of field personnel to GPS and robotic technologies that are faster and require fewer employees to deploy. The technology, methodology, standards, quality controls and delivered results of these surveying operations need to be catalogued and evaluated to determine the best operational approach to use for the range of surveying operations employed by MDOT.

In addition, surveying at the district level within MDOT is organized in many different ways. For example, in some districts surveying teams are centralized with most jobs filled by the main office while in other districts surveying tasks are spread among numerous field offices. These organizational strategies need to be studied to determine the most efficient organizational model/process for MDOT surveying operations.

Some MDOT locations have embraced modern surveying technologies such as GPS RTK systems, robotic total stations, automated field data collection and CADD modeling procedures with great success. Others have been slower to adopt the newest technology and have had less success in field deployment. A study is needed to determine the best adoption strategies including potentially targeted training, field demonstration, new equipment, phase in strategy and computerized work flow for most effectively rolling out new surveying technologies (ex: GPS) to all MDOT districts.

1.2. OVERALL PROJECT GOAL

The overall goal of this project was to evaluate the surveying processes throughout MDOT to move toward providing electronic 3D surveys, improve accuracy and increase efficiency in MDOT survey efforts. This goal was achieved by targeting each district office to determine: (1) Best operational approach to use a range of surveying technologies, (2) Most effective organizational model/process to best utilize the newest surveying technologies; and (3) Best roll-out strategy which would help MDOT districts move to the most efficient surveying technology. The following is a brief description of these three components:

(1) MDOT Best Operational Approach: The USM team gathered data from the various MDOT districts on their current surveying operations. This data was gathered

through individual online questionnaire sent to a selected group of representatives from project office from each district (Project Office personnel: Project Engineer, Survey Coordinator, field crew chief, and CADD personnel). This online questionnaire was aimed to determine the following:

1. Detailed description of surveying methods currently in place (All types of surveys being performed not just preliminary surveys)
2. Standards (compliance, problems with standards, awareness of standards)
3. Types of surveying equipment currently being used and equipment available for use within the District/Project Office. (Methods of use)
4. Where is the MDOT now, as a whole and by district, with the in-place technology?

(2) MDOT Most Effective Organizational Model/Process: The USM team gathered data from the various MDOT districts on their current organizational model/process to perform surveying activity processes. This data was gathered through online questionnaire to same targeted group describe above. This online questionnaire aimed to determine the following:

1. District wide organizational structure of surveying operations.
2. Professional Standards/Quality Control Processes (Adequate Professional Surveyor Supervision?
3. Evaluation of data format (Can data move straight into CADD system without being manipulated?
4. What recommendations does the study suggest MDOT implement to achieve electronic 3D surveys?

(3) MDOT Best Survey Technologies Roll-Out Strategy: The USM team interacted with several MDOT districts that have excelled in the adoption of the advanced surveying technologies to gather keys to their success. The USM team also gathered data from MDOT offices which seem most reluctant to adopt the new approaches. This was done through online questionnaire that helped answer the following questions:

1. What will be required to implement electronic 3D Surveys throughout the department?
2. Is more equipment needed?
3. Is better equipment needed?
4. What organizational changes need to be enacted?
5. Training needs?
6. What resources will it take to implement any suggested changes?

1.3. METHODOLOGY

Each data collection activity for this project was based on the idea of dividing the project into tasks. Each task had a pre-defined set of goals to be accomplished and required approval from MDOT Technical Advisory Committee (before proceeding to the next stage). Additionally, each task had tangible deliverables which are provided in Table 1.1 below.

Table 1.1 Project Proposed Tasks With Their Corresponding Goals and Deliverables

Tasks	Goals	Deliverables
Task 1	Prepare MDOT distribution list of surveying stakeholders	Contact list of MDOT employees that will participate in the collections of surveying information
Task 2	Round Table to discuss the preparation of the online questionnaire to collect data form MDOT district offices on (1) Best Operational Approach, (2) Most Effective Organizational Model and (3) Best Survey Technologies Roll-Out Strategy.	N/A
Task 3	Develop Online Questionnaire based on the previous round table for (1) Best Operational Approach, (2) Most Effective Organizational Model and (3) Best Survey Technologies Roll-Out Strategy.	Online Questionnaire for (1) Best Operational Approach, (2) Most Effective Organizational Model and (3) Best Survey Technologies Roll-Out Strategy.
Task 4	Feedback of the Online Questionnaire from the TAC	Online Questionnaire Comments
Task 5a	Approval Online Questionnaire from the TAC	Online Questionnaire for Deployment
Task 5b	Deploy and Initial Follow-ups Online Questionnaire	Answers MDOT District Offices
Task 5c	Preliminary Report of initial findings from the Online Questionnaire.	Presentation of first half "MDOT Surveying Operational, Model/Process, Roll-Out Approach Statewide" This report was expected to have between 15 and 20 pages.
Task 6a	Last Follow-ups and final answer of the Online Questionnaire	
Task 6b	Delivery of online questionnaire answer from MDOT District Offices.	Answers from online questionnaire MDOT District Offices
Task 6c	Preliminary Report progress to TAC of all data collected with online questionnaire.	Comprehensive Presentation "MDOT Surveying Operational, Model/Process, Roll-Out Approach Statewide" This report is expected to have between 15 and 20 pages.
Task 7	Round Table to discuss findings and establish priorities of results (1) Best Operational Approach, (2) Most Effective Organizational Model and (3) Best Survey Technologies Roll-Out Strategy.	N/A

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Continue From Previous Page

Table 1 Project Proposed Tasks With Their Corresponding Goals and Deliverables

Tasks	Goals	Deliverables
Task 8	Consolidate answers based on groups and result priorities	Consolidated answers
Task 9	Organized consolidated data from previous task into (1) Best Operational Approach, (2) Most Effective Organizational Model and (3) Best Survey Technologies Roll-Out Strategy.	Presentation "MDOT Surveying Operational, Model/Process, Roll-Out Approach Statewide" This report is expected to have between 2 and 5 pages.
Task 10	Fine-tune analysis	N/A
Task 11	Report progress to TAC of all analysis	This report is expected to have between 15 and 20 pages.
Task 12	Round Table to discuss final findings (1) Best Operational Approach, (2) Most Effective Organizational Model and (3) Best Survey Technologies Roll-Out Strategy.	N/A
Task 13	Final Draft Best Practices of MDOT's (1) Best Operational Approach, (2) Most Effective Organizational Model and (3) Best Survey Technologies Roll-Out Strategy.	This report is expected to have between 30 and 45 pages
Task 14	Final Report and project close out	This report will have between 30 and 45 pages.

1.4. ANTICIPATED BENEFITS

This statewide evaluation of MDOT's Survey Operation, Organization and Technology Implementation is providing MDOT and Mississippi taxpayers both tangible and intangible benefits. Some of those benefits are as follows:

- Comprehensive inventory of all MDOT districts surveying approach employed through-out the state.
- Identification of the best MDOT surveying practices and process implemented in the state
- Well-grounded document with the best practices and barrier to implement surveying technologies at MDOT.
- Increase the MDOT usage of latest surveying technologies that will provide cost savings and enhance services to Mississippi taxpayers.
- Enhance public perception of MDOT management through the best use of taxpayers' money.

1.5. SUMMARY

Despite MDOT's high commitment and efforts to optimize the use of taxpayers' money by investing on the latest surveying technology, MDOT surveying operation, organization and technology implementation there are still great opportunities to improve.

The overall goal of this project was to increase the cost efficiency, timeliness and safety of MDOT surveying activities through the identification of MDOT best practices grounded on: (1) Best operational approach to use a range of surveying technologies, (2) Most effective organizational model/process to best utilize the newest surveying technologies; and (3) Best roll-out strategy which will help MDOT districts move to the most efficient surveying technology.

The result of this project forms a body of knowledge which could be used by policy makers to increase the use of cost and time effective technologies for surveying throughout MDOT.

CHAPTER 2. STATE-OF-THE-ART: BEST PRACTICES OF MDOT'S SURVEY OPERATION, ORGANIZATION AND TECHNOLOGY IMPLEMENTATION

2.1. INTRODUCTION TO SURVEYING OPERATIONS, ORGANIZATION AND TECHNOLOGY IMPLEMENTATION

The American Congress on Surveying and Mapping (ACSM) defines surveying as "The science and art of making all essential measurements to determine the relative position of points and/or physical and cultural details above, on, or beneath the surface of the Earth, and to depict them in a usable form, or to establish the position of points and/or details." [Saikia 2010]

Figure 2.1 Surveying Sample Picture

The United States Bureau of Labor Statistics estimates that 77,000 surveyors are employed by Federal, state and local governments and by private commercial enterprises in the United States. [USBLS2010]

Surveying operation may be classified as either *Plane Surveying* in which small areas are measured and the curvature of the earth may be ignored or *Geodetic Surveying* in which larger areas of the earth surface are measured and corrections must be made for the curvature of the earth in order to achieve the desired level of accuracy. Surveying may also be classified based upon the intent of the survey operation. Major classifications include the following:

Topographical Survey: A survey which results in varying elevation of the earth is described to show various man-made and natural features. Topographical surveys may be done for many reasons including (1) establishing horizontal and vertical control that will serve as the framework of the survey, (2) determining enough horizontal location and elevation (usually called side shots) of ground points to provide enough data for plotting when the map is prepared, (3) locating natural and man-made features that may be required by the purpose of the survey, (4) computing distances, angles, and elevations, and (5) drawing topographic maps.

Cadastral Survey: A survey to locate and determine legal boundaries such as property lines and municipality boundaries. Cadastral surveys are performed to settle legal property matters and to

obtain legal boundary properties including (1) establishing markers or monuments to define and thereby preserve the boundaries of land belonging to a private concern, a corporation, or the government, (2) relocating markers or monuments legally established by original surveys, (3) subdividing landed estates into parcels of predetermined sizes and shapes, (4) calculating areas, distances, and directions and preparing the land map to portray the survey data so that it can be used as a permanent record and (5) writing technical descriptions for deeds.

Engineering Survey: A survey made in conjunction with the construction of various engineering works such as roads, bridges, railways and buildings to obtain (1) reconnaissance information and preliminary data required by engineers for selecting suitable routes and sites and for preparing structural designs, (2) defining of selected locations by establishing a system of reference points, (3) guiding construction by setting stakes or otherwise marking lines, grades, and principal points and by giving technical assistance, (4) measuring of construction items in place for the purpose of preparing progress reports and (5) dimensioning of structures for preparation of as-built plans.

Route Survey: A subset of Engineering Surveys focused on preparation of plans and stakes for the location and construction of lines of transportation or communication that continue across country for some distance, such as highways, railroads, open-conduit systems, pipelines, and power lines. Route Surveys are performed to obtain properties of the proposed route including (1) locating the center line, usually marked by stakes at 100-ft intervals called stations, (2) determining elevations along and across the center line for plotting profile and cross sections, (3) plotting the profile and cross sections and fixing the grades, (4) computing the volumes of earthwork and preparing a mass diagram, (5) staking out the extremities for cuts and fills, (6) determining drainage areas to be used in the design of ditches and culverts, (7) laying out structures, such as bridges and culverts, and (8) locating right-of-way boundaries, as well as staking out fence lines, if necessary.

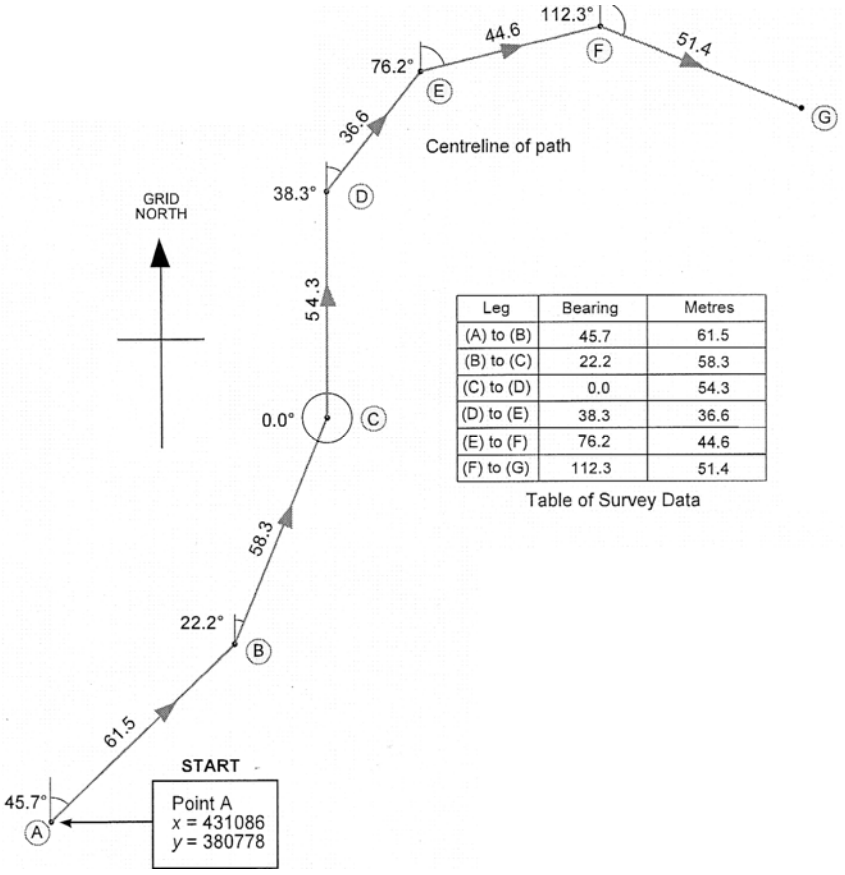
Hydrographic Survey: A survey of ocean or inland water boundaries either in preparation for construction or as aids to navigation.

Control Surveys: A survey to provide "basic control" or horizontal and vertical positions of points to which supplementary surveys are adjusted. Horizontal and vertical controls generated by land (geodetic) surveys provide coordinated position data for all surveyors. It is therefore necessary that these types of surveys use first-order and second-order accuracies.

Surveying operations may also be classified based upon the method employed. Major types of surveying methods are as follows:

Linear Survey: No angles are measured only distances for purposes such as determining dimensions of existing structures or sites, determining the location of various site features and setting out clearances and tolerances for construction. Methods of linear surveying with their approximate accuracy include (1) optical range finding (1:300), (2) trundle wheel (1:500), (3) stadia tachometry (1:1000), (4) tapping or chaining (1:1000), and (5) Electronic Distance Measurement (EDS) (1:50,000).

Traverse Survey: Traverse surveying is a method to establish control networks. Traverse networks involve placing the survey stations along a line or path of travel, and then using the previously surveyed points as a base for observing the next point. Unlike linear surveying the traverse can change to any shape and thus can accommodate a great deal of different terrains and obstacles. "Open traversals" as shown in figure 2-2, consist of series of measurements from a known station to one or more target points. This begins with a known point and seeks to locate a target point or points through a series of intermediate steps [United States Army 2006].

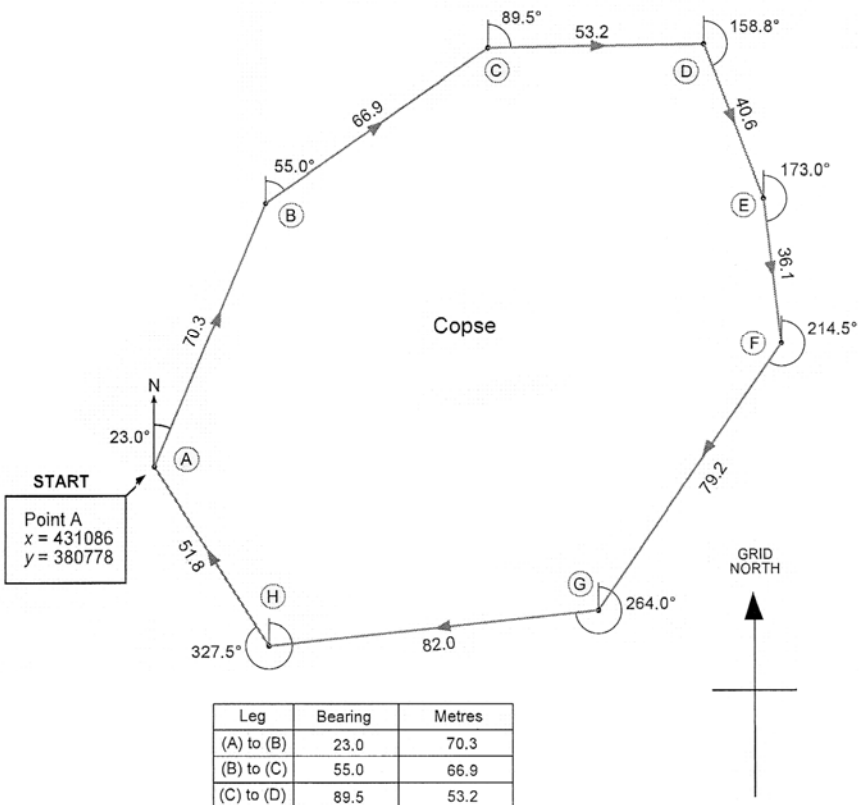


Leg	Bearing	Metres
(A) to (B)	45.7	61.5
(B) to (C)	22.2	58.3
(C) to (D)	0.0	54.3
(D) to (E)	38.3	36.6
(E) to (F)	76.2	44.6
(F) to (G)	112.3	51.4

Table of Survey Data

Figure 2.2 Open Traverse Survey [TCPD 2012]

"Closed traverse" consist of a series of measurements from a known station through several unknown points and back to the original plot point. By closing the loop error fort the survey can be computed directly by comparing the difference between the actual starting point and the computed starting point as shown in figure 2-3.



Leg	Bearing	Metres
(A) to (B)	23.0	70.3
(B) to (C)	55.0	66.9
(C) to (D)	89.5	53.2
(D) to (E)	158.8	40.6
(E) to (F)	173.0	36.1
(F) to (G)	214.5	79.2
(G) to (H)	264.0	82.0
(H) to (A)	327.5	51.8

Table of Survey Data

Figure 2.3 Closed Traverse Survey [TCPD 2012].

Tacheometric Survey (Stadia): A Tacheometric survey utilizes horizontal and vertical distances of points obtained by optical means as opposed to measurements by tape or chain. It is best adapted in obstacles such as steep and broken ground, deep ravines, stretches of water or swamp and so on, which make chaining difficult or impossible. The primary object of tachometry is the preparation of contoured maps or plans requiring both the horizontal as well as vertical control. Also, on surveys of higher accuracy, it provides a check on distances measured with the tape. The geometry of tachometric survey is shown in figure 2-4.

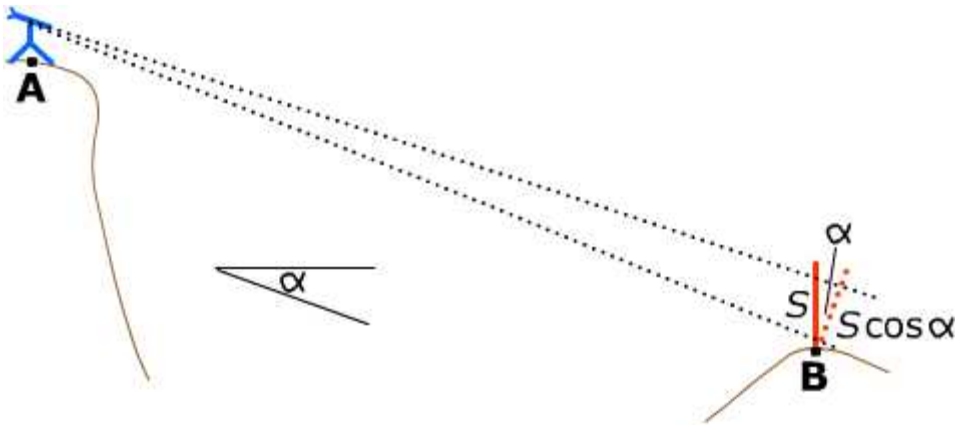


Figure 2.4 Geometry of Tacheometric Surveying. [American Mathematical Society]

2.2. CHARACTERISTICS OF GPS SURVEYING

The prospect for increased acceptance of GPS satellite surveying is very good, particularly as the cost of GPS systems drops and new higher productivity techniques are developed. Although GPS was initially used for high-order geodesy and geodetic control surveys on the one hand, and geophysical exploration surveys on the other, adoption of the GPS technology for applications such as lower-order control densification, and even cadastral, engineering and detail surveys, has already commenced.

GPS Surveying has a number of advantages over older technology including (1) intervisibility between stations is not necessary, (2) GPS uses radio frequencies to transmit the signals, the system is independent of weather conditions, (3) if the same field and data reduction procedures are used, position accuracy is largely a function of interstation distance, and not of network "shape" or "geometry", (4) because of the generally homogeneous accuracy of GPS surveying, geodetic network planning in the classical sense is no longer relevant. The points are placed where they are required (for example, in a valley), and need not be located at evenly distributed sites atop mountains to satisfy intervisibility, or network geometry, criteria., (5) because of the two advantages of not requiring intervisibility of stations, or following a conventional network design strategy, GPS surveying is more efficient, more flexible and less time consuming a positioning technique than using terrestrial survey technologies and (6) high accuracies can be achieved with relatively little effort, unlike conventional terrestrial techniques. The GPS instrumentation, and to some extent the data processing software, is similar whether accuracies at the 1 part in 10^4 or 1 part in 10^6 level are sought.

Field GPS Surveying operations are characterized by requirements for the following processes: (1) setup of antennas over predefined ground marks, (2) simultaneous operation of two or more GPS receivers, (3) coordinate data gathering operation so that data collected has the same time-tags, involves the same satellites, etc., (4) common data collection over some observation session, and (5) Coordinated demount of GPS antennas and transport to new stations.

Field validation of data collected, in order to (1) verify sufficient common data collected at all sites operating simultaneously, (2) verify quality of data to ensure that acceptable results will be

obtained, and (3) where data dropout is high or a station has not collected sufficient data, reoccupation may be necessary.

Office calculations following a field operation include (1) combining the results of single sessions into a network solution, (2) incorporating external information (for example, local control station coordinates), and hence modify the GPS-only network solution, (3) transforming the GPS results to the local geodetic datum, and to derive orthometric heights and (4) verifying the accuracy and reliability of the GPS survey.

The fundamental unit of a GPS solution is a 3-D baseline vector joining the antennas of two GPS receivers that have been tracking simultaneously the same satellites. GPS software to carry out the solution task is usually provided by the instrument manufacturer. One end of the baseline is held "fixed" (its coordinates are assumed known), and the other station's coordinates are determined relative to it (in effect, the baseline components are estimated). Solutions may be obtained from ambiguity-free or ambiguity-fixed double-differenced data solutions, with different resultant accuracies and reliabilities. All results are obtained in the quasi-WGS84 reference system, but relative to a fixed station (the WGS84 coordinates of one end of the baseline are assumed known). All results refer to the antenna phase centers, and the height of antenna and any offsets must be applied in order to reduce the coordinates to the ground marks. The quality of the baseline vector solution is dependent on, amongst other things: (1) the length of the (common) observing session, (2) the number of satellites tracked by the receivers, (3) the quality of the data (multipath and cycle slips, single or dual-frequency data, presence of noise and other biases), (4) the type of baseline solution: triple-difference, double-difference, etc., and(5) the software used to reduce the data.

2.3. RESEARCH METHODOLOGY

A descriptive research methodology was followed to summarize the available literature on GPS surveying. As part of the research methodology, a systematic literature review and a meta-analysis were performed. The meta-analysis combined the results from a number of previous studies in an attempt to summarize the use of GPS surveying by the various state departments of transportation. The meta-analysis included a qualitative component (pre-determined search criteria) and a quantitative component (integration of numerical information).

The qualitative component of the meta-analysis is challenging for most research projects. Various factors, such as very general keywords, can generate an unbearable amount of data to be analyzed. Using very specialized or precise technical keywords can produce zero results or very limited data. Combining the correct keywords with different databases will have a significant impact on the results of the research.

A slight variation in the search criteria (keyword and database) could result in differences in the outcome. Therefore, it is important to explicitly state the search criteria used. The keywords used in this project are presented in Table 2-2. These two keywords were used after several preliminary searches with a variety of keywords related to the subject. The databases used in this project were limited to the seven databases presented in Table 2-1. These databases were used based on the studied subject and recommendations from MDOT.

Table 2.1 Databases: Name, URL Location and Information used to Search

Database's Name	URL	Information
Transportation Research Board (TRIS)	http://trisonline.bts.gov/	TRIS Online provides links to full text and to resources for document delivery or access to documents where such information is available. These may include links to publishers, document delivery services, and distributors.
Federal Highway Administration (FHWA)	http://www.fhwa.dot.gov/search.html	FHWA search provides information regarding the outcomes of partnerships with the state and local agencies to meet the nation's transportation needs. The information provided relates to the FHWA work done cooperatively with governmental agencies, industry, and research community partners to research, develop, test, and implement the latest proven technological advancements including intelligent transportation systems.
National Cooperative Highway Research Program (NCHRP)	http://safety.transportation.org/Default.aspx	This web site offers access to a Safety Portal, where parties engaged in developing and implementing comprehensive state highway safety plans can exchange information, ask questions, and get expert advice from the developers of the AASHTO Strategic Highway Safety Plan implementation guides
Transportation Research Board - Research In Progress (TRB-RiP)	http://rip.trb.org	TRB-RiP database contains over 7,800 current or recently completed transportation research projects. Most of the RiP records are projects funded by Federal and State Departments of Transportation. University transportation research is also included.

Table 2.2 Keywords/Phrases Used for the Search

Keywords
GPS Surveying
Surveying Operations

2.4. IMPACT OF GPS SURVEYING NATIONALLY

The Federal Highway Administration (FHWA) recognizes the importance of increasing survey accuracy while reducing labor costs and improving efficiency—addressing this problem is one of the Agency's top priorities. Solution: GPS Increases Survey Accuracy, Improves Productivity, and Reduces Costs Over the past 5 years, studies across the United States have shown that GPS technology increases the productivity of conventional survey crews, reduces data collection time, improves survey accuracy, and allows crews to work under a broad range of weather conditions. Moreover, less expertise is required to operate a GPS surveying unit than is needed to operate conventional surveying technologies.

Various state departments of transportation are studying, rolling out and utilizing GPS surveying techniques currently. The following is a summary of these efforts:

The Design Bureau of the **Alabama Department of Transportation** currently has one survey crew specializing in GPS surveys for project location. This crew sets survey control for individual projects using static observations and a GOS first-order network. Typically the crew sets pairs of GPS points at 2-mile intervals. The survey network is then filled in with conventional survey methods. This crew is equipped with real-time kinematic surveys to obtain 1-cm topography, however this capability is rarely employed because of thick forestation.

The **Survey Division of the Arkansas State Highway and Transportation** utilizes GPS control surveys for highway projects with first-order NGS (1:100,000) Geodetic Survey control points from the Arkansas High-Accuracy Reference Network (HARN). One crew for static GPS measures has set more than 1000 control points for construction jobs utilizing HARN. Two additional crews utilize kinematic to perform small roadway design jobs, parcel survey jobs, right-of-way and construction stakeouts in the near future.

The **California Department of Transportation** employs GPS surveying for topographical and construction surveys using both fast static and kinematic equipment and methods.

The **State of Colorado Department of Transportation** has aggressively pursued use of advanced GPS technology with more than 1600 reference points in their High Accuracy Reference Network (HARN) and broad application to all surveying tasks including property boundaries, easement monuments, secondary control monuments and right-of-way stakeout. Colorado has opted for GPS-only equipment sets for many road construction surveys and current development includes the use of GPS equipment for as-built surveying.

The **Connecticut Department of Transportation Department** of has established a central base station and is in the process of developing additional base stations to move towards a High Accuracy Reference Network (HARN) to be utilized for construction project control. ConnDOT has estimated that use of GPS for project control has saved between $30,000 and $50,000 per project with greater accuracy than conventional techniques.

The **Florida Department of Transportation** has invested heavily in the ongoing development of the "Florida Permanent Reference Network" which currently employs 50 Continuously Operating Reference Stations (CORS) located throughout Florida. Each of the FDOT districts has been provided high quality GPS surveying equipment for various construction tasks.

The **Idaho Department of Transportation** uses survey-grade GPS to set the location of highway project including both cadastral and geodetic data.

The **Louisiana Department of Transportation** does not use GPS surveying.

The **New Jersey Department of Transportation** uses GPS exclusively to densify control networks. The New Jersey Geodetic Survey (NJGS) Unit of NJDOT has been actively using GPS since 1989 to develop a geodetic control network which contains approximately ±3,000

GPS suitable horizontal control stations in New Jersey which can be utilized for GPS surveying activities.

The **Tennessee Department of Transportation** has standardized on two general GPS surveying procedures: the (1) *traverse method* using a leapfrog methodology for projects with five or fewer control points and (2) the *wing point* method in which points are measured from two base points giving a better check resulting in better overall accuracy. All project controls are set using GPS surveying with the Tennessee State Plane Grid Coordinates (TSPGC).

The **Utah Department of Transportation** found that one person operating GPS equipment is generally twice as fast as a conventional survey crew, and a GPS system with two units is potentially four times faster than crews using conventional surveying technologies. Other advantages of GPS technology include the ability to use the technology across long distances with minimal setups. After a GPS system is placed, roving can be performed within a radius of 10 kilometers (6 miles) of the stationary base unit. Using conventional technologies, the base unit would have to be moved every 183 meters (600 feet). In one study, GPS equipment recorded 5,511 topographic points in 30 person-hours, while a similar project using conventional technologies covered only 1,500 topographic points in 120 person-hours.

2.5. SUMMARY

Results from various studies conducted by state departments of transportation have shown considerable advantage to GPS surveying techniques both as a cost effective and accurate alternative to more traditional measuring methods. The purpose of this study is to determine the current state-of-the art surveying technology and to study the organizational model which takes best advantage of the new technology. Given historical barriers to the adoption of new technologies this study will also determine the best approach to rolling out and promoting the use of the latest most effective technology.

CHAPTER 3. QUESTIONNAIRE PREPARATION AND DATA COLLECTION PROCESS

3.1. INTRODUCTION

This chapter describes the method used to prepare the questionnaire used to collect data and the process implemented to collect the data. In order to gather the required data for this study, the USM team in conjunction with the MDOT Technical Advisory Committee developed five online questionnaires to collect data regarding the current survey operations of MDOT. The questionnaires targeted five groups of people at MDOT representing project offices of all districts. These groups included the field Personnel, CADD Personnel, Management, Administration and Internal Customers.

The online questionnaires were developed based on the data requirements for identifying the current surveying operations and performance levels of different personnel that are involved in surveying operations of MDOT's projects. The questionnaires were composed of question groups regarding the general operation, quality measurement, equipment, performance, training, standards, organization, structure, processes, and expected deliverables in the current operations of the organization. These questions enabled the research team to collect the necessary information regarding current techniques and methodologies employed which in turn would guide MDOT officials to determine the most efficient organizational model and strategies to improve the current surveying operation.

Upon completing the online questionnaires, MDOT sent an e-mail to each project office of all districts highlighting the importance of this project. Then a series of e-mails and follow-ups were sent by the research team to collect all the required data from the field Personnel, CADD Personnel, Management, Administration and Internal Customers.

3.2 QUESTIONNAIRE DEVELOPMENT AND CHARACTERISTICS

The questionnaire development process was an iterative process that required several iterations until all members of the USM research team and the MDOT Technical Advisory Committee decided that the online questionnaires were ready to be deployed. For simplicity, the process is outline below in a linear way.

3.2.1. Questionnaire Development

In the questionnaire development process, the research team first solicited important questions from the MDOT TAC. The MDOT TAC questions combined with the USM research team questions totaled 188 questions. The 188 questions were processed, fine-tuned and combined resulting in a total of 128 questions. These questions were put online to allow all member of the MDOT TAC to rank each question based on its importance for the targeted groups (as shown in Figure 3.1). Each member of the MDOT TAC gave a value that ranged from 1 (not relevant) to 5 (critically important) depending on the opinion relevance of the questions for each particular group.

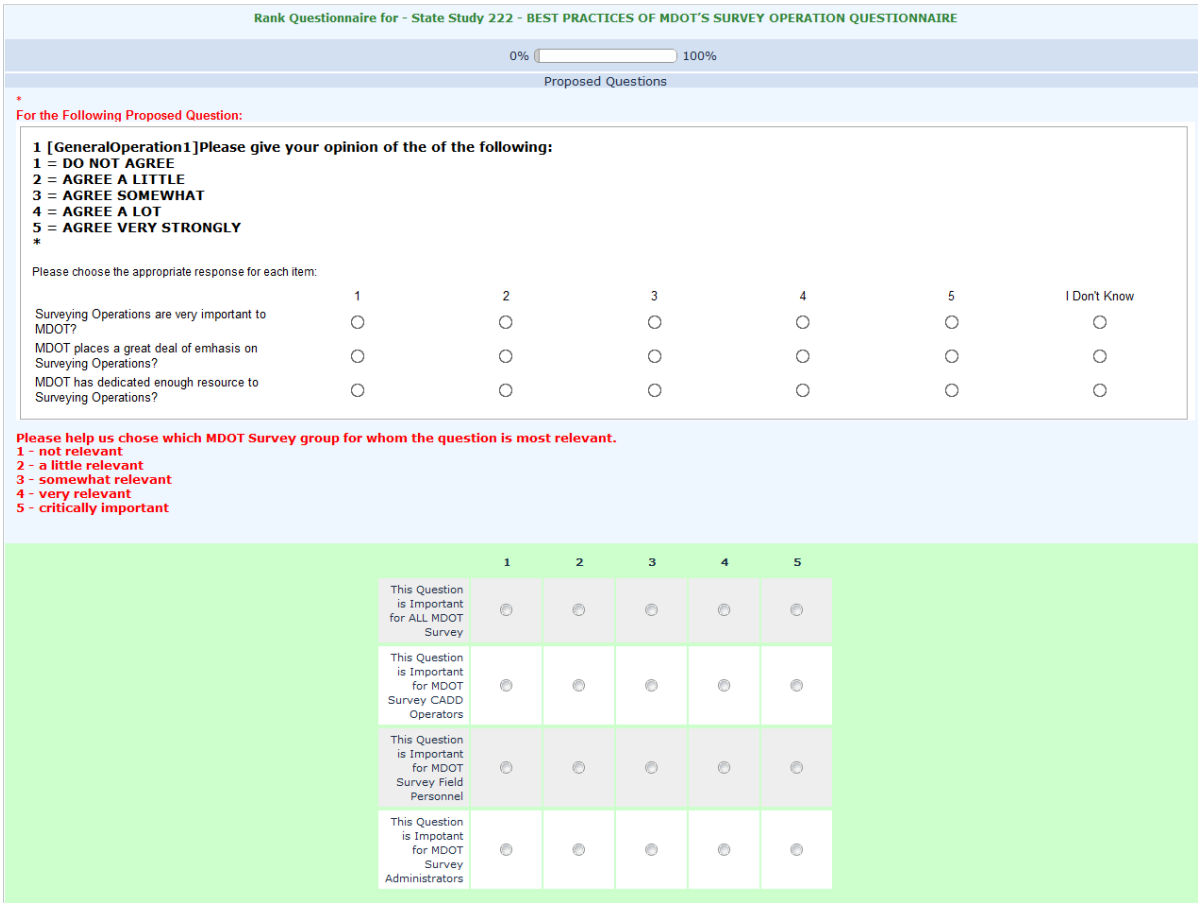


Figure 3.1 TAC Online Ranking of Questionnaire

The USM research team received nine responses from the MDOT TAC representing the different districts and groups. Based on the ranking received, the average ranking for each question was calculated and questions were sorted from highest to lowest rank. Figure 3.2 below shows the order and the ranks of questions developed for Administration, CADD, Field, and All personnel.

	Sorted by ALL						Sorted by CADD						Sorted by Field						Sorted by Admin					
	Question	ALL	CADD	Field	Admin		Question	ALL	CADD	Field	Admin		Question	ALL	CADD	Field	Admin		Question	ALL	CADD	Field	Admin
32	21.0	3.4	4.3	3.9	4.1	32	95.0	3.5	3.5	3.8	4.3	32	114.0	2.7	2.7	4.3	3.8	32	66.0	3.0	2.8	3.3	4.7
31	24.0	3.4	3.6	3.4	4.7	31	96.0	2.7	3.5	4.3	3.5	31	118.0	2.8	4.2	4.3	3.8	31	72.0	3.3	2.5	3.2	4.7
30	26.0	3.4	2.6	4.6	4.1	30	121.0	3.8	3.5	1.8	4.7	30	2.0	2.9	4.0	4.4	4.1	30	79.0	2.5	1.7	2.3	4.7
29	27.0	3.4	2.4	4.4	4.1	29	24.0	3.4	3.6	3.4	4.7	29	8.0	2.4	2.1	4.4	3.1	29	80.0	2.5	1.7	2.8	4.7
28	76.0	3.5	3.3	3.8	4.3	28	75.0	3.7	3.7	4.0	4.5	28	27.0	3.4	2.4	4.4	4.1	28	83.0	2.3	3.5	2.0	4.7
27	95.0	3.5	3.5	3.8	4.3	27	86.0	3.8	3.7	4.3	3.8	27	28.0	3.6	2.6	4.4	4.3	27	94.0	2.8	2.5	3.2	4.7
26	119.0	3.5	3.3	2.3	4.8	26	36.0	4.1	3.7	4.7	4.3	26	30.0	2.9	1.6	4.4	4.0	26	107.0	2.7	2.0	2.7	4.7
25	15.0	3.6	2.6	4.1	4.4	25	71.0	4.0	3.8	3.8	4.3	25	37.0	3.3	3.0	4.5	3.5	25	109.0	2.5	3.2	2.0	4.7
24	28.0	3.6	2.6	4.4	4.3	24	85.0	2.7	3.8	4.3	4.3	24	44.0	4.0	4.0	4.5	3.3	24	112.0	2.8	1.5	2.8	4.7
23	75.0	3.7	3.7	4.0	4.5	23	110.0	3.2	3.8	3.5	4.5	23	47.0	3.0	2.3	4.5	4.8	23	121.0	3.8	3.5	1.8	4.7
22	78.0	3.7	3.5	3.5	4.3	22	128.0	3.0	3.8	1.7	4.0	22	49.0	3.0	3.2	4.5	4.3	22	122.0	3.7	2.5	2.0	4.7
21	122.0	3.7	2.5	2.0	4.7	21	2.0	2.9	4.0	4.4	4.1	21	55.0	2.8	3.3	4.5	3.2	21	123.0	2.8	2.0	2.0	4.7
20	127.0	3.7	2.5	2.5	4.5	20	42.0	4.0	4.0	4.3	4.2	20	56.0	3.0	3.5	4.5	3.5	20	124.0	3.2	2.8	2.3	4.7
19	22.0	3.7	4.1	3.7	4.6	19	43.0	3.8	4.0	4.2	3.8	19	57.0	3.8	4.5	4.5	4.3	19	125.0	3.2	2.3	1.3	4.7
18	23.0	3.7	4.4	4.1	4.9	18	44.0	4.0	4.0	4.5	3.3	18	59.0	2.7	1.7	4.5	3.7	18	3.0	4.1	4.3	4.3	4.7
17	43.0	3.8	4.0	4.2	3.8	17	22.0	3.7	4.1	3.7	4.6	17	90.0	2.2	2.0	4.5	4.0	17	5.0	3.0	1.4	1.4	4.7
16	57.0	3.8	4.5	4.5	4.3	16	25.0	3.9	4.1	4.0	3.9	16	93.0	2.3	1.5	4.5	3.8	16	6.0	3.9	3.3	4.3	4.7
15	74.0	3.8	3.5	4.0	4.3	15	115.0	3.0	4.2	3.3	3.5	15	99.0	2.8	1.8	4.5	3.5	15	24.0	3.4	3.6	3.4	4.7
14	86.0	3.8	3.7	4.3	3.8	14	117.0	2.8	4.2	3.0	4.0	14	7.0	3.1	2.7	4.6	3.9	14	45.0	2.8	3.0	2.2	4.8
13	121.0	3.8	3.5	1.8	4.7	13	118.0	2.8	4.2	4.3	3.8	13	11.0	3.3	2.1	4.6	3.4	13	47.0	3.0	2.3	4.5	4.8
12	6.0	3.9	3.3	4.3	4.7	12	3.0	4.1	4.3	4.3	4.7	12	26.0	3.4	2.6	4.6	4.1	12	48.0	2.8	2.2	3.3	4.8
11	25.0	3.9	4.1	4.0	3.9	11	21.0	3.4	4.3	3.9	4.1	11	29.0	3.3	2.3	4.6	4.0	11	53.0	3.2	2.5	3.5	4.8
10	35.0	4.0	3.4	3.4	4.6	10	34.0	4.4	4.3	4.9	4.6	10	31.0	3.0	2.4	4.6	4.1	10	82.0	3.0	2.3	2.8	4.8
9	42.0	4.0	4.0	4.3	4.2	9	40.0	4.3	4.3	4.8	3.8	9	38.0	3.2	3.3	4.7	4.2	9	103.0	2.7	2.5	3.5	4.8
8	44.0	4.0	4.0	4.5	3.3	8	41.0	4.3	4.3	4.8	3.8	8	39.0	3.3	2.0	4.7	3.5	8	104.0	3.0	2.3	2.7	4.8
7	71.0	4.0	3.8	3.8	4.3	7	19.0	2.9	4.4	2.1	4.3	7	46.0	3.3	2.3	4.7	4.3	7	106.0	2.3	1.5	2.3	4.8
6	3.0	4.1	4.3	4.3	4.7	6	23.0	3.7	4.4	4.1	4.9	6	58.0	2.5	1.8	4.7	3.0	6	108.0	3.0	1.8	2.0	4.8
5	33.0	4.1	4.4	4.1	4.6	5	33.0	4.1	4.4	4.1	4.6	5	32.0	3.1	2.7	4.7	4.6	5	119.0	3.5	3.3	2.3	4.8
4	36.0	4.1	3.7	4.7	4.3	4	57.0	3.8	4.5	4.5	4.3	4	36.0	4.1	3.7	4.7	4.3	4	120.0	3.0	2.7	2.0	4.8
3	40.0	4.3	4.3	4.8	3.8	3	20.0	3.0	4.6	3.4	3.7	3	40.0	4.3	4.3	4.8	3.8	3	4.0	2.1	1.9	1.9	4.9
2	41.0	4.3	4.3	4.8	3.8	2	111.0	3.0	4.7	2.3	3.7	2	41.0	4.3	4.3	4.8	3.8	2	23.0	3.7	4.4	4.1	4.9
1	34.0	4.4	4.3	4.9	4.6	1	116.0	3.3	4.7	3.5	3.8	1	34.0	4.4	4.3	4.9	4.6	1	50.0	3.0	2.5	3.7	5.0

Figure 3.2 TAC Online Ranking of Questionnaire

Based on the ranking the total number of questions for further analysis were reduced using as criteria to remain in the list that the questions must have an average raking of 4.0 (very relevant) or more and at least 40 questions per group must be presented to the MDOT TAC for further analysis as shown in Figure 3.3. Based on these criteria, the MDOT TAC was presented for further analysis with 89 questions for Administration, 56 for field, 40 for CADD, and 40 for all representative groups.

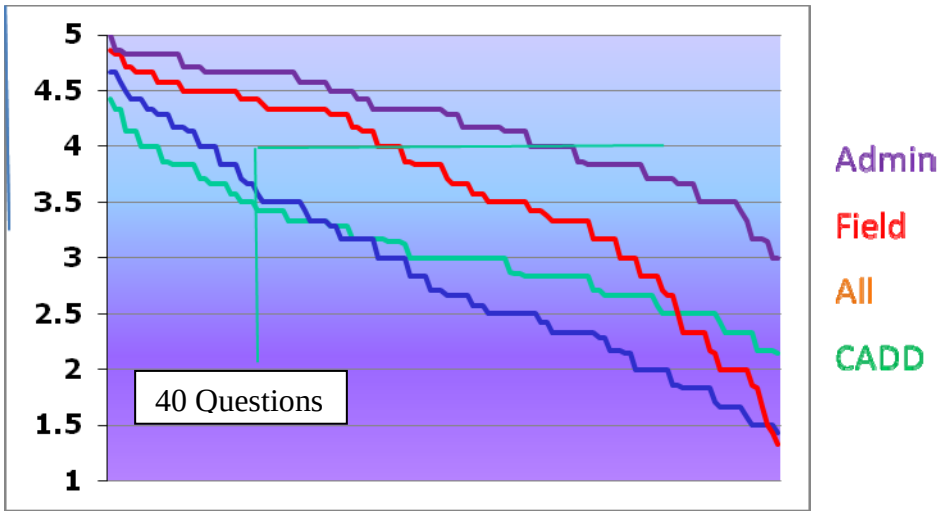


Figure 3.3 TAC Online Ranking Questionnaire – Rank curve

A series of meetings were held between the MDOT TAC and the USM research team to further reduce the number of question for each group, and refine/improve the wording of the questions. Additionally, during the meetings the Administration questionnaire was further classified to better represent different groups involved in MDOT administration personnel. These included: Management, Administration, and Internal customers. The number of questions for each of the five online questionnaires was as follows:

Group 1 – Field Personnel: are questions for field crew members and other personnel. There are 37 questions in this survey.

Group 2 – CADD Personnel: survey prepared for the design and engineering staff who are using CAD design software. This survey has 31 questions.

Group 3 – Management: mainly for management personnel involved in managing projects. This survey has 54 questions.

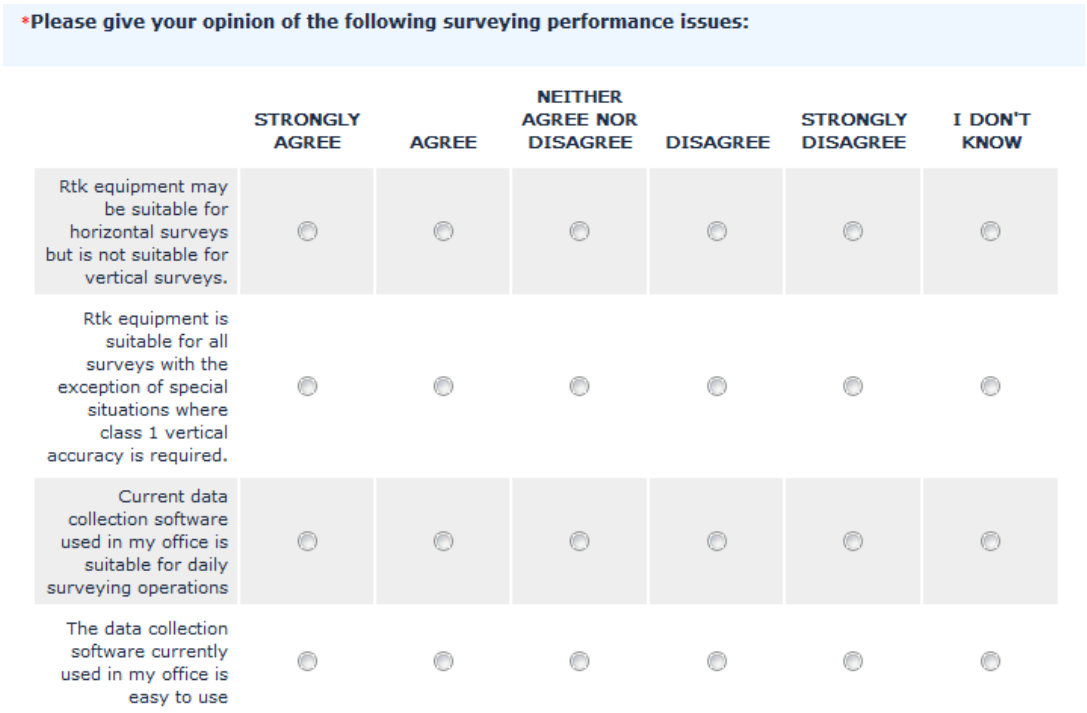
Group 4 – Administration: For all personnel involved in the organization and administration of the working staff in each district, there are 28 questions in this survey.

Group 5 – Internal Customers: this survey group is for internal customers of MDOT that are also involved in the operations of the organizations. There are 16 questions in this survey.

3.2.2. Questionnaire Characteristics

The final five online questionnaires are included in the Appendix of this document and a sample question is shown in Figure 3.4. In general, the questionnaires comprised questions regarding the general operations, quality, equipment, performance, training, standards, organization, structure, processes, and deliverables. It is composed of dichotomous, importance/agreement bipolar, liker, and rate scaling types of questions. Most of the questions in the questionnaires are dichotomous and importance/agreement type of questions. And some of the questions provide additional spaces for comment, suggestions and questions on the survey. Questions that require short

answers are also included in the questionnaire. These questions enabled the team to get current data about the strategies and methodologies being used by MDOT and help identify areas of operations that may require improvements and/or modifications.


*Please give your opinion of the following surveying performance issues:

	STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE	I DON'T KNOW
Rtk equipment may be suitable for horizontal surveys but is not suitable for vertical surveys.						
Rtk equipment is suitable for all surveys with the exception of special situations where class 1 vertical accuracy is required.						
Current data collection software used in my office is suitable for daily surveying operations						
The data collection software currently used in my office is easy to use						

Figure 3.4 Sample Question

3.3. DATA COLLECTION PROCESS USING QUESTIONNAIRE

The collection, processing, archiving and retrieving of data is a costly, demanding and a necessary activity. In general questionnaires are considered a relative inexpensive way to collect data from a potentially large number of participants as it was the cased in the project.

In the data collection process, the research team first prepared a MDOT distribution list of surveying stakeholders to get the contact list of MDOT employees that will participate. The distribution list was organized according to each of the five target groups and included participants from all seven MDOT district offices (Figure 3.5) as well as the administration building.

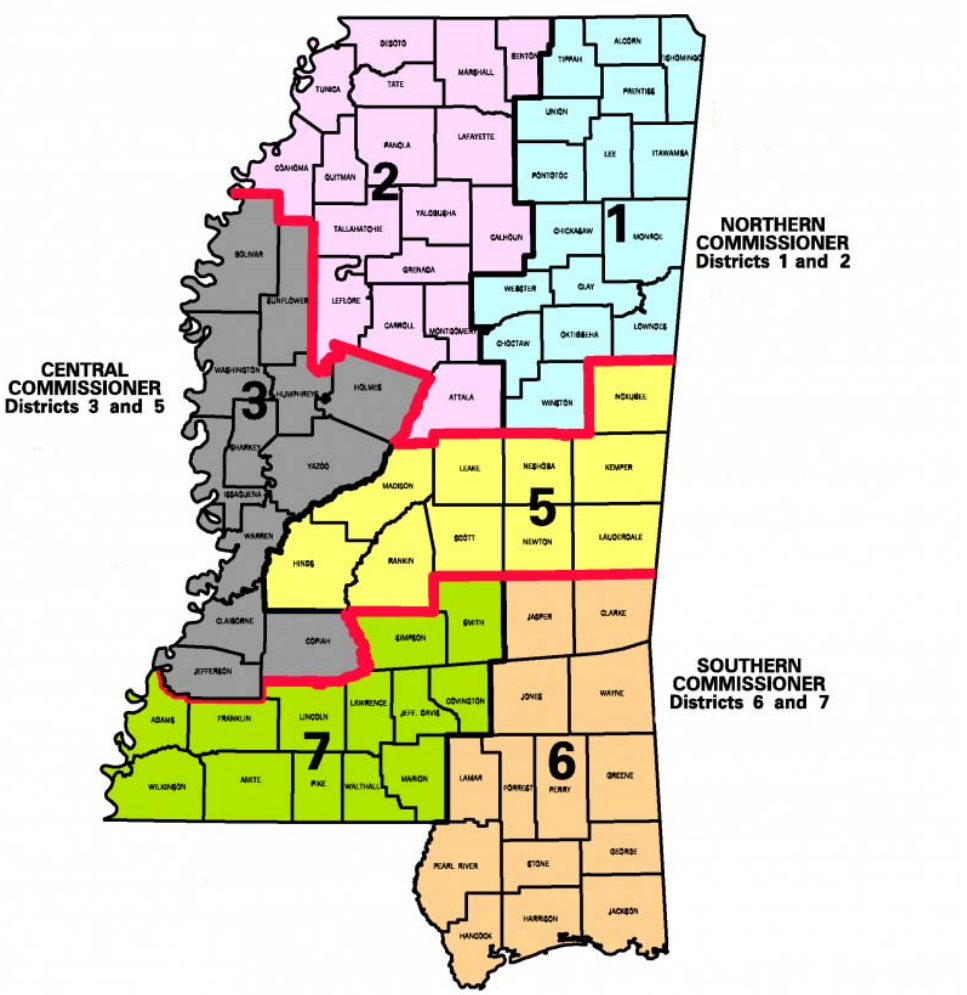


Figure 3.5 MDOT Seven Districts Geographical Distribution

The first step to initiate the deployment of the online questionnaire was a letter that was sent by upper administration to all participants. (shown in Figure 3.6)

The department has been working with the University of Southern Mississippi on a research project studying the effectiveness of MDOT's surveying efforts. Information gathered in this study, will help the department in making any necessary changes to improve its surveying efforts. Part of this study will involve you sharing your knowledge and expertise by completing a questionnaire.

In the near future, someone from the University will be contacting you by e-mail with instructions for completing the questionnaire. The goal of the department is 100% participation of employees selected to be part of the study.

Thank you in advance for your cooperation.

Figure 3.6 MDOT Upper Administration Letter to District Office

Following the e-mail from MDOT administration, five standard templates (one for each group) were developed and used to invite participants to answer the online- questionnaire. A Sample Invitation Letter is shown in Figure 3.7.

The Mississippi Department of Transportation (MDOT) is working with the University of Southern Mississippi on a project titled "Best Practices of MDOT's Survey Operation, Organization and Technology Implementation."

This project is very important for MDOT, and based on your expertise and experience the MDOT Technical Advisory Committee has recommended you to share information critical for the project. Therefore, we would greatly appreciate it if you could complete the questionnaire at the link below at your earliest convenience but no later than March 28th, 2011.

1- MDOT - State Study 222 - Field (Group 1).
http://icee.usm.edu/surveys/limesurvey1/index.php?lang=en&sid=11963&token=r3bme3vsh4m2w55

This questionnaire will take you approximately 12 minutes to complete.

Should you have any questions, feel free to contact Dr.Tulio Sulbaran (Tulio.Sulbaran@usm.edu) and/or Dr. Andrew Strelzoff (Andrew.Strelzoff@usm.edu).

Regards,
-Tulio

Tulio Sulbaran, Ph.D.
Associate Professor, School of Construction
Director, ICEE
The University of Southern Mississippi

Figure 3.7 Sample Invitation E-mail

The research team allowed the participants several days to answer the online questionnaires. The participants that after several days had not answered the questionnaire, were sent a reminder as the sample shown in Figure 3.8

On Friday March 11th we sent you an invitation with the information below. We noticed that you have not yet completed the questionnaire yet, and the deadline of March 28th, 2011 is rapidly approaching.

We would greatly appreciate if you could click on the link below and complete the questionnaire at your earliest convenience before March 28th, 2011.

Figure 3.8 Sample Reminder E-mail

The participants were sent an initial invitation and a reminder. The participants that had not responded by the deadline were called up to two times and sent a second e-mail reminder to encourage them to answer the on-line survey.

Throughout the data collection process, progress meeting and reports were provided to the MDOT TAC to get feedback and to solicit their help in encouraging participants to answer the online questionnaire. This process allowed the research team to receive 100% participation from four groups and 97% participation in the fifth group.

3.4. SUMMARY

The research team would like to emphasize the very important role that the members of the MDOT Technical Advisory Committee had during the development and deployment of the five online questionnaires that resulted in 100% response rate across most of the groups. The research team believes that their involvement in the project made the participants very willing to collaborate in the data process. The data collected is very valuable as it is a comprehensive analysis of the MDOT Surveying operations from the District and Division perspective.

CHAPTER 4: STATISTICAL ANALYSIS OF BEST PRACTICES OF MDOT'S SURVEY OPERATION, ORGANIZATION AND TECHNOLOGY IMPLEMENTATION

4.1. INTRODUCTION

The improvement of surveying operations is very critical to MDOT because most of the projects undertaken by the organization involve surveying during the project cycle. This study used statistical analysis to determine the best practices for survey operations that can be used to achieve better results on projects involving surveying. More specifically, the analysis focused on: (1) Best operational approach to use a range of surveying technologies, (2) Most effective organizational model/process to best utilize the newest surveying technologies; and (3) Best roll-out strategy which would help MDOT districts move to the most efficient surveying technology.
The Statistical analyses are based on the data gathered from the five online questionnaire responses.

4.2. OVERVIEW OF STATISTICAL ANALYSIS

Statistical Analysis is the science of the collection, organization, and interpretation of data. It deals with all aspects of this, including the planning of data collection in terms of the design of surveys and experiments [Wikipedia 2010]. Statistical analysis pertains to collection, analysis, interpretation, and presentation of data as well as drawing valid conclusions and making reasonable decisions on the basis of such analysis. In most research projects the statistical analysis involves three major steps, done in roughly this order:

- Cleaning and organizing the data for analysis (Data Preparation),
- Describing the data (Descriptive Statistics),
- Testing hypotheses and models (Inferential Statistics)

4.2.1 Data Preparation

A general term covering the collection of information such as: - face to face interviewing in-home, in the street, in a central venue, at place of work; - group discussions, depth interviews; - telephone interviewing from a telephone centre; - telephone interviewing from interviewers' home; - auditors collecting in-store information; - evaluators conducting mystery shopping and client service work; - respondents completing self-completion/postal questionnaires; - through electronic techniques (such as in this project five online questionnaires). It involves checking or logging the data in, checking the data for accuracy, entering the data into the computer, transforming the data and developing and documenting a database structure that integrates the various measures. [Wikipedia 2010]

4.2.2 Descriptive Statistics

Describe the main features of a collection of data quantitatively. Descriptive statistics are distinguished from inferential statistics (or inductive statistics), in that descriptive statistics aim to summarize a data set quantitatively without employing a probabilistic formulation, rather than use the data to make inferences about the population that the data are thought to represent.
They are used to describe the basic features of the data in a study. They provide simple summaries about the sample and the measures. Together with graphical analysis, they form the basis of virtually every quantitative analysis of data. Descriptive statistics are used to present quantitative descriptions in a manageable form. They are used to simplify large amounts of data

in a sensible way. Descriptive statistics involves the examination across cases of one variable at a time. With descriptive statistics the researchers are simply describing what the data shows. [Wikipedia 2010]. The three major characteristics of a single variable are its distribution, central tendency and dispersion.

A. Distribution is a summary of the frequency on individual values for a variable. One of the most common ways to describe a single variable is with a frequency distribution. Graphical forms such as histograms or bar charts are effective tools for depicting frequency distributions [Trochim 2006].

B. Central Tendency of a variable is the estimate of the "center" of a distribution of its values. The three major types of estimates of central tendency of a variable are its mean, median and mode. The mean is the variable's average value. The median is the score found at the exact middle of a set of variable values. The mode is the most frequently occurring value for the variable [Trochim 2006].

C. Dispersion refers to the spread of the values of the variable around the central tendency. The two most common measures of dispersion of a variable are its range and standard deviation. The range is the highest value of the variable minus the lowest value. The standard deviation is more accurate reflection of dispersion by reducing the effect of outlier values of a variable [Trochim 2006].

4.2.3 Inferential Statistics.

Statistical inference is the process of drawing conclusions from data that are subject to random variation, for example, observational errors or sampling variation. More substantially, the terms statistical inference, statistical induction and inferential statistics are used to describe systems of procedures that can be used to draw conclusions from datasets arising from systems affected by random variation. Initial requirements of such a system of procedures for inference and induction are that the system should produce reasonable answers when applied to well-defined situations and that it should be general enough to be applied across a range of situations. [Wikipedia 2010]
Focus on trying to reach conclusions that extend beyond the raw data. Inferential statistics are used to make inferences from the descriptive statistics to more general conditions; where the descriptive statistics simply is used to describe what's going on with the data. The inferential statistical "tools" available for use within SPSS are Chi-square, *T* test, Regression, General Linear Model, and Correlation [SPSS 2006].

A. Chi-square test: A **chi-square test** (also **chi squared test** or **χ^2 test**) is any statistical hypothesis test in which the sampling distribution of the test statistic is a chi-square distribution when the null hypothesis is true, or any in which this is *asymptotically* true, meaning that the sampling distribution (if the null hypothesis is true) can be made to approximate a chi-square distribution as closely as desired by making the sample size large enough [Wikipedia 2008].

B. T test: It is used for comparing mean values of two sets of numbers. The comparison will provide a statistic basis to determine if there is a statistically significant difference between the numbers.

C. Regression: It is used to determine the effect of one or more predictor variables on an outcome variable. Regression allows you to make statements about how well independent variables will predict the value of a dependent variable.

D. Analysis of Variance (ANOVA): Analysis of variance is used to determine if there are differences between groups on the basis an outcome variable. In SPSS the majority of procedures used for conducting analysis of variance (ANOVA) can be found under the *General Linear Model* [SPSS 2006].

E. Correlation: It is a measure of the relation between two or more variables. Correlation coefficients can range from -1.00 to +1.00. The value of -1.00 represents a perfect negative correlation while a value of +1.00 represents a perfect positive correlation. A value of 0.00 represents a lack of correlation. The most widely-used type of correlation coefficient is *Pearson* correlation *r*. The Pearson correlation assumes that the two variables are measured on at least interval scales, and it determines the extent to which values of the two variables are "proportional" to each other. The value of correlation or correlation coefficient does not depend on the specific measurement units used. The correlation is high if the data can be summarized by a straight line. This line is called the regression line or least squares line, because it is determined such that the sum of the squared distances of all the data points from the line is the lowest possible. In order to evaluate the correlation between variables, it is important to know the significance of the correlation. The significance level calculated for each correlation is a primary source of information about the reliability of the correlation. The test of significance is based on the assumption that the distribution of the deviations from the regression line for the dependent variable, *y*, follows the normal distribution, and that the variability of the residual values are the same for all values of the independent variable *x* [Stat Soft 2006]. Figure 4-1 shows some data samples with it corresponding r values.

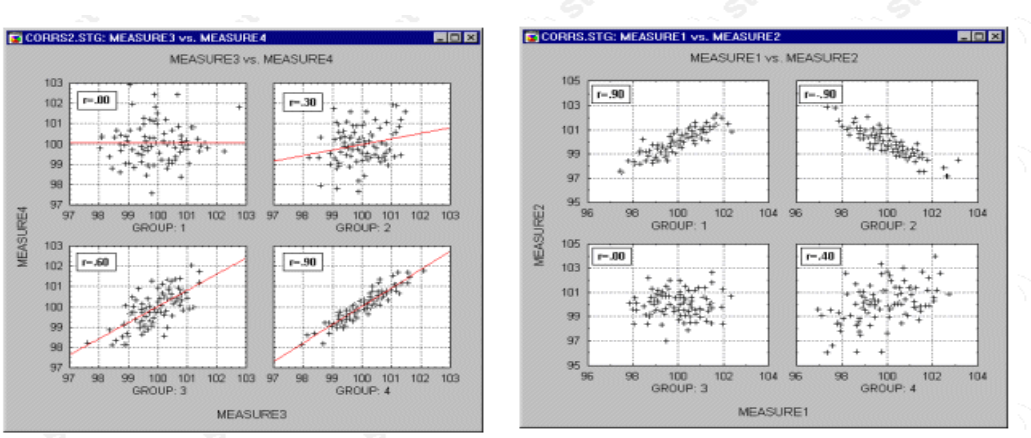


Figure 4.1 Sample data with corresponding r values.

Since the data collection process was covered in the previous chapter and the data collected is not conducive to statistical induction and inferential statistics to describe systems, this chapter will focus on the Descriptive Statistics.

4.3. DESCRIPTIVE STATISTICAL ANALYSIS

The statistical analysis focused on analyzing the survey data using the responses from the questionnaire from the five targeted groups

4.3.1. Group Responses Overview Analysis

Response rates vary significantly from study to study based on a variety of factors such as targeted populations, duration, topic, etc. Achieving 100% response rate as it was done in this project is seldom the case as it significantly strengthens the results presented in this report. For instance, a study was conducted to explore what could and should be a reasonable response rate in academic studies. 141 papers which included 175 different studies were examined. They were published in well-known journals such as the Academy of Management Journal, Human Relations, Journal of Applied Psychology, Organizational Behavior and Human Decision Processes, and Journal of International Business Studies. The research found that the average response rate was 55.6% [Baruch, Y 1999]. The response rates for each of the five groups of this project were as follows:

Group 1 – Field Personnel: had 37 questions, 39 invitations were sent and there were 38 responses for a respond rate of 97% as shown in Figure 4.2

Total invitations sent	39
Total Responses	38 (97%)

Figure 4.2 Field Personnel Questionnaire Invitations vs. Total Responses

Group 2 – CADD Personnel: had 31 questions, 32 invitations were sent and there were 32 responses for a respond rate of 100% as shown in Figure 4.3.

Total invitations sent	32
Total Responses	32 (100%)

Figure 4.3 CADD Personnel Questionnaire Invitations vs. Total Responses

Group 3 – Management: had 54 questions, 64 invitations were sent and there were 64 responses for a respond rate of 100% as shown in Figure 4.4.

Total invitations sent	64
Total Responses	64 (100%)

Figure 4.4 Management Questionnaire Invitations vs. Total Responses

Group 4 – Administration: had 28 questions, 18 invitations were sent and there were 18 responses for a respond rate of 100% as shown in Figure 4.5.

Total invitations sent	18
Total Responses	18 (100%)

Figure 4.5 Administration Questionnaire Invitations vs. Total Responses

Group 5 – Internal Customers: had 16 questions, 9 invitations were sent and there were 9 responses for a respond rate of 100% as shown in Figure 4.6.

Total invitations sent	9
Total Responses	9 (100%)

Figure 4.6 Internal Customers Questionnaire Invitations vs. Total Responses

4.3.2 MDOT Best Operational Approach Answers Analysis

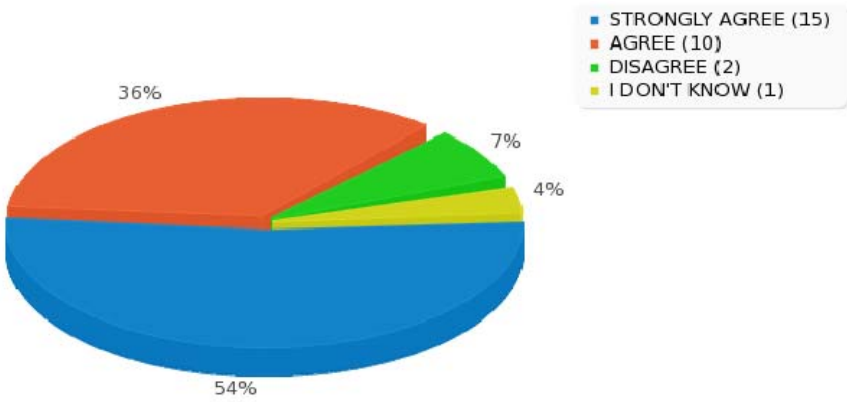
The results presented below are a summary of the descriptive statistical analysis of the responses from the online questionnaires. The complete descriptive statistics for each group are included in the appendix of this document.

The summary analysis presented here corresponds to the responses that were considered to be the most relevant. They were extracted from the five groups and were organized according to the element that was considered to be the most impacted by the finding. However, it is worth noting in many cases one particular analysis impacts more than one element.

4.3.2.1 Quality Measures

This analysis focused on the quality of products, the production operations and delivery of projects. It is used to assess the importance of improved production in terms of speed, completion of tasks, making deadline, etc. compared to improving the quality of products. The following corresponds to the findings that were considered to be the most relevant:

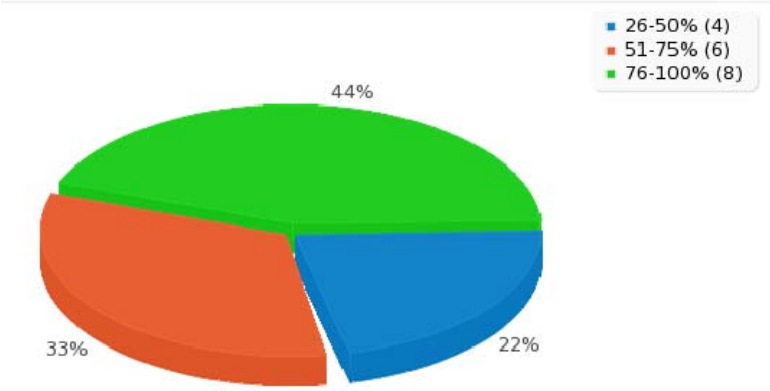
- Over 90% of the Field Personnel Group believes that Quality of Product should be the most important priority of their unit as shown in Figure 4.7.



Survey Question: Please rate the accuracy of the following statements:
[I believe quality should be the most important priority in my unit]

Figure 4.7 Quality Measure Responses from Field Personnel

- Only 44% of the Administration Group believes that 76-100% of ROW markers set by contractors meet MDOT specifications and standards of practice as shown in figure 4.3 below.



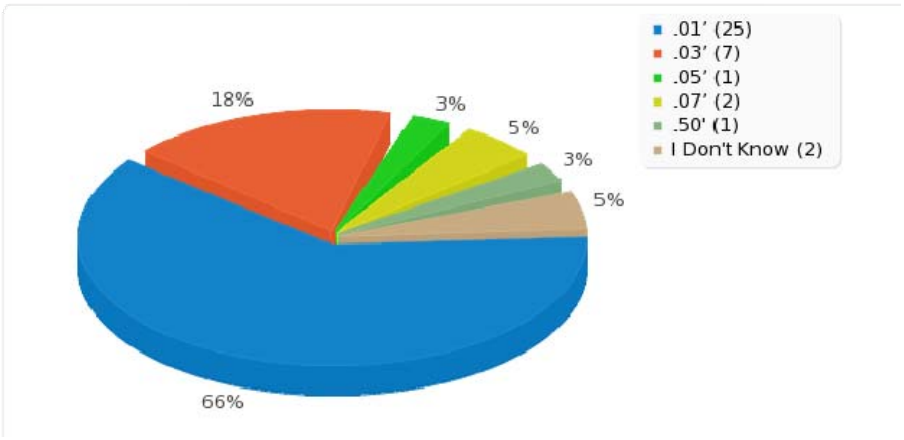
Survey Question: In your opinion, what percent of ROW markers set by contractors meet MDOT specifications and standards of practice?

Figure 4.8 Process Responses from Administration Group

4.3.2.2 Performance

MDOT uses different machinery and equipment for its survey operations. This analysis was used to evaluate the appropriateness and performance level of the equipment used in the survey operations. The following corresponds to the findings that were considered to be the most relevant:

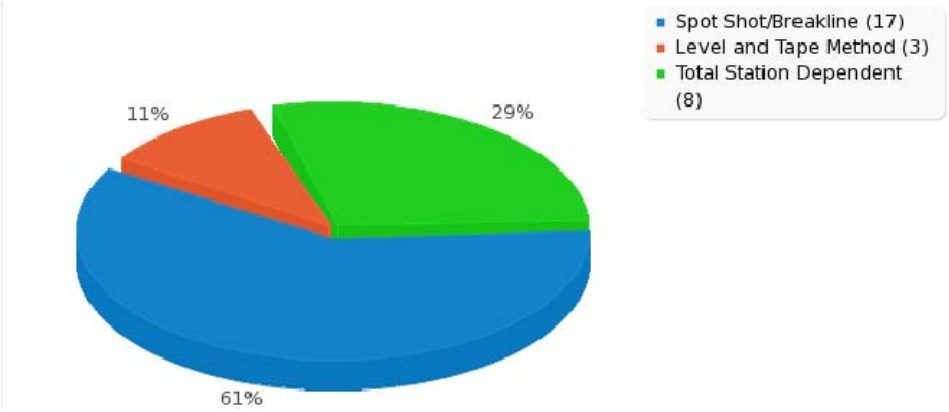
- 66% of the Field Personnel Group can achieve a vertical accuracy level of .01' on Level equipment. But other responses about accuracy levels on equipment show no consensus. Reponses were evenly distributed among other values.



Survey Question: What vertical accuracy level can you achieve with the following equipment? [Level]

Figure 4.9. Performance Reponses from Field personnel

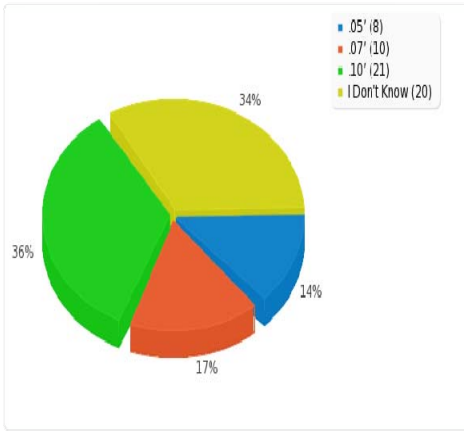
- 61% of the Field Personnel Group prefers to use Spot Shot/Break-line as method of collecting earthwork compared to other methods like Total station as shown below in Figure 4.10.



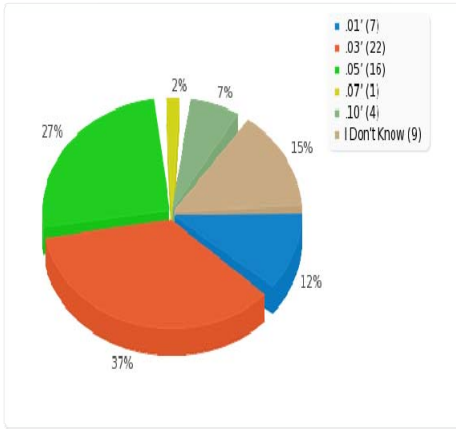
Survey Question: What is your preferred method of collecting earthwork?

Figure 4.**10.**Process Responses from Field personnel

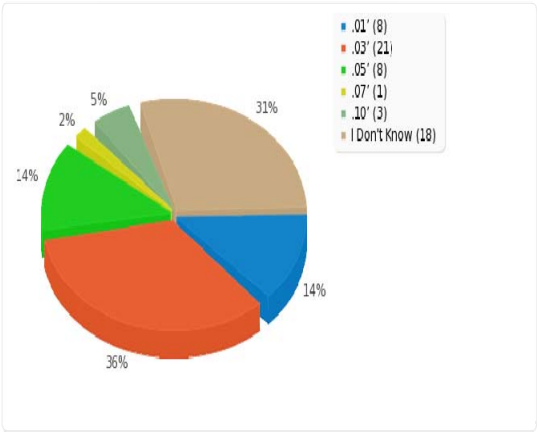
- Management Group Responses showed no consensus regarding the accuracy levels that could be achieved using various equipment like RTK and total station. Reponses were distributed among different values as shown in Figure 4.11 below.



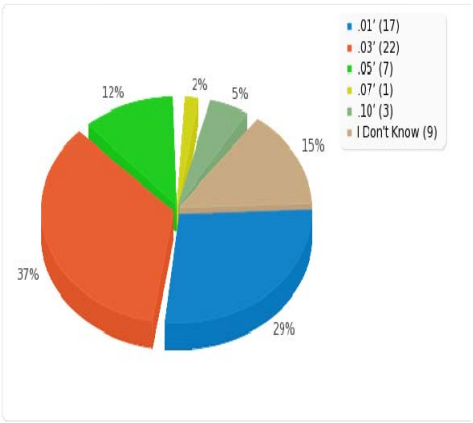
RTK Equipment (Vertical)]



Total Station (Vertical)]



RTK Equipment (Horizontal)



Total Station (Horizontal)

Survey Question: What horizontal accuracy level can you achieve with the following equipment?

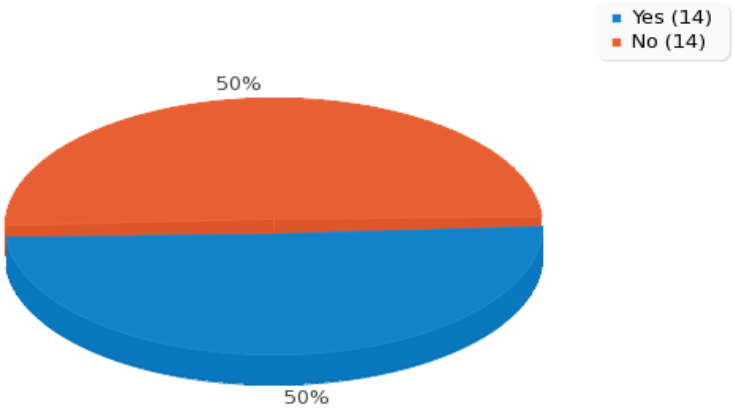
Figure 4.11.Performance Responses from Field personnel

4.3.2.3 Standards and MDOT Manuals

Standard and MDOT Manuals analysis focused on examining the use of standard survey manuals and if the surveying operations followed the standards established by the state of Mississippi. The following corresponds to the findings that were considered to be the most relevant:

- Half of the Field Personnel Group answered “yes” to the question “Do you refer to the Mississippi Board of Licensure for Professional Engineers and Surveyors “Standards of

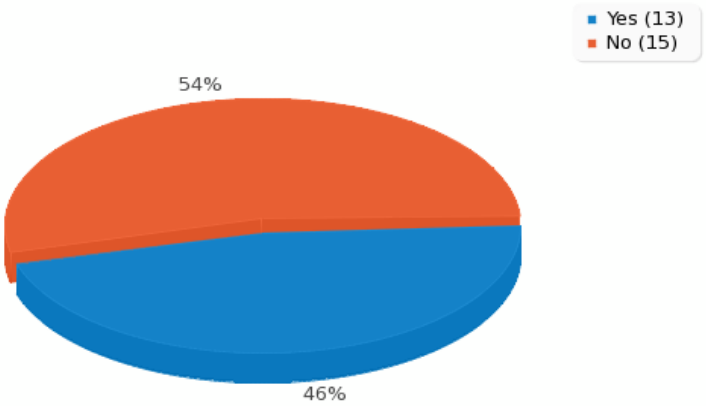
Practice for surveyors" when performing surveys?" and the other half said "no", which shows no consensus as shown in figure 4.12 below.



Survey Question: Do you refer to the Mississippi Board of Licensure for Professional Engineers and Surveyors "Standards of Practice for surveyors" when performing surveys?

Figure 4.12. Standard Responses from Field personnel

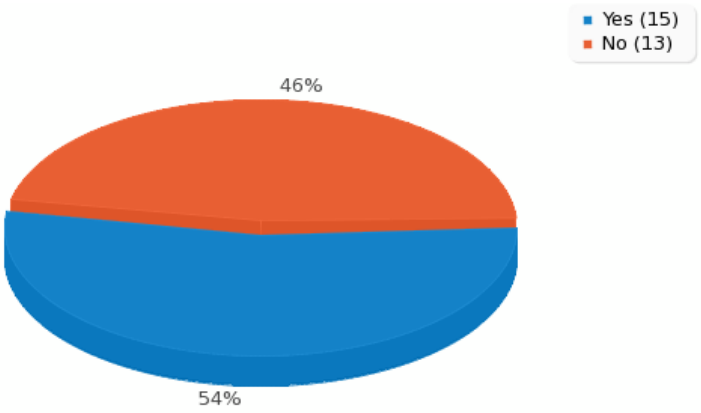
- 53% of the Field Personnel Group answered "no" to the question "Should MDOT surveying standards exceed the professional surveying standards set forth by the Mississippi Board of Licensure for Professional Engineers and Surveyors?" as shown in Figure 4.13 below.



Survey Question: Should MDOT surveying standards exceed the professional surveying standards set forth by the Mississippi Board of Licensure for Professional Engineers and Surveyors?

Figure 4.13 Standard Responses from Field personnel

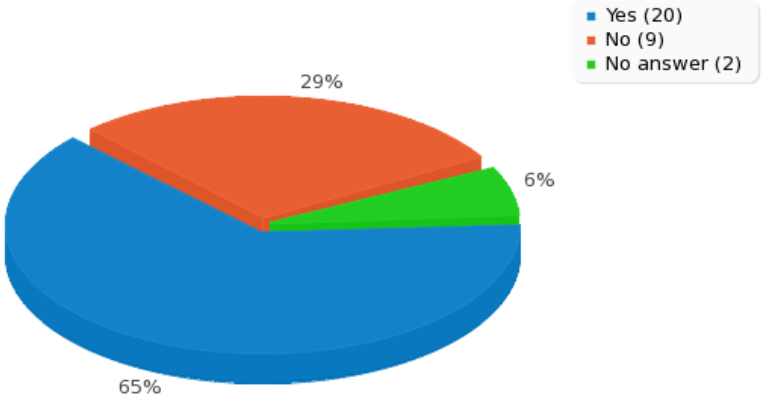
- Only 54% of the Field Personnel Group has read, understood and follows the standard current standard MDOT's Survey Manual as shown in Figure 4.14 below.



Survey Question: Have you read and understood the current MDOT Survey Manual?

Figure 4.14.Standard Responses from Field personnel

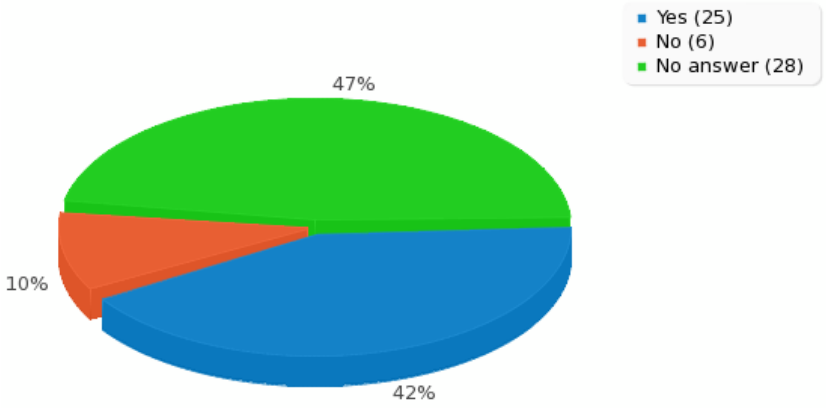
- 65% of the CADD Personnel Group responded that they have read, understood and are following the current standard MDOT's Survey Manual as shown in Figure 4.15 below.



Survey Question: Have you read and understood the current MDOT Survey Manual?

Figure 4.15.Standard Responses from CADD personnel

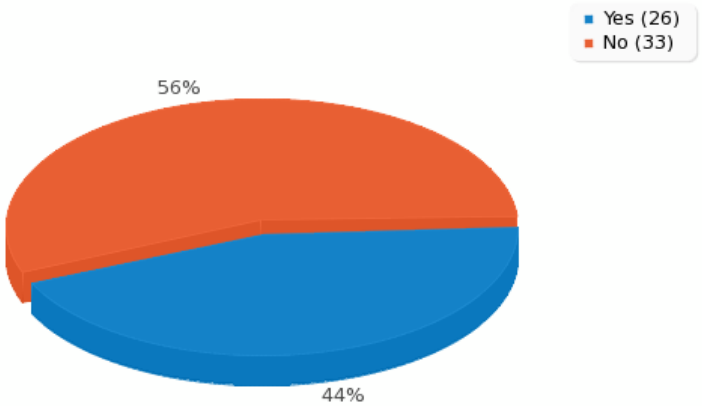
- 47% of the Management Group believes that the requirements defined by the current MDOT Survey Manual are being met, while more than 50% are not sure, as shown in Figure 4.16 below



Survey Question: Are the requirements as defined by the current MDOT Survey Manual being met?

Figure 4.16.Standard Responses from Management

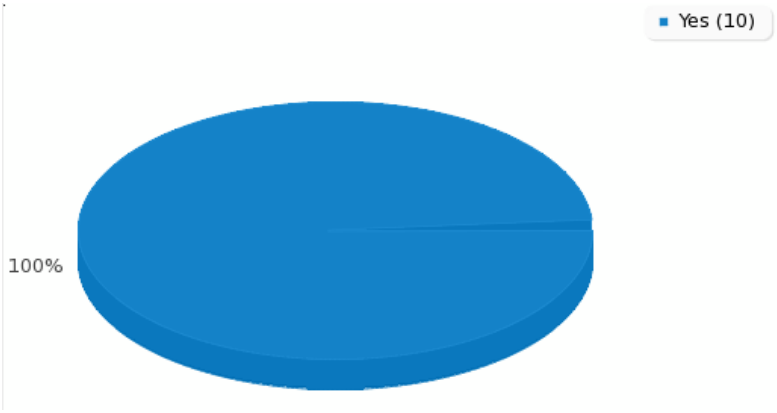
- 56% of Management Group responded that they have not read and understood the standard MDOT's Survey Manual as shown in Figure 4.17 below.



Survey Question: Have you read and understand the 2008 MDOT's Survey Manual?

Figure 4.17. Standard Responses from Management

- All Internal Customer Group members agreed that their division's survey needs/requirements are outlined in the MDOT Survey Manual. As shown in Figure 4.18



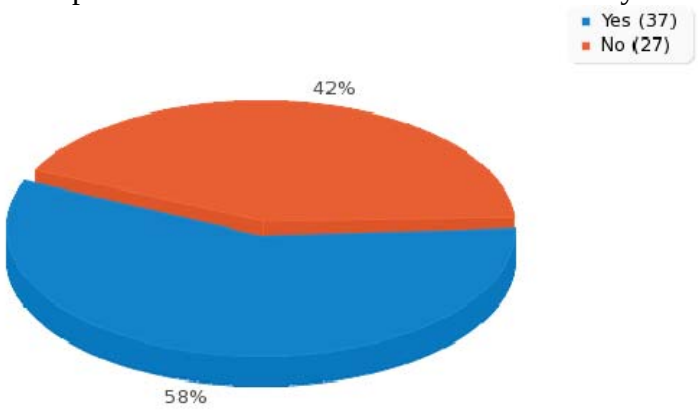
Survey Question: Have you read and understand the 2008 MDOT's Survey Manual?

Figure 4.18. Standard Responses from Internal Customers

4.3.2.4 Organizational Structure

Operational structure analysis focused on identifying the duties and responsibilities of different personnel of MDOT to determine the most efficient and effective organizational structures. The following corresponds to the findings that were considered to be the most relevant:

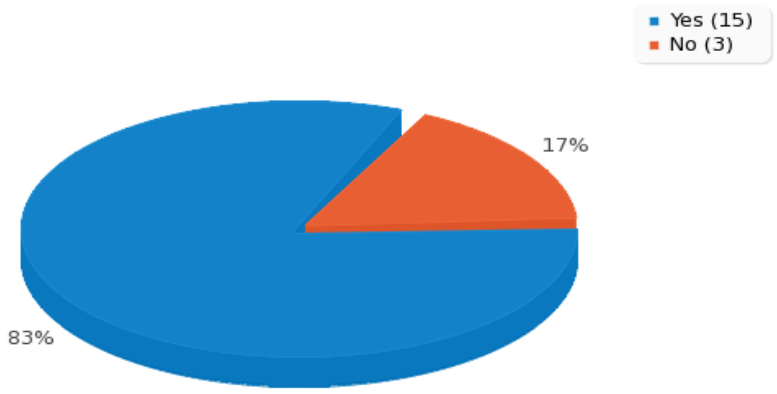
- 58% of Management Personnel responded 'yes' to the question 'Are all existing and proposed right of way and property line surveys being done by MDOT survey crews under the direct supervision of a Licensed Professional Surveyor?



Survey Question: Are all existing and proposed right of way and property line surveys being done by MDOT survey crews under the direct supervision of a Licensed Professional Surveyor?

Figure 4.19. Standard Responses from Management Personnel

- 83% of Administration Group responded “yes” to the question **“**Are All exist and proposed right of way and property line surveys being done by MDOT survey crews under the direct supervision of a Licensed Professional Surveyor?” as shown in Figure 4.20.



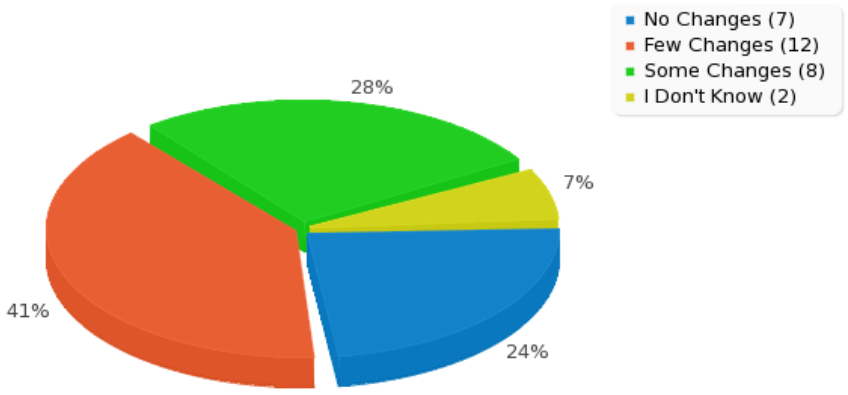
Survey Question: Are all existing and proposed right of way and property line surveys being performed by MDOT survey crews under the direct supervision of a Licensed Professional Surveyor?

Figure 4.20. Standard Responses from Administration

4.3.2.5 Surveying processes

This analysis focused on information regarding the current survey processes at MDOT. The following corresponds to the findings that were considered to be the most relevant:

- 69 % of the Field Personnel Group believes that ‘few’ or ‘some’ changes are needed in the area of surveying techniques of MDOT survey operations as shown in Figure 4.21 below.



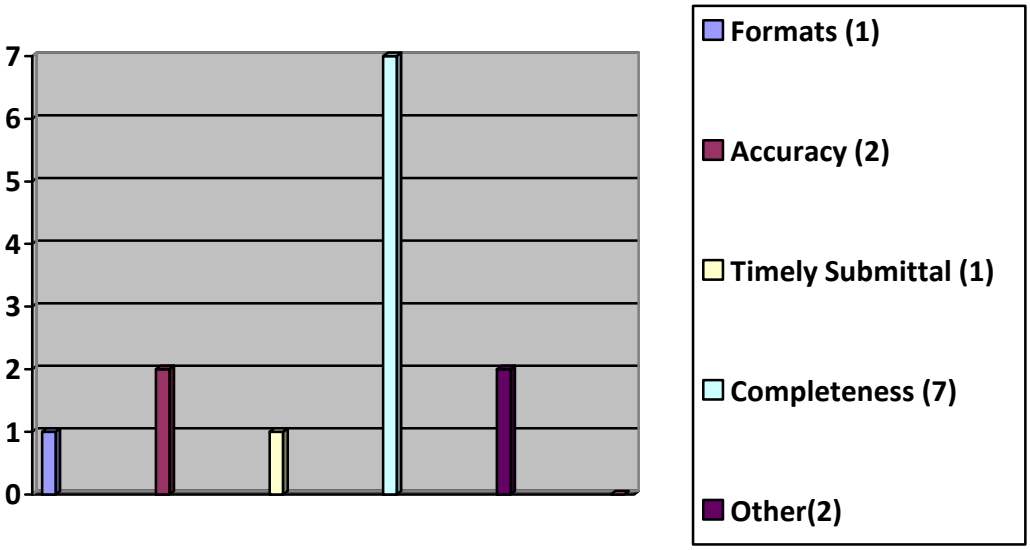
Survey Question: What areas of MDOT survey operations are in need of change?

Figure 4.21 General Operation Responses from Field Personnel

4.3.2.6 Deliverables

This analysis corresponds to the data gathering process in the surveying operations involved and the communication between MDOT offices and Roadway Design, Right of Way and the Districts. The following corresponds to the findings that were considered to be the most relevant:

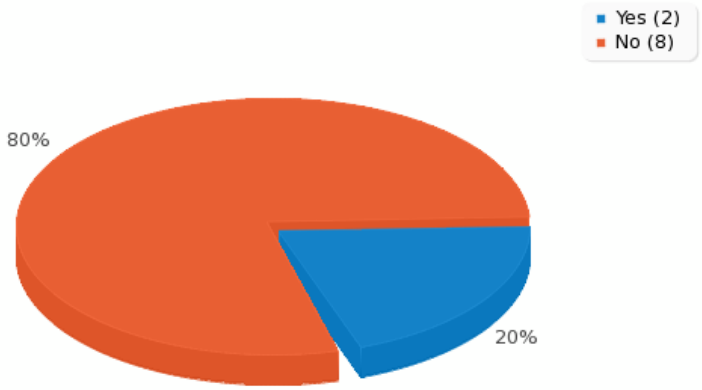
- 70% of the Internal Customer Group responses indicated that they were encountering problems in their division because of incompleteness of survey data as shown in Figure 4.22 below.



Survey Question: What problems are your division encountering with Survey data?

Figure 4.22 Administration Responses from Internal Customers

- 80% of the Internal Customer Group responded "no" to the question "Does your office receive all the information required when surveys are originally submitted?", as shown in Figure 4.23 below.



Survey Question: Does your office receive all the information required when surveys are originally submitted?

Figure 4.23 Administration Responses from Internal Customers

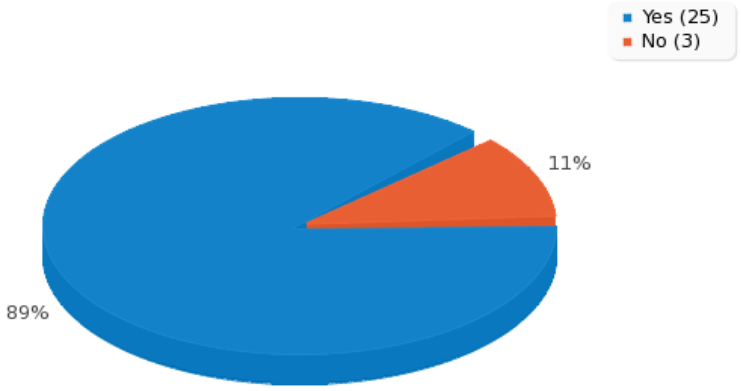
4.3.3 MDOT Most Effective Organizational Model/Process Answers Analysis

The results presented below, as in the previous section, correspond to a summary of the descriptive statistical analysis. The complete descriptive statistics for each group are included in the appendix of this document. The summary analysis presented here corresponds to the responses that were considered to be the most relevant. However, it is worth noting in many cases one particular analysis impacts more than one element.

4.3.3.1 Training

MDOT has been using skilled personnel for surveying tasks, specifically on road projects, for many years. These include survey technicians who work under the direction of a licensed professional surveyor. Using this survey training needs concerning data collection, leveling, general survey procedure, survey standards and practices were examined. The following corresponds to the findings that were considered to be the most relevant:

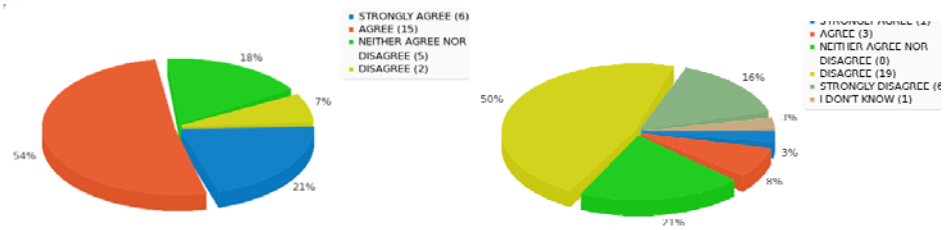
- 89% of the Field Personnel Group responded "yes" to the question "Should MDOT have a formal career path established for survey technician?" as shown in Figure 4.24



Survey Question: Should MDOT have a formal career path established for survey technician?

Figure 4.24 Standard Responses from Field Personnel

- 75% of the Field Personnel Group agreed on the fact that Training is needed and should be required as part of their job classifications while only 11% responded that they do not have time to attend training classes as shown in the Figure 4.25 below.



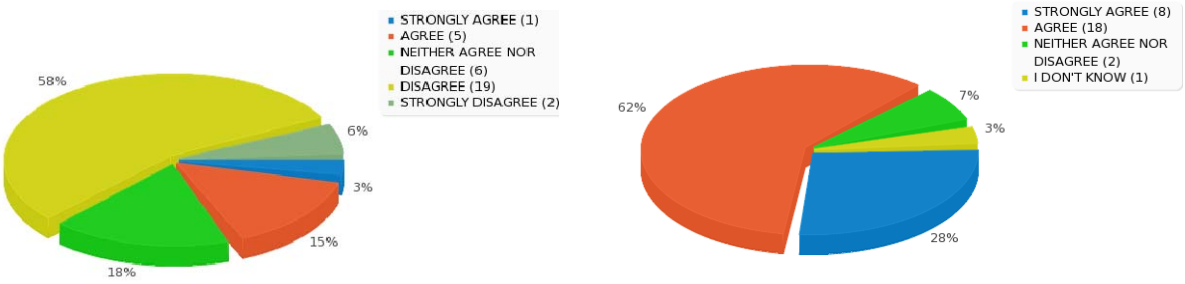
[Training is needed and should be required as part of our job classifications]

[I do not have time to attend training classes]

Survey Question: Please give your opinion of the following:

Figure 4.25 Training Responses from Field Personnel

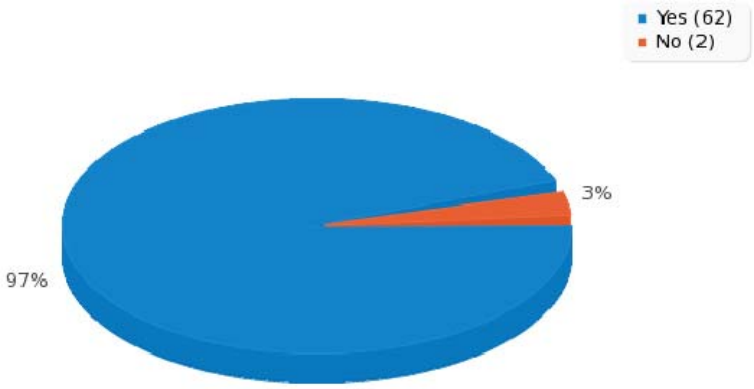
- 64% of the CADD Personnel Group believes that time spent attending training classes is better than time spent working and 80% of the CADD Personnel Group believes that training is needed and should be required as part of our job classifications. Other responses about the current training programs and their application on day to day work showed some consensus as shown in the Figure 4.26.



Survey Question: Please give your opinion of the following:
[My time is better spent working than attending training classes] [Training is needed and should be required as part of our job Classifications]

Figure 4.26 Training Responses from Field Personnel

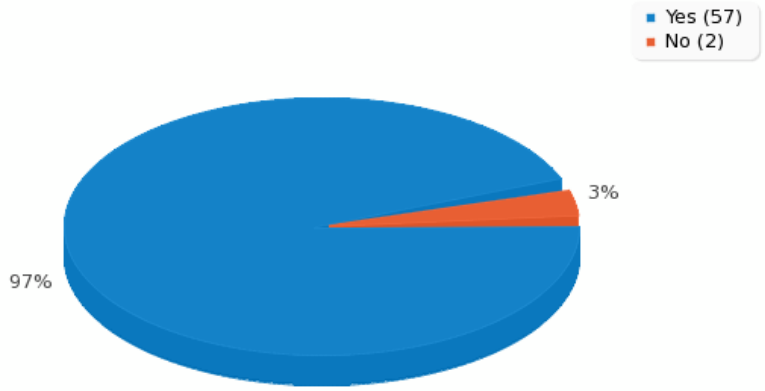
- 97 % of The Management Group responded “yes” to the question ‘Should MDOT have a formal career path established for survey technicians?” as shown in the Figure 4.27.



Survey Question: Should MDOT have a formal career path establish for survey technicians?

Figure 4.27 Organization Responses from Management

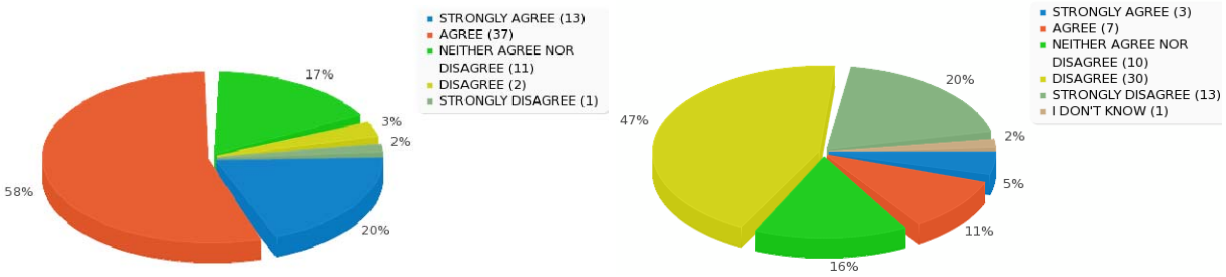
- 96 % of The Management Group responded “yes” to the question “Should MDOT have a formal career path for inspection & construction personnel?” as shown in the Figure 4.28.



Survey Question: Should MDOT have a formal career path for inspection & construction personnel?

Figure 4.28 Organization Responses from Management

- 78% of The Management Group agrees that training is needed and should be required as part of their job classification and believe they have time to attend training classes. 67% responded that their office does not have an established succession plan for retaining trained and qualified surveyors as shown in Figure 4.29.



Survey Question: Please give your opinion of the following:

[Training is needed and should be required as part of our job Classifications]

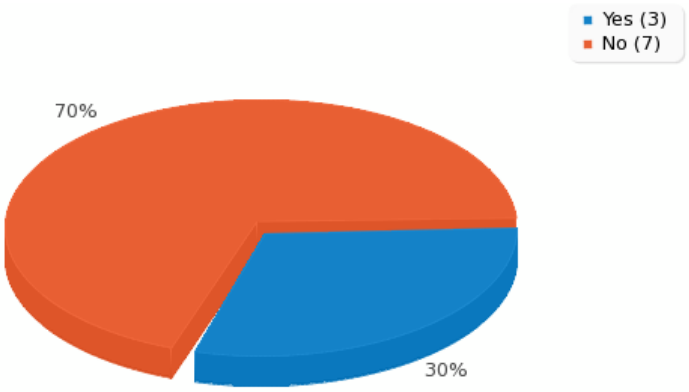
[My office has an established succession plan for retaining trained and qualified surveyors]

Figure 4.29 Organization Responses from Management

4.3.3.2 Standards and MDOT Manuals

Standard and MDOT Manuals analysis focused on examining the use of standard survey manuals and to see if the surveying operations are following standards established by the state of Mississippi. The following corresponds to the findings that were considered to be the most relevant:

- 70% of the Internal Customers Group members answered “no” to the question ‘Do surveys received by your office meet all requirements as outlined in the survey manual and CADD manual?”, as shown in Figure 4.30 below.



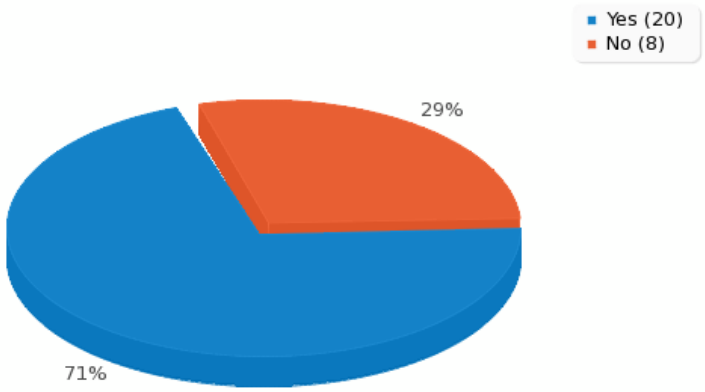
Survey Question: Do surveys received by your office meet all requirements as outlined in the survey manual and CADD manual?

Figure 4.30 Deliverable Responses from Internal Customers

4.3.3.3 Organizational Structure

Operational structure analysis is focused on identifying the duties and responsibilities of different personnel of MDOT to determine the most efficient and effective organizational structures. The following corresponds to the findings that were considered to be the most relevant:

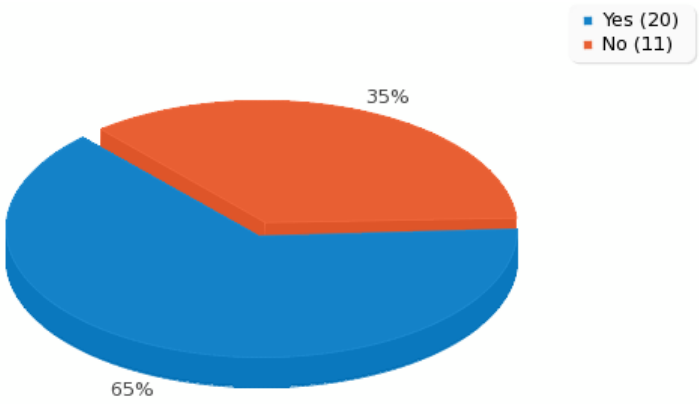
- 71% of the Field Personnel Group believes that the surveying office is adequately staffed to perform the necessary job functions required to submit finalized electronic drawings to Roadway Design as shown in Figure 4.31 below.



Survey Question: In your opinion, is the surveying office adequately staffed to perform the necessary job functions required to submit finalized electronic drawings to Roadway Design?

Figure 4.31 Equipment Responses from Field Personnel

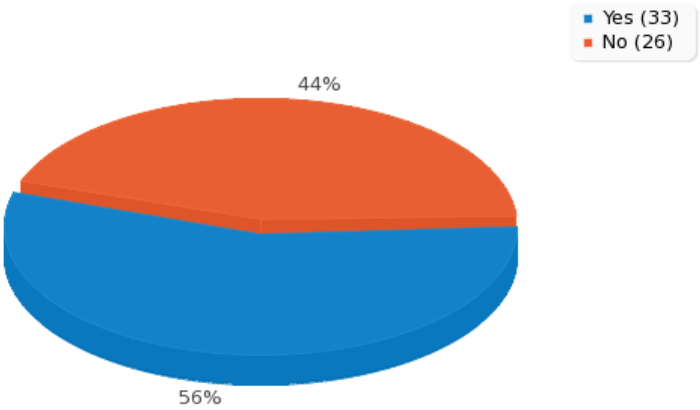
- 65% of the CADD Personnel Group believes that they have adequate CADD staff to perform the necessary job functions required to submit finalized electronic drawings to Roadway Design as shown in Figure 4.32 below.



Survey Question: In your opinion, is the surveying office adequately staffed to perform the necessary job functions required to submit finalized electronic drawings to Roadway Design?

Figure 4.32 Equipment Responses from Field Personnel

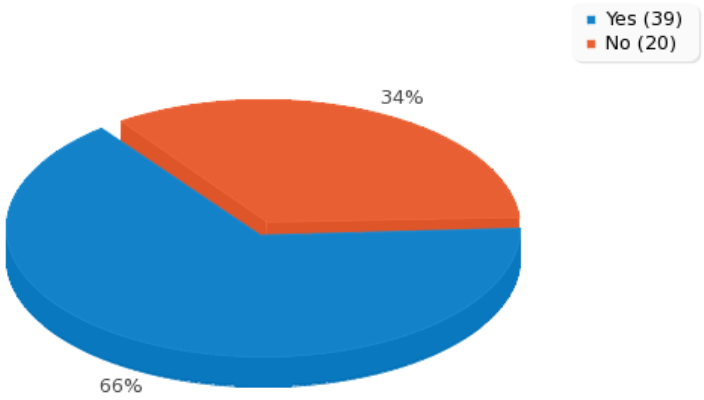
- 56% of the Management Group responded that the current model is effective and efficient as shown in Figure 4.33 below.



Survey Question: In your opinion is your current model effective and efficient?

Figure 4.33 Organization Responses from Management

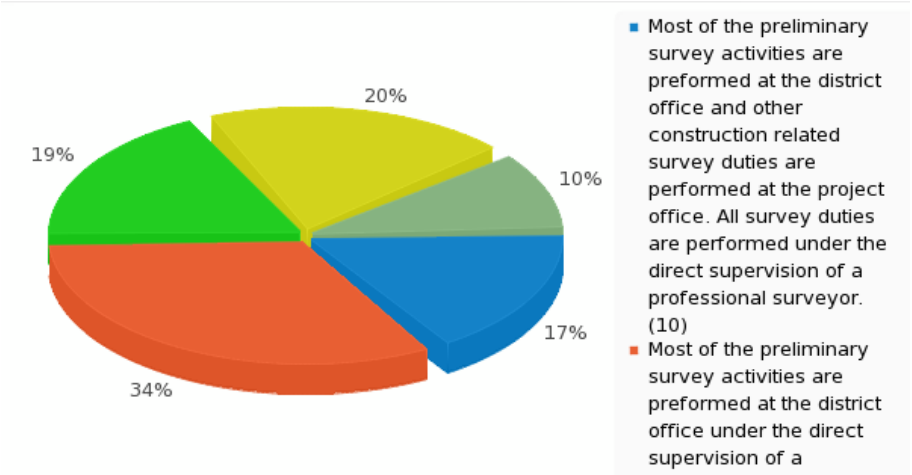
- 66% of the Management Group believes that each office should have a PLS as shown in Figure 4.34 below.



Survey Question: Should each project office have a PLS in the office?

Figure 4.34 Organization Responses from Management

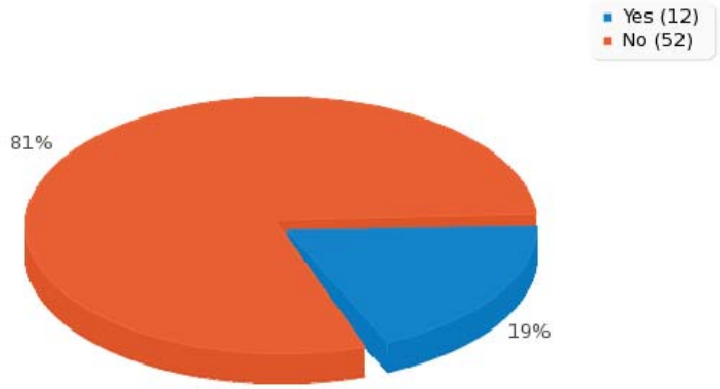
- The Management Group responses about the efficiency of the organizational survey model were evenly distributed among the options of project offices or district office performing the preliminary survey operations as shown in Figure 4.35 below.



Survey Question: Which organizational survey model is the most efficient in your opinion?

Figure 4.35 Organization Responses from Management

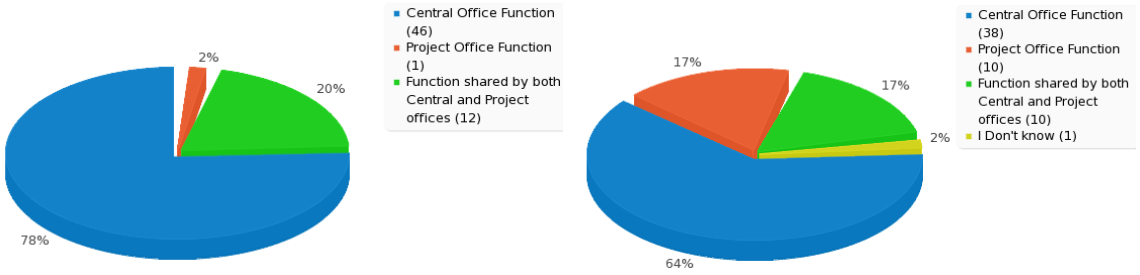
- 81% of the Management Group does not believe that the current State Personnel Board job classifications adequately cover the surveying profession



Survey Question: Does the current State Personnel Board job classifications adequately cover the surveying profession?

Figure 4.36 Organization Responses from Management

- 78% of The Management Group responses responded that Control Surveys and Eminent Domain Surveys are central office (Jackson) functions; while more than 90% responded that Surveying for earthwork quantities and Construction Staking are project office functions as shown in Figure 4.37.

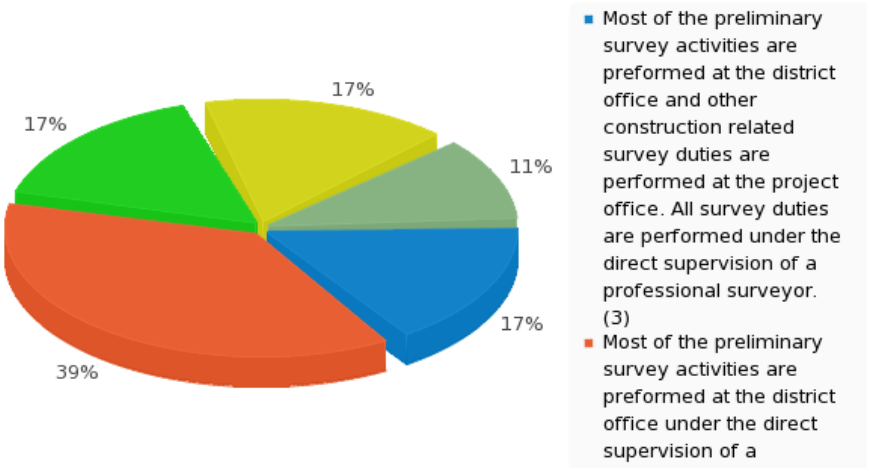


Survey Question: In your District, which survey operations are centralized and which operations are performed by the individual project offices?

Figure 4.37 Organization Responses from Management

- The Administration Group responses were evenly distributed among answer options, some showing that most of the preliminary survey activities are performed at the district office and other construction related survey duties are performed at the project office. Other responses included that most of the preliminary survey activities are performed at the district office under the direct supervision of a professional surveyor. The others responded that construction related survey duties are performed at the project office

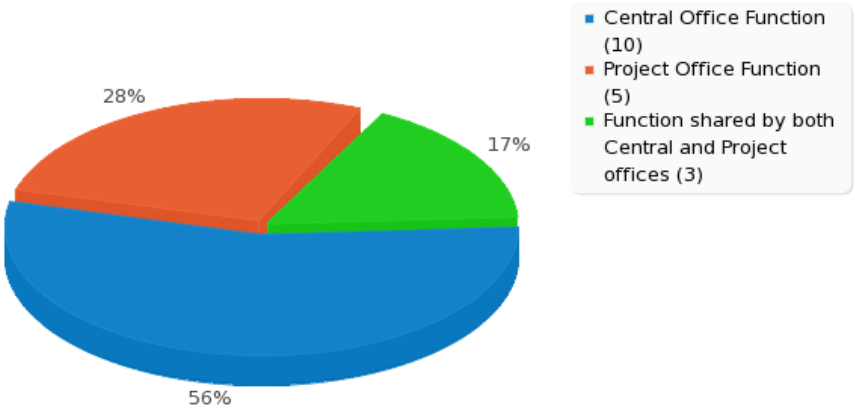
without direct supervision of a professional surveyor. Another set of responses showed that the district office performs some surveying duties primarily establishing project control and performing some boundary surveys under the direct supervision of a professional surveyor. The remaining responses indicated that the project office performing most of the preliminary surveys, including boundary surveys, were without direct supervision of a professional surveyor. The district office performs some surveying duties primarily establishing project control as shown in Figure 4.38 below.



Survey Question: In your District, which survey operations are centralized and which operations are performed by the individual project offices?

Figure 4.38 Organization Responses from Administration

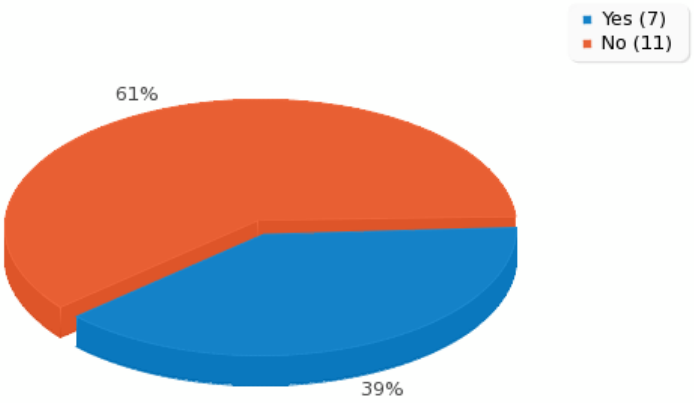
- 56% of The Administration Group responses indicated that Eminent Domain Surveys are central office (Jackson) functions as shown in Figure 4.39 below.



Survey Question: In your District, which survey operations are centralized and which operations are performed by the individual project offices?

Figure 4.39. Organization Responses from Administration

- 61% of The Administration Group believes that each project office should have PLS as shown in Figure 4.40.



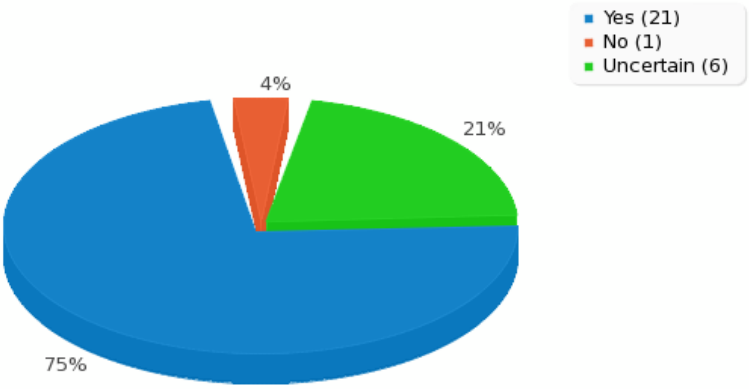
Survey Question: Should each project office have a PLS in the office?

Figure 4.40. Organization Responses from Administration

4.3.3.4 Surveying processes

This analysis focused on information regarding the current survey processes at MDOT. The following corresponds to the findings that were considered to be the most relevant:

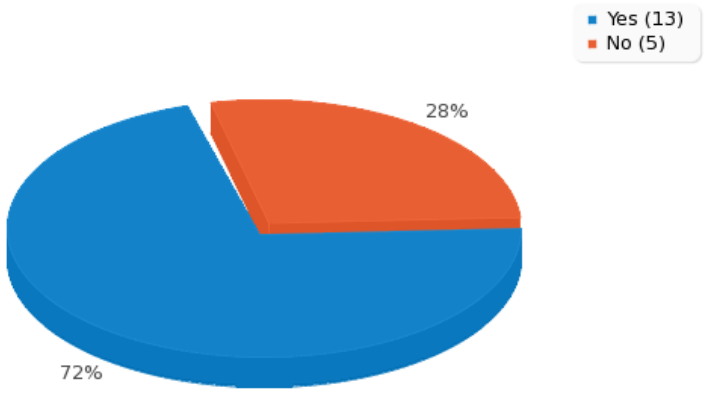
- 75% of the Field Personnel Group responded that direct supervision from a licensed surveyor is a standard practice and required for Eminent Domain survey types as shown in the Figure 4.41.



Survey Question: Is direct supervision from a licensed surveyor required for the following types of surveys?

Figure 4.41 Standards Responses from Field Personnel

- 72% of responses from The Administration Group indicated that there is an effective communication between their office, Roadway Design and Right of Way as shown in Figure 4.42.



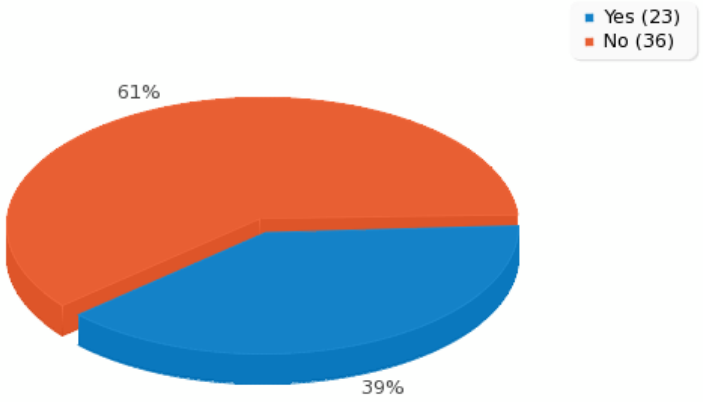
Survey Question: Is there effective communication between your office, Roadway Design and Right of Way?

Figure 4.42 Deliverable Responses from Administration

4.3.3.5 Deliverables

This analysis corresponds to the data gathering process in the surveying operations and the communication between MDOT offices, Roadway Design, Right of Way and the Districts. The following corresponds to the findings that were considered to be the most relevant:

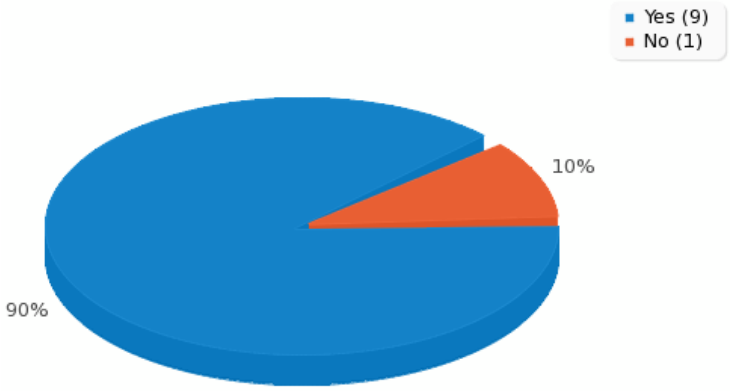
- 61% of the CADD Personnel Group answered "yes" to the question "Is there effective communication between your office, Roadway Design, Right of Way and the Districts?" as shown in Figure 4.43.



Survey Question: Is there effective communication between your office, Roadway Design, Right of Way and the Districts?

Figure 4.43 Deliverable Responses from CADD Personnel

• 90% of Internal Customers Group responses show that there is an effective communication among Roadway Design, Right of Way and the Districts as shown in Figure 4.45.



Survey Question: Is there effective communication between your office and Roadway Design, Right of Way?

Figure 4.44 Deliverable Responses from Internal Customers

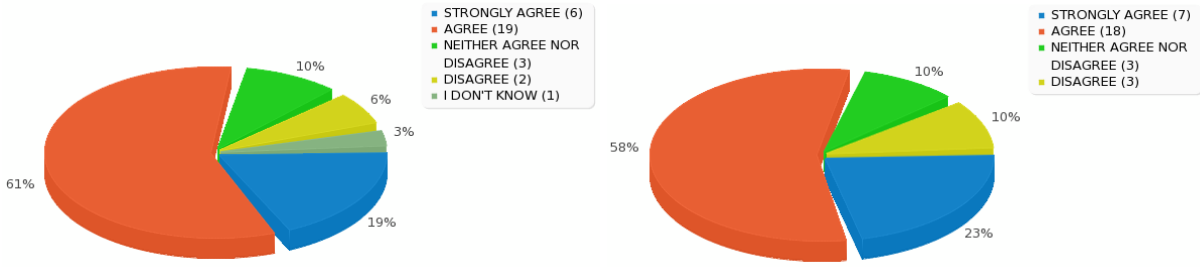
4.3.4 MDOT Best Survey Technologies Roll-Out Strategy Answers Analysis

As in the previous two sections, this section provides a summary of the descriptive statistical analysis. The complete descriptive statistics are included in the appendix of this document.

4.3.4.1 Performance

MDOT uses different machinery and equipment for its survey operations. This analysis was used to evaluate the appropriateness and performance level of equipment used in the survey operations. The following corresponds to the findings that were considered to be the most relevant:

- On Average, more than 80% of the CADD Personnel Group members responded that their office is utilizing the most recent and updated software and RWD Programs provided by MDOT. 81% responded that the most recent and updated equipment is used as shown in Figure 4.46.



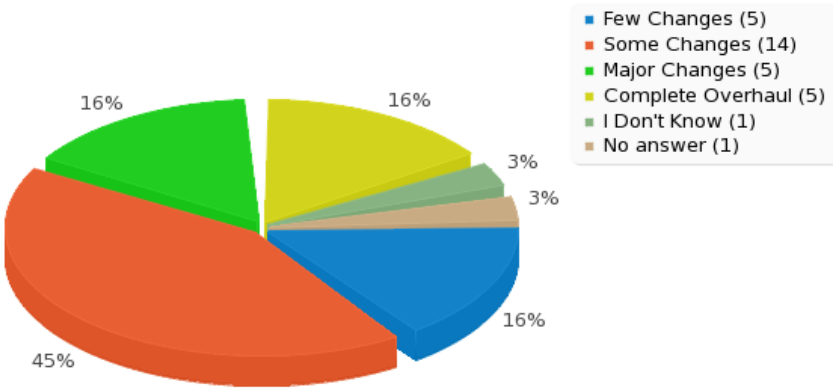
Survey Question: Your office is utilizing the most recent and updated equipment, software and RWD menus/configurations provided by MDOT.

Figure 4.45. Performance Responses from CADD Personnel

4.3.4.2 Training

MDOT has been using skilled personnel for surveying tasks, specifically on road projects, for many years. These include survey technicians who work under the direction of a licensed professional surveyor. Using this survey training needs concerning data collection, leveling, general survey procedure, survey standards and practices were examined. The following corresponds to the findings that were considered to be the most relevant:

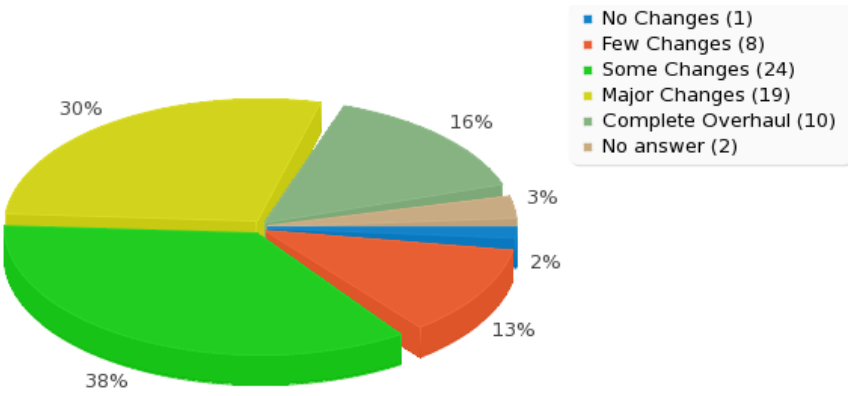
- 77% of the CADD Personnel Group responded that major changes are needed regarding training as shown in Figure 4.47 below.



Survey Question: What areas of MDOT survey operations are in need of change?

Figure 4.46 General Operation Responses from CADD Personnel

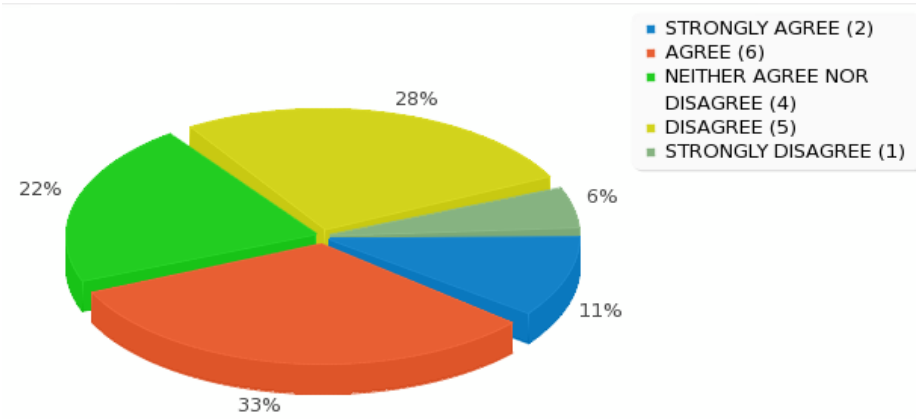
- 51% of The Management Group believes that 'few' or 'some' changes are needed on training operations as show in Figure 4.48 below.



Survey Question: What areas of MDOT survey operations are in need of change? [Training]

Figure 4.47. General Operation Responses from Management Personnel

- The Administration Group did not reach consensus on the statement, “MDOT staffs using modern surveying equipment are being trained to use this equipment properly and effectively.” 44% agree on the statement while 28% disagree and the remaining neither agreed nor disagreed as shown in Figure 4.49 below.



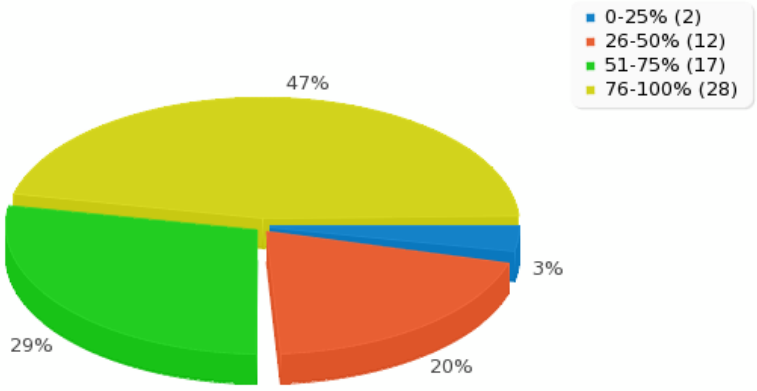
Survey Question: Please give your opinion of the following statements regarding Equipment [MDOT staff using modern surveying equipment are being trained to use this equipment properly and effectively]

Figure 4.48 Equipment Responses from Management

4.3.4.3 Standards and MDOT Manuals

Standard and MDOT Manuals analysis focused on examining the use of standard survey manuals to see if the surveying operations were following the standards established by the state of Mississippi. The following corresponds to the findings that were considered to be the most relevant:

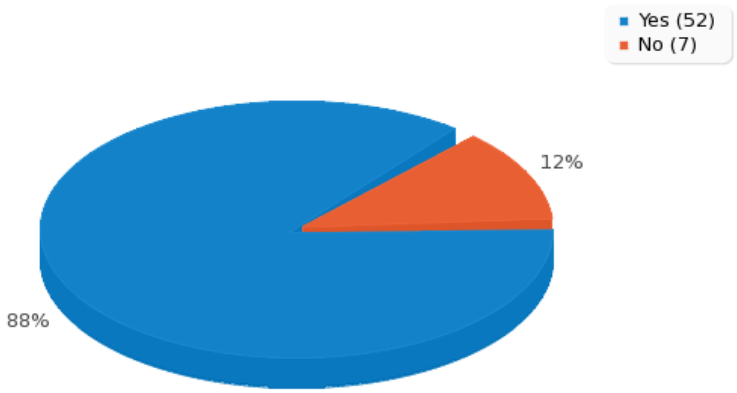
- 47% of the Management Group believes that 76-100% of ROW markers set by contractors meet MDOT specifications and standards of practice as shown in Figure 4.50 below.



Survey Question: In your opinion, what percent of ROW markers set by contractors meet MDOT specifications and standards of practice?

Figure 4.49 Process Responses from Management

- 88 % of The Management Group answered “yes” to the statement **“**Should MDOT established a standard procedure for checking the placement of ROW markers?”



Survey Question: In your opinion, what percent of ROW markers set by contractors meet MDOT specifications and standards of practice?

Figure 4.50 Process Responses from Management

4.4. SUMMARY

This chapter focused on the summaries of descriptive statistical on: (1) Best operational approach to use a range of surveying technologies, (2) Most effective organizational model/process to best utilize the newest surveying technologies; and (3) Best roll-out strategy which would help MDOT districts move to the most efficient surveying technology.

The results presented in this chapter indicate that MDOT Survey operation could be positively impacted by establishing training programs for MDOT personnel coupled with formal career path and proper retention programs. It is also evident that policies and training regarding standards and MDOT manual should be implemented. Communication between the departments could be encouraged and formalized.

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APPENDICES

APPENDIX A

RANKED INITIAL QUESTIONS

Admin Survey - Handout

Question: 50 Average Importance: 5.0 Ranking: 1

50 [Standards11]Are MDOT surveying practices meeting the professional standards? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 23 Average Importance: 4.9 Ranking: 2

23 [Equipment15]In your opinion, is the surveying office adequately staffed to perform the necessary job functions required to submit finalized electronic drawings to Roadway Design? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 4 Average Importance: 4.9 Ranking: 3

4 [GeneralOperation3]What should the Role of Consultants be in MDOT Survey Operations?
1 = DO NOT AGREE
2 = AGREE A LITTLE
3 = AGREE SOMEWHAT
4 = AGREE A LOT
5 = AGREE VERY STRONGLY
*

Please choose the appropriate response for each item:

	1	2	3	4	5	I Don't Know
MDOT personnel should perform all surveys	○	○	○	○	○	○
Consultants should perform all MDOT surveys	○	○	○	○	○	○
Both MDOT and consultants should perform MDOT surveys	○	○	○	○	○	○
MDOT should contract with consultants to do preliminary surveys	○	○	○	○	○	○
MDOT should contract with consultants to do control surveys	○	○	○	○	○	○

Questions/Comments:

Question: 120 Average Importance: 4.8 Ranking: 4

120 [Deliverable6]Do we have the proper personnel in Roadway Design and Right of Way Divisions handling survey data provided by the Districts?
*

Please choose **only one** of the following:

○ Yes
○ No

Questions/Comments:

Question: 119 Average Importance: 4.8 Ranking: 5

119 [Deliverable5]Is there effective communication between Roadway Design, Right of Way and the Districts?
*

Please choose **only one** of the following:

○ Yes
○ No

Questions/Comments:

Question: 108 Average Importance: 4.8 Ranking: 6

108 [Processes25]If no PLS is present in a project office, should that office do condemnation plat staking and plat preparation?
*

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 106 Average Importance: 4.8 Ranking: 7

106 [Processes22]Should the control survey for MDOT projects be done at the project offices or by a central crew from the district office?
*

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 104 Average Importance: 4.8 Ranking: 8

106 [Processes22]Should the control survey for MDOT projects be done at the project offices or by a central crew from the district office?
*

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 103 Average Importance: 4.8 Ranking: 9

103 [Processes19]If MDOT performs preliminary surveys, should they be done by project offices or by survey crews from the district office?
*

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 82 Average Importance: 4.8 Ranking: 10

82 [22]Do you agree that MDOT should be inspecting survey work performed by consultants? Is your office adequately staffed to perform these inspections?
*

Please write your answer here:

Questions/Comments:

Question: 53 Average Importance: 4.8 Ranking: 11

53 [Standards14]Please give your opinion of the of the following:
1 = DO NOT AGREE
2 = AGREE A LITTLE
3 = AGREE SOMEWHAT
4 = AGREE A LOT
5 = AGREE VERY STRONGLY

*

Please choose the appropriate response for each item:

	1	2	3	4	5	I Don't Know
Professional Surveyors across the State see MDOT surveying practices as sub-standard	○	○	○	○	○	○
MDOT is leading the way for surveyors across the State with modern surveying equipment	○	○	○	○	○	○
MDOT Survey should set as a goal to lead the state of Mississippi with the best reputation for quality surveys	○	○	○	○	○	○

Questions/Comments:

Question: 48 Average Importance: 4.8 Ranking: 12

48 [Standards9]Should all surveying activities within MDOT be performed under the direct supervision of a Professional Surveyor?
*

Please choose **only one** of the following:

○ Yes
○ No

Questions/Comments:

Question: 47 Average Importance: 4.8 Ranking: 13

47 [Standards8]Is all surveying activities within your office being performed under the direct supervision of a Professional Surveyor? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 45 Average Importance: 4.8 Ranking: 14

45 [Standards6]How often should the MDOT Survey Manual be revised? *

Please choose **only one** of the following:

- ○ Every 6 Months
- ○ Yearly
- ○ Every other Year
- ○ Every 5 Years
- ○ I Don't know

Questions/Comments:

Question: 24 Average Importance: 4.7 Ranking: 15

24 [Equipment16]If not, what additional staffing needs would improve this workflow? *

Only answer this question if the following conditions are met:
* Answer was 'Yes' at question '23 [Equipment15]' (In your opinion, is the surveying office adequately staffed to perform the necessary job functions required to submit finalized electronic drawings to Roadway Design?)

Please write your answer here:

Questions/Comments:

Question: 6 Average Importance: 4.7 Ranking: 16

6 [QualityMeasures1]Please give your opinion of the of the following:
1 = DO NOT AGREE
2 = AGREE A LITTLE
3 = AGREE SOMEWHAT
4 = AGREE A LOT
5 = AGREE VERY STRONGLY *

Please choose the appropriate response for each item:

	1	2	3	4	5	I Don't Know
Production (Speed, completion of tasks, making deadlines, ...) is the most important priority in my unit	○	○	○	○	○	○
Quality of Product (Accuracy, completeness, delivery in proper format, ...) is the most important priority in my unit.	○	○	○	○	○	○
Field surveying requires the gathering of enormous amounts of data therefore it is expected that a percentage of the data will be inaccurate regardless of field methods used.	○	○	○	○	○	○
Redundant measurement procedures will slightly improve accuracy but the extra time involved makes redundant procedures not feasible	○	○	○	○	○	○
MDOT recieves a quality product when consultants are emploed for surveying	○	○	○	○	○	○

Questions/Comments:

Question: 5 Average Importance: 4.7 Ranking: 17

5 [GeneralOperation5]What percent of survey work in your office is currently contracted to outside surveyors? *

Please choose **only one** of the following:

- ○ none
- ○ 10%
- ○ 25%
- ○ 50%
- ○ 75%
- ○ 100%
- ○ More Specific Percentage (enter in the comments)

Make a comment on your choice here:

Questions/Comments:

Question: 3 Average Importance: 4.7 Ranking: 18

3 [GeneralOperation4]What type of training related to Survey does your office need? *

Please choose **only one** of the following:

- ○ General Survey Procedures
- ○ 3d Collection
- ○ 3d CADD modeling
- ○ Standards and Practices
- ○ Other (explain in comments)

Make a comment on your choice here:

Questions/Comments:

Question: 125 Average Importance: 4.7 Ranking: 19

125 [Admin2]Does the data received from the district require any manipulation, re-formatting or modifications to be used in the design applications? If so, explain process?
*

Please write your answer here:

Questions/Comments:

Question: 124 Average Importance: 4.7 Ranking: 20

124 [Admin1]Is your division encountering any problems with Survey data?

*

Please choose **all** that apply:

- ☐ Formats?
- ☐ Accuracy?
- ☐ Timely submittal?
- ☐ Completeness?
- ☐ Other?

Questions/Comments:

Question: 123 Average Importance: 4.7 Ranking: 21

123 [Deliverable9]Are the personnel in the Jackson Divisions handling survey data qualified to adjust, translate and rotate survey data because they don't understand the state plane coordinate system or they don't understand property surveying?
*

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 122 Average Importance: 4.7 Ranking: 22

122 [Deliverable8]If there is an apparent problem with the survey data sent to Jackson should a technician within the Division take upon themselves to adjust the data as they see fit?
*

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 121 Average Importance: 4.7 Ranking: 23

121 [Deliverable7]Should a Division in Jackson contact the District if there is an apparent problem with survey data provided by the District to make sure the data is correct? Who should they contact?
*

Please write your answer here:

Questions/Comments:

Question: 112 Average Importance: 4.7 Ranking: 24

112 [Processes29]Are ROW markers checked once placed by the Contractor?
Should MDOT establish a standard for checking the placement of ROW markers? If yes, do you have the resources available to check them?
Preliminary Deed Research: Who does it? (Project Office, District Office, ROW Division, Other)
*

Please write your answer(s) here:

Should MDOT establish a standard for checking the placement of ROW markers?	
If yes, do you have the resources available to check them?	
Preliminary Deed Research: Who does it? (Project Office, District Office, ROW Division, Other)	

Questions/Comments:

Question: 109 Average Importance: 4.7 Ranking: 25

109 [Processes26]Should project offices submit their data directly to Roadway Design or should it be routed through the district office?
*

Please choose **all** that apply:

- ☐ Roadway Design
- ☐ District Office
- ☐ Other
- ☐ I Don't Know

Questions/Comments:

Question: 107 Average Importance: 4.7 Ranking: 26

107 [Processes23]Should condemnation plat preparation and staking be done exclusively by MDOT or should consultants be used?
*

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 94 Average Importance: 4.7 Ranking: 27

94 [Processes10]Are all property and right of way surveys done under the direct supervision of a Licensed Professional Surveyor?

*

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 83 Average Importance: 4.7 Ranking: 28

83 [23]Who is responsible for reviewing in house surveys prior to their final submittal?
*

Please write your answer here:

Questions/Comments:

Question: 80 Average Importance: 4.7 Ranking: 29

80 [Organization20]Should each project office have a PLS in the office? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 79 Average Importance: 4.7 Ranking: 30

79 [Organization19]How many Licensed Professional Surveyors at the District Surveyor level are needed in your district? *

Please write your answer here:

Questions/Comments:

Question: 72 Average Importance: 4.7 Ranking: 31

72 [Organization12]Does MDOT have a career path or personnel structure for Professional Surveyors? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 66 Average Importance: 4.7 Ranking: 32

66 [Organization6]Does the current State Personnel Board job classifications adequately cover the surveying profession? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 65 Average Importance: 4.7 Ranking: 33

65 [Organization5]Which organization of survey model is the most efficient in your opinion? *

Please choose **only one** of the following:

- ○ Most of the preliminary survey activities are preformed at the district office and other construction related survey duties are performed at the project office. All survey duties are performed under the direct supervision of a professional surveyor.
- ○ Most of the preliminary survey activities are preformed at the district office under the direct supervision of a professional surveyor and other construction related survey duties are performed at the project office without direct supervision of a professional surveyor
- ○ District office performs some surveying duties primarily establishing project control and performing some boundary surveys under the direct supervision of a professional surveyor
- ○ Project office performing most of the preliminary surveys including boundary surveys without direct supervision of a professional surveyor. District office performs some surveying duties primarily establishing project control
- ○ other (specify in comments)

Make a comment on your choice here:

Questions/Comments:

Question: 64 Average Importance: 4.7 Ranking: 34

64 [Organization4]In your opinion is your current model effective and efficient? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 52 Average Importance: 4.7 Ranking: 35

52 [Standards13]Are all existing and proposed right of way and property line surveys being done by MDOT survey crews under the direct supervision of a Licensed Professional Surveyor? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 51 Average Importance: 4.7 Ranking: 36

51 [Standards12]Should MDOT surveying standards exceed the professional surveying standards set forth by the Mississippi Board of Licensure for Professional Engineers and Surveyors?
*

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 35 Average Importance: 4.6 Ranking: 37

35 [Training2]Has your office established any formal training for survey personnel? *

Please choose the appropriate response for each item:

	Formal training regulalry available	Formal training occasionally available	Formal training rarely available	Currently no formal training - it has been offered in the past	No Formal training	I Don't know
Professional	○	○	○	○	○	○
Technical	○	○	○	○	○	○
Field Work	○	○	○	○	○	○
CADD	○	○	○	○	○	○

Questions/Comments:

Question: 34 Average Importance: 4.6 Ranking: 38

34 [Training1]Select the training needs for the following categories of Survey Skills: *

Please choose the appropriate response for each item:

	Yes, Training Needed	Yes, Some Training Needed	Yes, A Little Training Needed	No, not used	I don't know
Data collection	○	○	○	○	○
Leveling	○	○	○	○	○
Total station	○	○	○	○	○
PCODES and Linking codes	○	○	○	○	○
DTM	○	○	○	○	○
Cogo	○	○	○	○	○
GeoPak	○	○	○	○	○
RWD Codes	○	○	○	○	○
Allegro data collectors	○	○	○	○	○
Other Survey Equipment	○	○	○	○	○

Questions/Comments:

Question: 33 Average Importance: 4.6 Ranking: 39

33 [Performance6]Is your office utilizing the most recent and updated equipment, software and RWD programs provided by MDOT? *

Please choose the appropriate response for each item:

	Already well-incorpaorated in everyday operations	Used regulalry but still moving towards full integration with operations	Used occasionally and making some progress towards regular use	Rarely used and unlikely to become standard in everyday usage	Never used, lacking training or motivation to put into use	I don't know
Equipment	○	○	○	○	○	○
Software	○	○	○	○	○	○
RWD Programs	○	○	○	○	○	○

Questions/Comments:

Question: 62 Average Importance: 4.6 Ranking: 40

62 [Organiaztion2]What is the typical number of crew members in your GPS survey crew? *

Please choose **only one** of the following:

- ○ 2
- ○ 3
- ○ 4
- ○ 5
- ○ 6
- ○ Does Not Apply(GPS not used)

Make a comment on your choice here:

Questions/Comments:

Question: 22 Average Importance: 4.6 Ranking: 41

22 [Equipment14]How much time does the use of DTM's save compared to conventional surveys? *

Only answer this question if the following conditions are met:
* Answer was 'Yes' at question '20 [Equipment12]' (Do you create DTM's?)

Please write your answer here:

Questions/Comments:

Question: 13 Average Importance: 4.6 Ranking: 42

13 [Equipment5]Should MDOT establish a committee to determine what surveying equipment is needed? *

Please choose **only one** of the following:

- ○ Yes - A committee of District Survey Adminstrators should be formed
- ○ Yes - A committee of Adminstrators and Field personnel should be formed
- ○ Yes - A committee drawn from MDOT survey staff at all levels should be formed
- ○ No - The MDOT main office should make equipment recomendations
- ○ No - Each District adminstration should determine the best equipment to purchase
- ○ No - each project office should determine the best equipment to purchase
- ○ Other

Questions/Comments:

Question: 127 Average Importance: 4.5 Ranking: 43

127 [Admin4]Are your division's survey needs/requirements outlined in the MDOT Survey Manual? Are these requirements being met by surveys received by your office? *

Please write your answer here:

Questions/Comments:

Question: 110 Average Importance: 4.5 Ranking: 44

110 [Processes27]Should MDOT require all surveys to be in DTM format? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 75 Average Importance: 4.5 Ranking: 45

75 [Organzation15]Please give your opinion of the of the following:
1 = DO NOT AGREE
2 = AGREE A LITTLE
3 = AGREE SOMEWHAT
4 = AGREE A LOT
5 = AGREE VERY STRONGLY *

Please choose the appropriate response for each item

	1	2	3	4	5	I Don't Know
My office has an established succession plan for retaining trained and qualified surveyors	○	○	○	○	○	○
I do not have time to attend training classes	○	○	○	○	○	○
Training that I have received in the past does not relate to my day to day job functions	○	○	○	○	○	○
Training is needed and should be required as part of our job classifications	○	○	○	○	○	○

Questions/Comments:

Question: 67 Average Importance: 4.5 Ranking: 46

67 [Organization7]What changes to the job classifications should be made? *

Please write your answer here:

Questions/Comments:

Question: 1 Average Importance: 4.5 Ranking: 47

1 [GeneralOperation1]Please give your opinion of the of the following:
1 = DO NOT AGREE
2 = AGREE A LITTLE
3 = AGREE SOMEWHAT
4 = AGREE A LOT
5 = AGREE VERY STRONGLY
***

Please choose the appropriate response for each item:

	1	2	3	4	5	I Don't Know
Surveying Operations are very important to MDOT?	○	○	○	○	○	○
MDOT places a great deal of emhasis on Surveying Operations?	○	○	○	○	○	○
MDOT has dedicated enough resource to Surveying Operations?	○	○	○	○	○	○

Questions/Comments:

Question: 15 Average Importance: 4.4 Ranking: 48

15 [Equipment7]What equipment do you need? *

Please write your answer(s) here:

Needed Equipment	
Needed Equipment	
Needed Equipment	
Needed Equipment	
Needed Equipment	

Questions/Comments:

Question: 12 Average Importance: 4.4 Ranking: 49

12 [Equipment4]What surveying equipment do we need and for what tasks is this equipment needed for? *

Please write your answer(s) here:

Equipment + Need	
Equipment + Need	
Equipment + Need	
Equipment + Need	
Equipment + Need	

Questions/Comments:

Question: 9 Average Importance: 4.4 Ranking: 50

9 [Equipment1]Please give your opinion of the following statements regarding Equipment
1 = DO NOT AGREE
2 = AGREE A LITTLE
3 = AGREE SOMEWHAT
4 = AGREE A LOT
5 = AGREE VERY STRONGLY *

Please choose the appropriate response for each item

	1	2	3	4	5	I Don't Know
MDOT has the proper surveying equipment to perform surveying duties	○	○	○	○	○	○
MDOT is keeping up with modern surveying technologies and equipment	○	○	○	○	○	○
MDOT is providing the necessary surveying equipment to all survey crews across the State	○	○	○	○	○	○
MDOT should have GPS equipment available for all surveying operations	○	○	○	○	○	○
MDOT should lease modern surveying equipment such as GPS	○	○	○	○	○	○
MDOT Districts have adequate budgeting for current and future surveying equipment	○	○	○	○	○	○
MDOT staff using modern surveying equipment are being trained to use this equipment properly and effectively	○	○	○	○	○	○
MDOT needs to use the same data collection software for all surveying equipment (total stations, robotics, and GPS)?	○	○	○	○	○	○
The computer hardware and software available to Survey staff is adequate for processing our survey data	○	○	○	○	○	○

Questions/Comments:

Question: 113 Average Importance: 4.3 Ranking: 51

113 [Processes30]What field method is used to collect Section Corner, ¼ Section Corner, Property Corner ties: Traverse or RTK *

Please write your answer(s) here:

Section Corner: Traverse or RTK	
¼ Section Corner: Traverse or RTK	
Property Corner ties: Traverse or RTK	

Questions/Comments:

Question: 100 Average Importance: 4.3 Ranking: 52

100 [Processes16]Are you currently setting construction stakes on Projects?
In your office, what percent of construction stakes on projects currently underway are you doing in-house?
Do you feel it's better for MDOT or Consultants to set construction stakes?
Are you currently checking consultant construction stakes?
Is it important to check the consultants work?
Do you have the personnel available to check construction stakes?

Which items do you stake for a typical project?
*

Please write your answer(s) here:

In your office, what percent of construction stakes on projects currently underway are you doing in-house?	
Do you feel it's better for MDOT or Consultants to set construction stakes?	
Are you currently checking consultant construction stakes?	
Is it important to check the consultants work?	
Do you have the personnel available to check construction stakes?	
Which items do you stake for a typical project?	

Questions/Comments:

Question: 95 Average Importance: 4.3 Ranking: 53

95 [Processes11]What type surveys are required in your office? *

Please write your answer(s) here:

1	
2	
3	
4	
5	
6	
7	

Questions/Comments:

Question: 85 Average Importance: 4.3 Ranking: 54

85 [Processes1]Do you agree with the statement "3d field collection procedures and modeling is too complicated and should not be adopted within MDOT"?
*

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 78 Average Importance: 4.3 Ranking: 55

78 [Organization18]In your opinion, would a Surveying Division at MDOT help improve the quality of surveys submitted to Roadway Design?
*

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 76 Average Importance: 4.3 Ranking: 56

76 [Organization16]Should MDOT have a formal career path established for survey personnel as they have for inspection/construction personnel?
*

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 74 Average Importance: 4.3 Ranking: 57

74 [Organization15]Is a system in place to reward surveyors and technicians who work hard and are willing to attend training to learn how to do their job correctly?
*

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 71 Average Importance: 4.3 Ranking: 58

71 [Organization11]Do your personnel need additional training in the following areas:
*

Please choose the appropriate response for each item

	Yes, Training Needed	Yes, Some Training Needed	Yes, A Little Training Needed	No, not used	I don't know
Collecting field data necessary for a DTM	○	○	○	○	○
Field operations for topographic surveys mapped by MDOT pcodes	○	○	○	○	○
Importing data into Geopak	○	○	○	○	○
Mapping survey data in Microstation	○	○	○	○	○
Survey data required on a route survey	○	○	○	○	○
Operation of electronic data collectors	○	○	○	○	○

Questions/Comments:

Question: 68 Average Importance: 4.3 Ranking: 59

68 [Organization8]How many employees does your office have committed to surveying? *

Please write your answer here:

Questions/Comments:

Question: 63 Average Importance: 4.3 Ranking: 60

63 [Organization3]Please choose the model that best fits your current survey organization structure? *

Please choose **only one** of the following:

- ○ Most of the preliminary survey activities are preformed at the district office and other construction related survey duties are performed at the project office. All survey duties are performed under the direct supervision of a professional surveyor.
- ○ Most of the preliminary survey activities are preformed at the district office under the direct supervision of a professional surveyor and other construction related survey duties are performed at the project office without direct supervision of a professional surveyor
- ○ District office performs some surveying duties primarily establishing project control and performing some boundary surveys under the direct supervision of a professional surveyor
- ○ Project office performing most of the preliminary surveys including boundary surveys without direct supervision of a professional surveyor. District office performs some surveying duties primarily establishing project control
- ○ other (specify in comments)

Make a comment on your choice here:

Questions/Comments:

Question: 61 Average Importance: 4.3 Ranking: 61

61 [Organization1]What is the typical number of crew members in your conventional survey crew?
*

Please choose **only one** of the following:

- ○ 2
- ○ 3
- ○ 4
- ○ 5
- ○ 6
- ○ other (specify in comments)

Make a comment on your choice here:

Questions/Comments:

Question: 57 Average Importance: 4.3 Ranking: 62

57 [Standards18]Have you read and understood the 2008 MDOT's Survey Manual?
*

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 49 Average Importance: 4.3 Ranking: 63

49 [Standards10]Do you refer to the Mississippi Board of Licensure for Professional Engineers and Surveyors "Standards of Practice for surveyors" when performing surveys?
*

Please choose **only one** of the following:

- Yes
- No

Questions/Comments:

Question: 46 Average Importance: 4.3 Ranking: 64

46 [Standards7]Are you aware that surveying is a profession regulated by the Mississippi Board of Licensure for Professional Engineers and Surveyors?
*

Please choose **only one** of the following:

- Yes
- No

Questions/Comments:

Question: 36 Average Importance: 4.3 Ranking: 65

36 [Training3]Has MDOT training on survey operations and requirements been adequate? *

Please choose **only one** of the following:

- Yes
- No

Questions/Comments:

Question: 28 Average Importance: 4.3 Ranking: 66

28 [Performance1]What is your confidence level of the accuracy of GPS equipment? *

Please choose **only one** of the following:

- ○ Not confident
- ○ A little Confident
- ○ Somewhat Confident
- ○ Very Confident
- ○ Completely Confident
- ○ Other

Questions/Comments:

Question: 19 Average Importance: 4.3 Ranking: 67

19 [Equipment11]What CADD programs do you use? *

Please write your answer(s) here:

CADD
CADD
CADD
CADD
CADD

Questions/Comments:

Question: 81 Average Importance: 4.2 Ranking: 68

81 [21]How can MDOT attract and keep good surveying personnel? *

Please write your answer here:

Questions/Comments:

Question: 77 Average Importance: 4.2 Ranking: 69

77 [Organization17]Should MDOT have an organizational structure for surveying personnel? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 73 Average Importance: 4.2 Ranking: 70

73 [Organization13]Should surveying personnel be classified as Surveying Technicians instead of Engineering Technicians? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 70 Average Importance: 4.2 Ranking: 71

70 [Organization10]In your District, what survey operations are centralized and what operations are performed by the individual project offices? *

Please choose the appropriate response for each item

	Central Office Function	Project Office Function	Function shared byboth Central and Project offices	I Don't know
Control Surveys	○	○	○	○
Preliminary surveying for engineering design (topo, drainage, cross sections, etc.)	○	○	○	○
Preliminary Right of Way stakeout for appraisal	○	○	○	○
Eminent Domain Surveys	○	○	○	○
Construction Staking	○	○	○	○
Surveying for earthwork quantities	○	○	○	○

Questions/Comments:

Question: 62 Average Importance: 4.2 Ranking: 72

62 [Organiaztion2]What is the typical number of crew members in your GPS survey crew? *

Please choose **only one** of the following:

- ○ 2
- ○ 3
- ○ 4
- ○ 5
- ○ 6
- ○ Does Not Apply(GPS not used)

Make a comment on your choice here:

Questions/Comments:

Question: 60 Average Importance: 4.2 Ranking: 73

60 [21]Do you submit all of your surveys to a Professional Surveyor for verification? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 42 Average Importance: 4.2 Ranking: 74

42 [Standards3]Do you think the MDOT survey Manual covers all surveying topics with enough detail? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 38 Average Importance: 4.2 Ranking: 75

38 [Training5]Are survey personnel adequately trained in performing Topographic surveys? (The use of Break Points?) *

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 31 Average Importance: 4.1 Ranking: 76

31 [Performace4]Please give your opinion of the of the following surveying performance issues:
1 = DO NOT AGREE
2 = AGREE A LITTLE
3 = AGREE SOMEWHAT
4 = AGREE A LOT
5 = AGREE VERY STRONGLY *

Please choose the appropriate response for each item:

	1	2	3	4	5	I Don't Know
Rtk equipment may be suitable for horizontal surveys but is not suitable for vertical surveys.	○	○	○	○	○	○
Rtk equipment is suitable for all surveys with the exception of special situations where class 1 vertical accuracy is required.	○	○	○	○	○	○
Current data collection software used in my office is suitable for daily surveying operations	○	○	○	○	○	○
The data collection software currently used in my office is easy to use	○	○	○	○	○	○

Questions/Comments:

Question: 27 Average Importance: 4.1 Ranking: 77

27 [Equipment19]How much time does GPS surveying equipment save compared to conventional equipment? *

Only answer this question if the following conditions are met:
"Answer was 'Yes' at question '26 [Equipment18]' (Does your office use GPS equipment? Or, do you have personal experience with GPS surveying equipment?)

Please choose **all** that apply:

- ☐ Very Little Time
- ☐ Some Time
- ☐ Lots of Time - doubles productivity
- ☐ Tons of Time - triples productivity
- ☐ Other:

Questions/Comments:

Question: 26 Average Importance: 4.1 Ranking: 78

26 [Equipment18]Does your office use GPS equipment? Or, do you have personal experience with GPS surveying equipment?
*

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 21 Average Importance: 4.1 Ranking: 79

21 [Equipment13]Does the use of DTM's save your office time? *

Only answer this question if the following conditions are met:
* Answer was 'Yes' at question '20 [Equipment12]' (Do you create DTM's?)

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 2 Average Importance: 4.1 Ranking: 80

2 [GeneralOperation2]What areas of MDOT Survey Operations are most in need of change
1 = NO CHANGES NEEDED
2 = A FEW CHANGES
3 = SOME CHANGES
4 = LOTS OF CHANGES
5 = COMPLETE OVERHAUL
*

Please choose the appropriate response for each item:

	1	2	3	4	5	I Don't Know
Surveying Techniques	○	○	○	○	○	○
Surveying Equipment	○	○	○	○	○	○
Organization of Surveying Tasks	○	○	○	○	○	○
Data Delivery Techniques	○	○	○	○	○	○
Training	○	○	○	○	○	○
Personnel Policies and Job Classifications	○	○	○	○	○	○
Use of Consultants	○	○	○	○	○	○
Division of Responsibilities between District and Project Offices	○	○	○	○	○	○

Questions/Comments:

Question: 128 Average Importance: 4.0 Ranking: 81

128 [5]If your division uses topographic surveys, where are the TIN files created?
*

Please choose **all** that apply:

- ☐ Roadway Design Division
- ☐ District
- ☐ Your Division
- ☐ Other

Questions/Comments:

Question: 126 Average Importance: 4.0 Ranking: 82

126 [Admin3]Does your office receive all the information requested when surveys are originally submitted?
*

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 117 Average Importance: 4.0 Ranking: 83

117 [Deliverable3]Can your personnel take electronic field data and produce a Digital Terrain Model?
*

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 105 Average Importance: 4.0 Ranking: 84

105 [Processes21]Should MDOT do construction staking on projects or should it be done by the contractor?
*

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 102 Average Importance: 4.0 Ranking: 85

102 [Processes18]Do you use a closed traverse on all property surveys?
*

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 90 Average Importance: 4.0 Ranking: 86

90 [Processes6]In any survey work other than Control Surveys:
Do the field crews regularly check/set atmospheric corrections in the total stations? Do you use an average yearly atmospheric correction factor? Do you think an average yearly atmospheric correction factor is accurate enough?
*

Please choose **all** that apply:

- ☐ Do the field crews regularly check/set atmospheric corrections in the total stations?
- ☐ Do you use an average yearly atmospheric correction factor?
- ☐ Do you think an average yearly atmospheric correction factor is accurate enough?

Questions/Comments:

Question: 88 Average Importance: 4.0 Ranking: 87

88 [Processes4]When performing surveys where elevations are a primary concern such as drainage or earthwork quantities, does your crew collect the elevation and position data electronically and simultaneously?

*

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 30 Average Importance: 4.0 Ranking: 88

30 [Performance3]What is your maximum measuring distance threshold to achieve your regular standard of accuracy? *

Please choose **only one** of the following:

- ○ 300'
- ○ 400'
- ○ 500'
- ○ 600'
- ○ 700'
- ○ 1000'
- ○ Other (specify in comments)

Make a comment on your choice here:

Questions/Comments:

Question: 29 Average Importance: 4.0 Ranking: 89

29 [Performance2]What vertical accuracy level can you achieve with the following equipment?
*

Please choose the appropriate response for each item:

	.01'	.03'	.05'	.07'	.10'	I Don't Know
RTK Equipment	○	○	○	○	○	○
Total Station	○	○	○	○	○	○

Questions/Comments:

ALL Survey - Handout

Question: 34 Average Importance: 4.4 Ranking: 1

34 [Training1]Select the training needs for the following categories of Survey Skills: *

Please choose the appropriate response for each item:

	Yes, Training Needed	Yes, Some Training Needed	Yes, A Little Training Needed	No, not used	I don't know
Data collection	○	○	○	○	○
Leveling	○	○	○	○	○
Total station	○	○	○	○	○
PCODES and Linking codes	○	○	○	○	○
DTM	○	○	○	○	○
Cogo	○	○	○	○	○
GeoPak	○	○	○	○	○
RWD Codes	○	○	○	○	○
Allegro data collectors	○	○	○	○	○
Other Survey Equipment	○	○	○	○	○

Questions/Comments:

Question: 41 Average Importance: 4.3 Ranking: 2

41 [Standards2]What version of the MDOT Survey Manual are you using? *

Please write your answer here:

Questions/Comments:

Question: 40 Average Importance: 4.3 Ranking: 3

40 [Standards1]Do you have access to the MDOT Survey Manual? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 36 Average Importance: 4.1 Ranking: 4

36 [Training3]Has MDOT training on survey operations and requirements been adequate? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 33 Average Importance: 4.1 Ranking: 5

33 [Performance6]Is your office utilizing the most recent and updated equipment, software and RWD programs provided by MDOT? *

Please choose the appropriate response for each item:

	Already well-incorpaorated in everyday operations	Used regulalry but still moving towards full integration with operations	Used occasionally and making some progress towards regular use	Rarely used and unlikely to become standard in everyday usage	Never used, lacking training or motivation to put into use	I don't know
Equipment	○	○	○	○	○	○
Software	○	○	○	○	○	○
RWD Programs	○	○	○	○	○	○

Questions/Comments:

Question: 3 Average Importance: 4.1 Ranking: 6

3 [GeneralOperation4]What type of training related to Survey does your office need? *

Please choose **only one** of the following:

- ○ General Survey Procedures
- ○ 3d Collection
- ○ 3d CADD modeling
- ○ Standards and Practices
- ○ Other (explain in comments)

Make a comment on your choice here:

Questions/Comments:

Question: 71 Average Importance: 4.0 Ranking: 7

71 [Organization11]Do your personnel need additional training in the following areas: *

Please choose the appropriate response for each item

	Yes, Training Needed	Yes, Some Training Needed	Yes, A Little Training Needed	No, not used	I don't know
Collecting field data necessary for a DTM	○	○	○	○	○
Field operations for topographic surveys mapped by MDOT pcodes	○	○	○	○	○
Importing data into Geopak	○	○	○	○	○
Mapping survey data in Microstation	○	○	○	○	○
Survey data required on a route survey	○	○	○	○	○
Operation of electronic data collectors	○	○	○	○	○

Questions/Comments:

Question: 44 Average Importance: 4.0 Ranking: 8

44 [Standards5]Does the MDOT Survey Manual help you with your surveying duties? *

Please write your answer here:

Questions/Comments:

Question: 42 Average Importance: 4.0 Ranking: 9

42 [Standards3]Do you think the MDOT survey Manual covers all surveying topics with enough detail? *

Please choose **only one** of the following:

○ Yes
○ No

Questions/Comments:

Question: 35 Average Importance: 4.0 Ranking: 10

35 [Training2]Has your office established any formal training for survey personnel? *

Please choose the appropriate response for each item:

	Formal training regularly available	Formal training occasionally available	Formal training rarely available	Currently no formal training - it has been offered in the past	No Formal training	I Don't know
Professional	○	○	○	○	○	○
Technical	○	○	○	○	○	○
Field Work	○	○	○	○	○	○
CADD	○	○	○	○	○	○

Questions/Comments:

Question: 25 Average Importance: 3.9 Ranking: 11

25 [Equipment17]Does your office need training for DTM use? *

Please choose **only one** of the following:

○ Yes
○ No

Questions/Comments:

Question: 6 Average Importance: 3.9 Ranking: 12

6 [QualityMeasures1]Please give your opinion of the of the following:
1 = DO NOT AGREE
2 = AGREE A LITTLE
3 = AGREE SOMEWHAT
4 = AGREE A LOT
5 = AGREE VERY STRONGLY *

Please choose the appropriate response for each item:

	1	2	3	4	5	I Don't Know
Production (Speed, completion of tasks, making deadlines, ...) is the most important priority in my unit	○	○	○	○	○	○
Quality of Product (Accuracy, completeness, delivery in proper format, ...) is the most important priority in my unit.	○	○	○	○	○	○
Field surveying requires the gathering of enormous amounts of data therefore it is expected that a percentage of the data will be inaccurate regardless of field methods used.	○	○	○	○	○	○
Redundant measurement procedures will slightly improve accuracy but the extra time involved makes redundant procedures not feasible	○	○	○	○	○	○
MDOT recieves a quality product when consultants are emploed for surveying	○	○	○	○	○	○

Questions/Comments:

Question: 121 Average Importance: 3.8 Ranking: 13

121 [Deliverable7]Should a Division in Jackson contact the District if there is an apparent problem with survey data provided by the District to make sure the data is correct? Who should they contact?
*

Please write your answer here:

Questions/Comments:

Question: 86 Average Importance: 3.8 Ranking: 14

86 [Processes2]Do you perform the following types of surveys? *

Please choose **all** that apply:

- ☐ Topographic surveys
- ☐ Drainage surveys
- ☐ Control surveys
- ☐ Preliminary property surveys
- ☐ Proposed right of way surveys
- ☐ Eminent Domain surveys
- ☐ Construction stake out
- ☐ Surveying to document earthwork pay quantities
- ☐ Surveying to document other pay quantities

Questions/Comments:

Question: 74 Average Importance: 3.8 Ranking: 15

74 [Organization15]Is a system in place to reward surveyors and technicians who work hard and are willing to attend training to learn how to do their job correctly?
*

Please choose **only one** of the following:

- ○ Yes
- ○ No

Question: 57 Average Importance: 3.8 Ranking: 16

57 [Standards18]Have you read and understood the 2008 MDOT's Survey Manual? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 43 Average Importance: 3.8 Ranking: 17

43 [Standards4]What other topics would you like the MDOT survey Manual to include? *

Please write your answer(s) here:

New or Expanded Topic	
New or Expanded Topic	
New or Expanded Topic	
New or Expanded Topic	
New or Expanded Topic	

Questions/Comments:

Question:23 Average Importance: 3.7 Ranking: 18

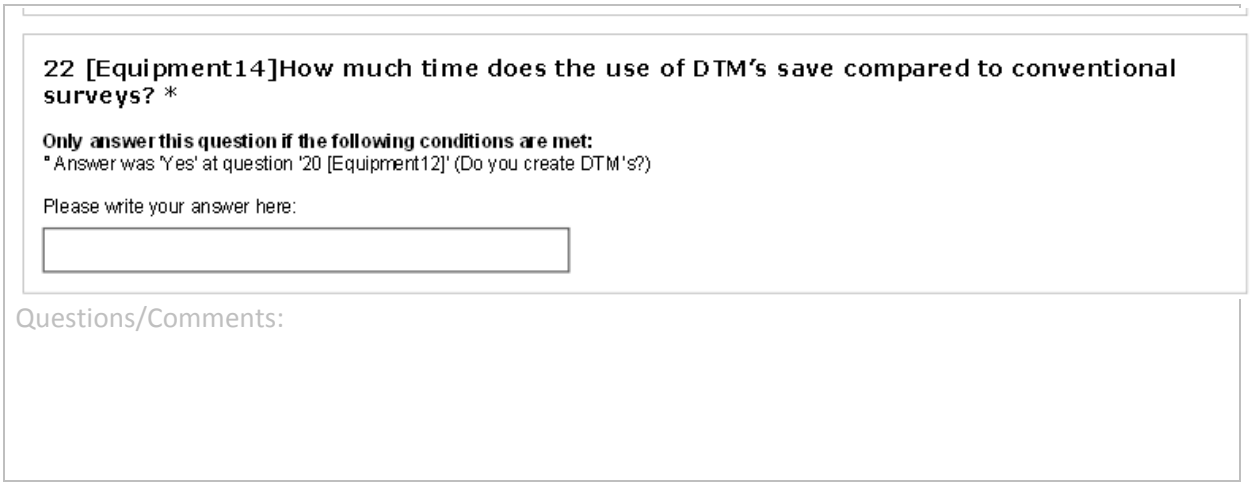
23 [Equipment15]In your opinion, is the surveying office adequately staffed to perform the necessary job functions required to submit finalized electronic drawings to Roadway Design? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question:22 Average Importance: 3.7 Ranking: 19

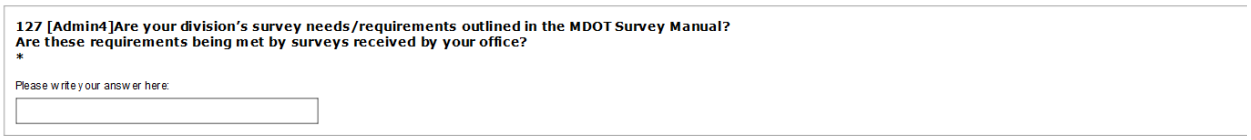

22 [Equipment14]How much time does the use of DTM's save compared to conventional surveys? *

Only answer this question if the following conditions are met:
* Answer was 'Yes' at question '20 [Equipment12]' (Do you create DTM's?)

Please write your answer here:

Questions/Comments:

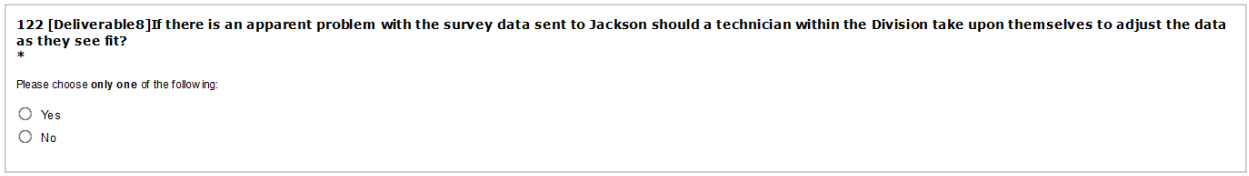
Question: 127 Average Importance: 3.7 Ranking: 20


127 [Admin4]Are your division's survey needs/requirements outlined in the MDOT Survey Manual? Are these requirements being met by surveys received by your office?
*

Please write your answer here:

Questions/Comments:

Question: 122 Average Importance: 3.7 Ranking: 21


122 [Deliverable8]If there is an apparent problem with the survey data sent to Jackson should a technician within the Division take upon themselves to adjust the data as they see fit?
*

Please choose only one of the following:

- Yes
- No

Questions/Comments:

Question: 78 Average Importance: 3.7 Ranking: 22

78 [Organization18]In your opinion, would a Surveying Division at MDOT help improve the quality of surveys submitted to Roadway Design?
*

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 75 Average Importance: 3.7 Ranking: 23

75 [Organzation15]Please give your opinion of the of the following:
1 = DO NOT AGREE
2 = AGREE A LITTLE
3 = AGREE SOMEWHAT
4 = AGREE A LOT
5 = AGREE VERY STRONGLY *

Please choose the appropriate response for each item

	1	2	3	4	5	I Don't Know
My office has an established succession plan for retaining trained and qualified surveyors	○	○	○	○	○	○
I do not have time to attend training classes	○	○	○	○	○	○
Training that I have received in the past does not relate to my day to day job functions	○	○	○	○	○	○
Training is needed and should be required as part of our job classifications	○	○	○	○	○	○

Questions/Comments:

Question: 28 Average Importance: 3.6 Ranking: 24

28 [Performance1]What is your confidence level of the accuracy of GPS equipment?
*

Please choose **only one** of the following:

- ○ Not confident
- ○ A little Confident
- ○ Somewhat Confident
- ○ Very Confident
- ○ Completely Confident
- ○ Other

Questions/Comments:

Question: 15 Average Importance: 3.6 Ranking: 25

15 [Equipment7]What equipment do you need? *

Please write your answer(s) here:

Needed Equipment
Needed Equipment
Needed Equipment
Needed Equipment
Needed Equipment

Questions/Comments:

Question: 119 Average Importance: 3.5 Ranking: 26

119 [Deliverable5]Is there effective communication between Roadway Design, Right of Way and the Districts? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 95 Average Importance: 3.5 Ranking: 27

95 [Processes11]What type surveys are required in your office? *

Please write your answer(s) here:

1
2
3
4
5
6
7

Questions/Comments:

Question: 76 Average Importance: 3.5 Ranking: 28

76 [Organization16]Should MDOT have a formal career path established for survey personnel as they have for inspection/construction personnel? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 27 Average Importance: 3.4 Ranking: 29

27 [Equipment19]How much time does GPS surveying equipment save compared to conventional equipment? *

Only answer this question if the following conditions are met:
" Answer was 'Yes' at question '26 [Equipment18]' (Does your office use GPS equipment? Or, do you have personal experience with GPS surveying equipment?)

Please choose **all** that apply:

- ☐ Very Little Time
- ☐ Some Time
- ☐ Lots of Time - doubles productivity
- ☐ Tons of Time - triples productivity
- ☐ Other:

Questions/Comments:

Question: 26 Average Importance: 3.4 Ranking: 30

26 [Equipment18]Does your office use GPS equipment? Or, do you have personal experience with GPS surveying equipment?
*

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 24 Average Importance: 3.4 Ranking: 31

24 [Equipment16]If not, what additional staffing needs would improve this workflow? *

Only answer this question if the following conditions are met:
* Answer was 'Yes' at question '23 [Equipment15]' (In your opinion, is the surveying office adequately staffed to perform the necessary job functions required to submit finalized electronic drawings to Roadway Design?)

Please write your answer here:

Questions/Comments:

Question: 21 Average Importance: 3.4 Ranking: 32

21 [Equipment13]Does the use of DTM's save your office time? *

Only answer this question if the following conditions are met:
* Answer was 'Yes' at question '20 [Equipment12]' (Do you create DTM's?)

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 12 Average Importance: 3.4 Ranking: 33

12 [Equipment4]What surveying equipment do we need and for what tasks is this equipment needed for?
*

Please write your answer(s) here:

Equipment + Need
Equipment + Need
Equipment + Need
Equipment + Need
Equipment + Need

Questions/Comments:

Question: 10 Average Importance: 3.4 Ranking: 34

10 [Equipment2]Please indicate which equipment is available to your unit as follows:
1 - YES (regularly used)
2 - YES (infrequently used)
3 - YES (available but training needed)
4 - NO (not available, not needed)
5 - NO (needed but unavailable or in poor repair)
*

Please choose the appropriate response for each item

	Available and in regualr use	Available but rarely used	Available but training needed	Not Available and not needed	Needed but Not Available or in poor repair	I Don't Know
GPS Equipment	○	○	○	○	○	○
GPS RTK equipment	○	○	○	○	○	○
GeoPak	○	○	○	○	○	○
Metal detector(s) to locate buried property corners	○	○	○	○	○	○

Questions/Comments:

Question: 116 Average Importance: 3.3 Ranking: 35

116 [Deliverable2]Will the data exported from your data collector import into Microstation/Geopak without any additional editing?
*

Please choose **only one** of the following:

○ Yes
○ No

Questions/Comments:

Question: 81 Average Importance: 3.3 Ranking: 36

81 [21]How can MDOT attract and keep good surveying personnel? *

Please write your answer here:

Questions/Comments:

Question: 77 Average Importance: 3.3 Ranking: 37

77 [Organization17]Should MDOT have an organizational structure for surveying personnel?
*

Please choose **only one** of the following:

○ Yes
○ No

Questions/Comments:

Question: 72 Average Importance: 3.3 Ranking: 38

72 [Organization12]Does MDOT have a career path or personnel structure for Professional Surveyors? *

Please choose **only one** of the following:

- Yes
- No

Questions/Comments:

Question: 51 Average Importance: 3.3 Ranking: 39

51 [Standards12]Should MDOT surveying standards exceed the professional surveying standards set forth by the Mississippi Board of Licensure for Professional Engineers and Surveyors?
*

Please choose **only one** of the following:

- Yes
- No

Questions/Comments:

Question: 46 Average Importance: 3.3 Ranking: 40

46 [Standards7]Are you aware that surveying is a profession regulated by the Mississippi Board of Licensure for Professional Engineers and Surveyors?
*

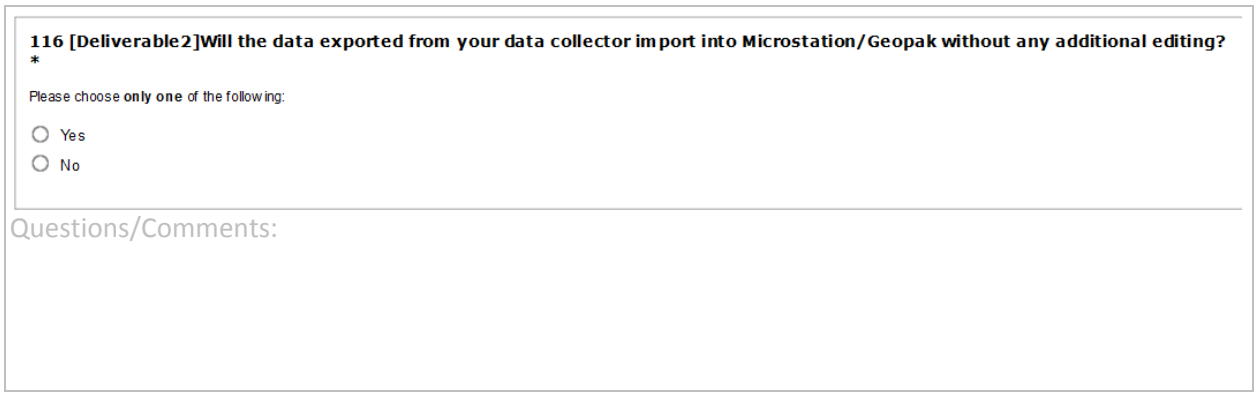
Please choose **only one** of the following:

- Yes
- No

Questions/Comments:

CADD Survey - Handout

Question: 116 Average Importance: 4.7 Ranking: 1

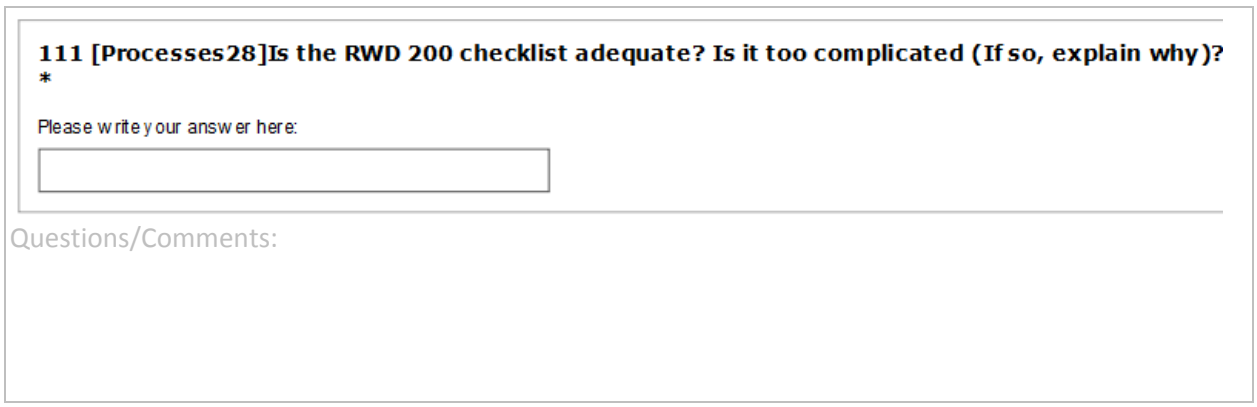

116 [Deliverable2]Will the data exported from your data collector import into Microstation/Geopak without any additional editing? *

Please choose only one of the following:

- Yes
- No

Questions/Comments:

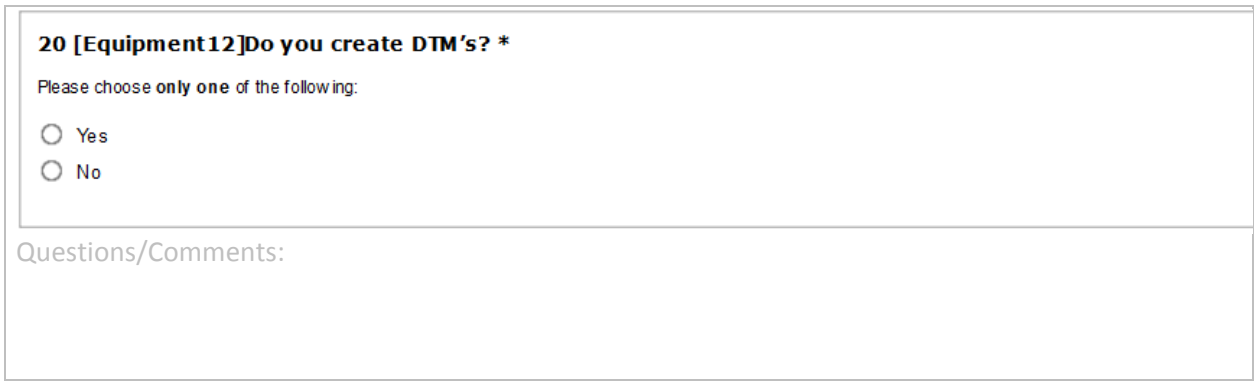
Question: 111 Average Importance: 4.7 Ranking: 2


111 [Processes28]Is the RWD 200 checklist adequate? Is it too complicated (If so, explain why)? *

Please write your answer here:

Questions/Comments:

Question: 20 Average Importance: 4.6 Ranking: 3


20 [Equipment12]Do you create DTM's? *

Please choose only one of the following:

- Yes
- No

Questions/Comments:

Question: 57 Average Importance: 4.5 Ranking: 4

57 [Standards18]Have you read and understood the 2008 MDOT's Survey Manual? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 33 Average Importance: 4.4 Ranking: 5

33 [Performance6]Is your office utilizing the most recent and updated equipment, software and RWD programs provided by MDOT? *

Please choose the appropriate response for each item:

	Already well-incorpaorated in everyday operations	Used regulalry but still moving towards full integration with operations	Used occasionally and making some progress towards regular use	Rarely used and unlikely to become standard in everyday usage	Never used, lacking training or motivation to put into use	I don't know
Equipment	○	○	○	○	○	○
Software	○	○	○	○	○	○
RWD Programs	○	○	○	○	○	○

Questions/Comments:

Question: 23 Average Importance: 3.7 Ranking: 6

23 [Equipment15]In your opinion, is the surveying office adequately staffed to perform the necessary job functions required to submit finalized electronic drawings to Roadway Design? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 19 Average Importance: 4.4 Ranking: 7

19 [Equipment11]What CADD programs do you use? *

Please write your answer(s) here:

CADD
CADD
CADD
CADD
CADD

Questions/Comments:

Question: 41 Average Importance: 4.3 Ranking: 8

41 [Standards2]What version of the MDOT Survey Manual are you using? *

Please write your answer here:

Questions/Comments:

Question: 40 Average Importance: 4.3 Ranking: 9

40 [Standards1]Do you have access to the MDOT Survey Manual? *

Please choose **only one** of the following:

- Yes
- No

Questions/Comments:

Question: 34 Average Importance: 4.3 Ranking: 10

34 [Training1]Select the training needs for the following categories of Survey Skills: *

Please choose the appropriate response for each item:

	Yes, Training Needed	Yes, Some Training Needed	Yes, A Little Training Needed	No, not used	I don't know
Data collection	○	○	○	○	○
Leveling	○	○	○	○	○
Total station	○	○	○	○	○
PCODES and Linking codes	○	○	○	○	○
DTM	○	○	○	○	○
Cogo	○	○	○	○	○
GeoPak	○	○	○	○	○
RWD Codes	○	○	○	○	○
Allegro data collectors	○	○	○	○	○
Other Survey Equipment	○	○	○	○	○

Questions/Comments:

Question: 21 Average Importance: 4.3 Ranking: 11

21 [Equipment13]Does the use of DTM's save your office time? *

Only answer this question if the following conditions are met:
* Answer was 'Yes' at question '20 [Equipment12]' (Do you create DTM's?)

Please choose **only one** of the following:

○ Yes
○ No

Questions/Comments:

Question: 3 Average Importance: 4.3 Ranking: 12

3 [GeneralOperation4]What type of training related to Survey does your office need? *

Please choose **only one** of the following:

- ○ General Survey Procedures
- ○ 3d Collection
- ○ 3d CADD modeling
- ○ Standards and Practices
- ○ Other (explain in comments)

Make a comment on your choice here:

Questions/Comments:

Question: 118 Average Importance: 4.2 Ranking: 13

118 [Deliverable4]What methods of error checking are used to ensure the accuracy of your survey data? *

Please write your answer(s) here:

1
2
3
4
5

Questions/Comments:

Question: 117 Average Importance: 4.2 Ranking: 14

117 [Deliverable3]Can your personnel take electronic field data and produce a Digital Terrain Model? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 115 Average Importance: 4.2 Ranking: 15

115 [Deliverable1]What are the formats and file types of the data exported from the instrument or data collector used in your crew? *

Please write your answer here:

Questions/Comments:

Question: 25 Average Importance: 4.1 Ranking: 16

25 [Equipment17]Does your office need training for DTM use? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 22 Average Importance: 4.1 Ranking: 17

22 [Equipment14]How much time does the use of DTM's save compared to conventional surveys? *

Only answer this question if the following conditions are met:
* Answer was 'Yes' at question '20 [Equipment12]' (Do you create DTM's?)

Please write your answer here:

Questions/Comments:

Question: 44 Average Importance: 4.0 Ranking: 18

44 [Standards5]Does the MDOT Survey Manual help you with your surveying duties? *

Please write your answer here:

Questions/Comments:

Question: 43 Average Importance: 4.0 Ranking: 19

43 [Standards4]What other topics would you like the MDOT survey Manual to include? *

Please write your answer(s) here:

New or Expanded Topic

New or Expanded Topic

New or Expanded Topic

New or Expanded Topic

New or Expanded Topic

Questions/Comments:

Question: 42 Average Importance: 4.0 Ranking: 20

42 [Standards3]Do you think the MDOT survey Manual covers all surveying topics with enough detail? *

Please choose **only one** of the following:

- Yes
- No

Questions/Comments:

Question: 2 Average Importance: 4.0 Ranking: 21

2 [GeneralOperation2]What areas of MDOT Survey Operations are most in need of change
1 = NO CHANGES NEEDED
2 = A FEW CHANGES
3 = SOME CHANGES
4 = LOTS OF CHANGES
5 = COMPLETE OVERHAUL
*

Please choose the appropriate response for each item:

	1	2	3	4	5	I Don't Know
Surveying Techniques	○	○	○	○	○	○
Surveying Equipment	○	○	○	○	○	○
Organization of Surveying Tasks	○	○	○	○	○	○
Data Delivery Techniques	○	○	○	○	○	○
Training	○	○	○	○	○	○
Personnel Policies and Job Classifications	○	○	○	○	○	○
Use of Consultants	○	○	○	○	○	○
Division of Responsibilities between District and Project Offices	○	○	○	○	○	○

Questions/Comments:

Question: 128 Average Importance: 3.8 Ranking: 22

128 [5]If your division uses topographic surveys, where are the TIN files created?
*

Please choose **all** that apply:

- ☐ Roadway Design Division
- ☐ District
- ☐ Your Division
- ☐ Other

Questions/Comments:

Question: 110 Average Importance: 3.8 Ranking: 23

110 [Processes27]Should MDOT require all surveys to be in DTM format?
*

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 85 Average Importance: 3.8 Ranking: 24

85 [Processes1]Do you agree with the statement "3d field collection procedures and modeling is too complicated and should not be adopted within MDOT"? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 71 Average Importance: 3.8 Ranking: 25

71 [Organization11]Do your personnel need additional training in the following areas: *

Please choose the appropriate response for each item

	Yes, Training Needed	Yes, Some Training Needed	Yes, A Little Training Needed	No, not used	I don't know
Collecting field data necessary for a DTM	○	○	○	○	○
Field operations for topographic surveys mapped by MDOT pcodes	○	○	○	○	○
Importing data into Geopak	○	○	○	○	○
Mapping survey data in Microstation	○	○	○	○	○
Survey data required on a route survey	○	○	○	○	○
Operation of electronic data collectors	○	○	○	○	○

Questions/Comments:

Question: 36 Average Importance: 3.7 Ranking: 26

36 [Training3]Has MDOT training on survey operations and requirements been adequate? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 86 Average Importance: 3.7 Ranking: 27

86 [Processes2]Do you perform the following types of surveys? *

Please choose all that apply:

- ☐ Topographic surveys
- ☐ Drainage surveys
- ☐ Control surveys
- ☐ Preliminary property surveys
- ☐ Proposed right of way surveys
- ☐ Eminent Domain surveys
- ☐ Construction stake out
- ☐ Surveying to document earthwork pay quantities
- ☐ Surveying to document other pay quantities

Questions/Comments:

Question: 75 Average Importance: 3.7 Ranking: 28

75 [Organzation15]Please give your opinion of the of the following:
1 = DO NOT AGREE
2 = AGREE A LITTLE
3 = AGREE SOMEWHAT
4 = AGREE A LOT
5 = AGREE VERY STRONGLY *

Please choose the appropriate response for each item

	1	2	3	4	5	I Don't Know
My office has an established succession plan for retaining trained and qualified surveyors	○	○	○	○	○	○
I do not have time to attend training classes	○	○	○	○	○	○
Training that I have received in the past does not relate to my day to day job functions	○	○	○	○	○	○
Training is needed and should be required as part of our job classifications	○	○	○	○	○	○

Questions/Comments:

Question: 24 Average Importance: 3.6 Ranking: 29

24 [Equipment16]If not, what additional staffing needs would improve this workflow? *

Only answer this question if the following conditions are met:
" Answer was 'Yes' at question '23 [Equipment15]' (In your opinion, is the surveying office adequately staffed to perform the necessary job functions required to submit finalized electronic drawings to Roadway Design?)

Please write your answer here:

Questions/Comments:

Question: 121 Average Importance: 3.5 Ranking: 30

121 [Deliverable7]Should a Division in Jackson contact the District if there is an apparent problem with survey data provided by the District to make sure the data is correct? Who should they contact?
*

Please write your answer here:

Questions/Comments:

Question: 96 Average Importance: 3.5 Ranking: 31

96 [Processes12]What is your preferred method of collecting earthwork? (*

Please choose **all** that apply:

- ☐ Spot Shot/ Breakline
- ☐ Level and Tape Method
- ☐ Total Station Dependent
- ☐ Total Station In-Dependent

Questions/Comments:

Question: 95 Average Importance: 3.5 Ranking: 32

95 [Processes11]What type surveys are required in your office? *

Please write your answer(s) here:

1
2
3
4
5
6
7

Questions/Comments:

Question: 83 Average Importance: 3.5 Ranking: 33

83 [23]Who is responsible for reviewing in house surveys prior to their final submittal?
*

Please write your answer here:

Questions/Comments:

Question: 78 Average Importance: 3.5 Ranking: 34

78 [Organization18]In your opinion, would a Surveying Division at MDOT help improve the quality of surveys submitted to Roadway Design?
*

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 74 Average Importance: 3.5 Ranking: 35

74 [Organization15]Is a system in place to reward surveyors and technicians who work hard and are willing to attend training to learn how to do their job correctly?
*

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 60 Average Importance: 3.5 Ranking: 36

60 [21]Do you submit all of your surveys to a Professional Surveyor for verification? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 56 Average Importance: 3.5 Ranking: 37

56 [Standards17]Do you provide all of the pertinent information about Drainage structures? i.e. Flow-line Elevation, size of pipe or box, etc. *

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 35 Average Importance: 3.4 Ranking: 38

35 [Training2]Has your office established any formal training for survey personnel? *

Please choose the appropriate response for each item:

	Formal training regularly available	Formal training occasionally available	Formal training rarely available	Currently no formal training - it has been offered in the past	No Formal training	I Don't know
Professional	○	○	○	○	○	○
Technical	○	○	○	○	○	○
Field Work	○	○	○	○	○	○
CADD	○	○	○	○	○	○

Questions/Comments:

Question: 119 Average Importance: 3.3 Ranking: 39

119 [Deliverable5]Is there effective communication between Roadway Design, Right of Way and the Districts?
*

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 76 Average Importance: 3.3 Ranking: 40

76 [Organization16]Should MDOT have a formal career path established for survey personnel as they have for inspection/construction personnel?
*

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Field Survey - Handout

Question: 34 Average Importance: 4.9 Ranking: 1

34 [Training1]Select the training needs for the following categories of Survey Skills: *

Please choose the appropriate response for each item:

	Yes, Training Needed	Yes, Some Training Needed	Yes, A Little Training Needed	No, not used	I don't know
Data collection	○	○	○	○	○
Leveling	○	○	○	○	○
Total station	○	○	○	○	○
PCODES and Linking codes	○	○	○	○	○
DTM	○	○	○	○	○
Cogo	○	○	○	○	○
GeoPak	○	○	○	○	○
RWD Codes	○	○	○	○	○
Allegro data collectors	○	○	○	○	○
Other Survey Equipment	○	○	○	○	○

Questions/Comments:

Question: 41 Average Importance: 4.8 Ranking: 2

41 [Standards2]What version of the MDOT Survey Manual are you using? *

Please write your answer here:

Questions/Comments:

Question: 40 Average Importance: 4.8 Ranking: 3

40 [Standards1]Do you have access to the MDOT Survey Manual? *

Please choose **only one** of the following:

○ Yes
○ No

Questions/Comments:

Question: 36 Average Importance: 4.7 Ranking: 4

36 [Training3]Has MDOT training on survey operations and requirements been adequate? *

Please choose **only one** of the following:

- Yes
- No

Questions/Comments:

Question: 32 Average Importance: 4.7 Ranking: 5

32 [Performance5]Which brand do you think produces the best surveying software? *

Please choose **only one** of the following:

- SMI
- Carlson
- Topcon
- TDS
- Trimble
- Leica
- Other (specify in comments)

Make a comment on your choice here:

Questions/Comments:

Question: 58 Average Importance: 4.7 Ranking: 6

58 [Standards19]Is there a current copy of the Survey Manual in the work vehicle? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 46 Average Importance: 4.7 Ranking: 7

46 [Standards7]Are you aware that surveying is a profession regulated by the Mississippi Board of Licensure for Professional Engineers and Surveyors? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 39 Average Importance: 4.7 Ranking: 8

39 [Training6]Are there any training needs for the equipment used by the survey crews? *

Please write your answer here:

Questions/Comments:

Question: 38 Average Importance: 4.7 Ranking: 9

38 [Training5]Are survey personnel adequately trained in performing Topographic surveys? (The use of Break Points?) *

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 31 Average Importance: 4.6 Ranking: 10

31 [Performace4]Please give your opinion of the of the following surveying performance issues:
1 = DO NOT AGREE
2 = AGREE A LITTLE
3 = AGREE SOMEWHAT
4 = AGREE A LOT
5 = AGREE VERY STRONGLY *

Please choose the appropriate response for each item:

	1	2	3	4	5	I Don't Know
Rtk equipment may be suitable for horizontal surveys but is not suitable for vertical surveys.	○	○	○	○	○	○
Rtk equipment is suitable for all surveys with the exception of special situations where class 1 vertical accuracy is required.	○	○	○	○	○	○
Current data collection software used in my office is suitable for daily surveying operations	○	○	○	○	○	○
The data collection software currently used in my office is easy to use	○	○	○	○	○	○

Questions/Comments:

Question: 29 Average Importance: 4.6 Ranking: 11

29 [Performance2]What vertical accuracy level can you achieve with the following equipment?
*

Please choose the appropriate response for each item:

	.01'	.03'	.05'	.07'	.10'	I Don't Know
RTK Equipment	○	○	○	○	○	○
Total Station	○	○	○	○	○	○

Questions/Comments:

Question: 26 Average Importance: 4.6 Ranking: 12

26 [Equipment18]Does your office use GPS equipment? Or, do you have personal experience with GPS surveying equipment?
*

Please choose **only one** of the following:

○ Yes
○ No

Questions/Comments:

Question: 11 Average Importance: 4.6 Ranking: 13

11 [Equipment3]Indicate how often you calibrate surveying tools *

Please choose the appropriate response for each item

	Every Day	Every Week	Every Month	Every Quarter	Never
How often do you calibrate your surveying instruments?	○	○	○	○	○
How often do you calibrate your surveying accessories (prism poles, rtk rover poles, fixed height tripods etc.)?	○	○	○	○	○

Questions/Comments:

Question: 7 Average Importance: 4.6 Ranking: 14

7 [QualityMeasures2]What statements best describes the survey measures your survey field operations employs? *

Please choose **all** that apply:

- ☐ We always start Survey sessions with known values
- ☐ At the begining of each Survey session we check other known values before collecting any data
- ☐ During the survey session we check other known values
- ☐ At the end of each Survey session we check other known values
- ☐ We always perform closed surveys on all property points and other critical points collected.
- ☐ When using RTK equipment a check to a known point is made prior to collecting data.
- ☐ When collecting property points and other critical points with RTK multiple shots are taken from at least two reference stations.
- ☐ Perform closed surveys on all property surveys with side-shots to some property points and other critical points collected. e taken and values are averaged to insure accuracy.
- ☐ When using RTK equipment once initialization process has been achieved collection of data begins.
- ☐ When collecting property points and other critical points with RTK multiple shots are taken and values are averaged to insure accuracy.

Questions/Comments:

Question: 99 Average Importance: 4.5 Ranking: 15

99 [Processes15]The current version of the Survey Manual contains a chapter on safety, in your opinion, are there any additional concerns that should be addressed involving safety? If so, what are they? *

Please write your answer(s) here:

1 _____
2 _____
3 _____
4 _____

Questions/Comments:

Question: 93 Average Importance: 4.5 Ranking: 16

93 [Processes9]How often are level vials checked/adjusted on the following items: *

Please write your answer(s) here:

Prism poles _____
Tribracs _____
Total Stations _____
Rover rods _____
Levels _____

Questions/Comments:

Question: 90 Average Importance: 4.5 Ranking: 17

90 [Processes6]In any survey work other than Control Surveys:
Do the field crews regularly check/set atmospheric corrections in the total stations? Do you use an average yearly atmospheric correction factor? Do you think an average yearly atmospheric correction factor is accurate enough?
*

Please choose **all** that apply:

- ☐ Do the field crews regularly check/set atmospheric corrections in the total stations?
- ☐ Do you use an average yearly atmospheric correction factor?
- ☐ Do you think an average yearly atmospheric correction factor is accurate enough?

Questions/Comments:

Question: 59 Average Importance: 4.5 Ranking: 18

59 [Standards20]Do you run multiple level runs to ensure accurate Benchmarks throughout the project?
*

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 57 Average Importance: 4.5 Ranking: 19

57 [Standards18]Have you read and understood the 2008 MDOT's Survey Manual?
*

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 56 Average Importance: 4.5 Ranking: 20

56 [Standards17]Do you provide all of the pertinent information about Drainage structures? i.e. Flow-line Elevation, size of pipe or box, etc.
*

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 55 Average Importance: 4.5 Ranking: 21

55 [Standards16]Do you always use Line Codes (LCODES) while collecting Topo?
*

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 49 Average Importance: 4.5 Ranking: 22

49 [Standards10]Do you refer to the Mississippi Board of Licensure for Professional Engineers and Surveyors "Standards of Practice for surveyors" when performing surveys?
*

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 47 Average Importance: 4.5 Ranking: 23

47 [Standards8]Is all surveying activities within your office being performed under the direct supervision of a Professional Surveyor?
*

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 44 Average Importance: 4.5 Ranking: 24

44 [Standards5]Does the MDOT Survey Manual help you with your surveying duties? *

Please write your answer here:

Questions/Comments:

Question: 37 Average Importance: 4.5 Ranking: 25

37 [training4]Do survey personnel feel they have been trained adequately in their job requirements?
*

Please write your answer here:

Questions/Comments:

Question: 30 Average Importance: 4.4 Ranking: 26

30 [Performance3]What is your maximum measuring distance threshold to achieve your regular standard of accuracy? *

Please choose **only one** of the following:

- ○ 300'
- ○ 400'
- ○ 500'
- ○ 600'
- ○ 700'
- ○ 1000'
- ○ Other (specify in comments)

Make a comment on your choice here:

Questions/Comments:

Question: 28 Average Importance: 4.4 Ranking: 27

28 [Performance1]What is your confidence level of the accuracy of GPS equipment? *

Please choose **only one** of the following:

- ○ Not confident
- ○ A little Confident
- ○ Somewhat Confident
- ○ Very Confident
- ○ Completely Confident
- ○ Other

Questions/Comments:

Question: 27 Average Importance: 4.4 Ranking: 28

27 [Equipment19]How much time does GPS surveying equipment save compared to conventional equipment? *

Only answer this question if the following conditions are met:
* Answer was 'Yes' at question '26 [Equipment18]' (Does your office use GPS equipment? Or, do you have personal experience with GPS surveying equipment?)

Please choose **all** that apply:

- ☐ Very Little Time
- ☐ Some Time
- ☐ Lots of Time - doubles productivity
- ☐ Tons of Time - triples productivity
- ☐ Other:

Questions/Comments:

Question: 8 Average Importance: 4.4 Ranking: 29

8 [QualityMeasures3]When establishing secondary control what percentage of the time do you employ resection procedures? *

Please choose **only one** of the following:

- ○ Never
- ○ 10%
- ○ 25%
- ○ 50%
- ○ 75%
- ○ 100%
- ○ More exact percentage (use comment)

Make a comment on your choice here:

Questions/Comments:

Question: 2 Average Importance: 4.4 Ranking: 30

2 [GeneralOperation2]What areas of MDOT Survey Operations are most in need of change
1 = NO CHANGES NEEDED
2 = A FEW CHANGES
3 = SOME CHANGES
4 = LOTS OF CHANGES
5 = COMPLETE OVERHAUL
*

Please choose the appropriate response for each item:

	1	2	3	4	5	I Don't Know
Surveying Techniques	○	○	○	○	○	○
Surveying Equipment	○	○	○	○	○	○
Organization of Surveying Tasks	○	○	○	○	○	○
Data Delivery Techniques	○	○	○	○	○	○
Training	○	○	○	○	○	○
Personnel Policies and Job Classifications	○	○	○	○	○	○
Use of Consultants	○	○	○	○	○	○
Division of Responsibilities between District and Project Offices	○	○	○	○	○	○

Questions/Comments:

Question: 118 Average Importance: 4.3 Ranking: 31

118 [Deliverable4]What methods of error checking are used to ensure the accuracy of your survey data?
*

Please write your answer(s) here:

1 _____
2 _____
3 _____
4 _____
5 _____

Questions/Comments:

Question: 114 Average Importance: 4.3 Ranking: 32

114 [Processes31]What method is used for Field Staking? Total Station, RTK Coordinates or Chains
*

Please choose **all** that apply:

☐ Total Station
☐ RTK Coordinates
☐ Chains

Questions/Comments:

Question: 113 Average Importance: 4.3 Ranking: 33

113 [Processes30]What field method is used to collect Section Corner, ¼ Section Corner, Property Corner ties: Traverse or RTK
*

Please write your answer(s) here:

Section Corner: Traverse or RTK	
¼ Section Corner: Traverse or RTK	
Property Corner ties: Traverse or RTK	

Questions/Comments:

Question: 102 Average Importance: 4.3 Ranking: 34

102 [Processes18]Do you use a closed traverse on all property surveys?
*

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 96 Average Importance: 4.3 Ranking: 35

96 [Processes12]What is your preferred method of collecting earthwork? (*

Please choose **all** that apply:

- ☐ Spot Shot/ Breakline
- ☐ Level and Tape Method
- ☐ Total Station Dependent
- ☐ Total Station In-Dependent

Questions/Comments:

Question: 92 Average Importance: 4.3 Ranking: 36

92 [Processes8]How often are collimation procedures run on your total station(s)?
*

Please write your answer here:

Questions/Comments:

Question: 91 Average Importance: 4.3 Ranking: 37

91 [Processes7]Does the field crew understand how to set or check a prism offset in the total station and determine which value is correct?
*

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 88 Average Importance: 4.3 Ranking: 38

88 [Processes4]When performing surveys where elevations are a primary concern such as drainage or earthwork quantities, does your crew collect the elevation and position data electronically and simultaneously?

*

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 86 Average Importance: 4.3 Ranking: 39

86 [Processes2]Do you perform the following types of surveys? *

Please choose **all** that apply:

- ☐ Topographic surveys
- ☐ Drainage surveys
- ☐ Control surveys
- ☐ Preliminary property surveys
- ☐ Proposed right of way surveys
- ☐ Eminent Domain surveys
- ☐ Construction stake out
- ☐ Surveying to document earthwork pay quantities
- ☐ Surveying to document other pay quantities

Questions/Comments:

Question: 85 Average Importance: 4.3 Ranking: 40

85 [Processes1]Do you agree with the statement "3d field collection procedures and modeling is too complicated and should not be adopted within MDOT"? *

Please choose only one of the following:

- Yes
- No

Questions/Comments:

Question: 54 Average Importance: 4.3 Ranking: 41

54 [Standards15]Do you always use the current Point Codes (PCODE) list provided by Roadway Design while you are collecting Topo? *

Please choose **only one** of the following:

- Yes
- No

Questions/Comments:

Question: 42 Average Importance: 4.3 Ranking: 42

42 [Standards3]Do you think the MDOT survey Manual covers all surveying topics with enough detail? *

Please choose **only one** of the following:

- Yes
- No

Questions/Comments:

Question: 12 Average Importance: 4.3 Ranking: 43

12 [Equipment4]What surveying equipment do we need and for what tasks is this equipment needed for?
*

Please write your answer(s) here:

Equipment + Need	
Equipment + Need	
Equipment + Need	
Equipment + Need	
Equipment + Need	

Questions/Comments:

Question: 10 Average Importance: 4.3 Ranking: 44

10 [Equipment2]Please indicate which equipment is available to your unit as follows:
1 - YES (regularly used)
2 - YES (infrequently used)
3 - YES (available but training needed)
4 - NO (not available, not needed)
5 - NO (needed but unavailable or in poor repair)
*

Please choose the appropriate response for each item

	Available and in regualr use	Available but rarely used	Available but training needed	Not Available and not needed	Needed but Not Available or in poor repair	I Don't Know
GPS Equipment	○	○	○	○	○	○
GPS RTK equipment	○	○	○	○	○	○
GeoPak	○	○	○	○	○	○
Metal detector(s) to locate buried property corners	○	○	○	○	○	○

Questions/Comments:

Question: 6 Average Importance: 4.3 Ranking: 45

6 [QualityMeasures1]Please give your opinion of the of the following:
1 = DO NOT AGREE
2 = AGREE A LITTLE
3 = AGREE SOMEWHAT
4 = AGREE A LOT
5 = AGREE VERY STRONGLY *

Please choose the appropriate response for each item:

	1	2	3	4	5	I Don't Know
Production (Speed, completion of tasks, making deadlines, ...) is the most important priority in my unit	○	○	○	○	○	○
Quality of Product (Accuracy, completeness, delivery in proper format, ...) is the most important priority in my unit.	○	○	○	○	○	○
Field surveying requires the gathering of enormous amounts of data therefore it is expected that a percentage of the data will be inaccurate regardless of field methods used.	○	○	○	○	○	○
Redundant measurement procedures will slightly improve accuracy but the extra time involved makes redundant procedures not feasible	○	○	○	○	○	○
MDOT recieves a quality product when consultants are emploed for surveying	○	○	○	○	○	○

Questions/Comments:

Question: 3 Average Importance: 4.3 Ranking: 46

3 [GeneralOperation4]What type of training related to Survey does your office need? *

Please choose **only one** of the following:

- ○ General Survey Procedures
- ○ 3d Collection
- ○ 3d CADD modeling
- ○ Standards and Practices
- ○ Other (explain in comments)

Make a comment on your choice here:

Questions/Comments:

Question: 97 Average Importance: 4.2 Ranking: 47

97 [Processes13]Do you collect cross sections at the same time you collect topo?
If yes, how long would you estimate it takes your field crew to collect this data on one mile of highway every 100 ft.? How many crew members would you need? Do you use RWD PCODES and linking codes?
If no, what surveying methods do your surveyors use to run cross-sections? How long would you estimate it takes your field survey crew to run cross- sections on one mile of highway every 100 ft? How many crew members would you need? Do you use RWD PCODES and Linking codes?

*

Please write your answer(s) here:

If yes, how long would you estimate it takes your field crew to collect this data on one mile of highway every 100 ft.?	
How many crew members would you need?	
Do you use RWD PCODES and linking codes?	
If no, what surveying methods do your surveyors use to run cross-sections?	
How long would you estimate it takes your field survey crew to run cross- sections on one mile of highway every 100 ft?	
How many crew members would you need?	
Do you use RWD PCODES and Linking codes?	

Questions/Comments:

Question: 43 Average Importance: 4.2 Ranking: 48

43 [Standards4]What other topics would you like the MDOT survey Manual to include? *

Please write your answer(s) here:

New or Expanded Topic	
New or Expanded Topic	
New or Expanded Topic	
New or Expanded Topic	
New or Expanded Topic	

Questions/Comments:

Question: 33 Average Importance: 4.1 Ranking: 49

33 [Performance6]Is your office utilizing the most recent and updated equipment, software and RWD programs provided by MDOT? *

Please choose the appropriate response for each item:

	Already well-incorpaorated in everyday operations	Used regulalry but still moving towards full integration with operations	Used occasionally and making some progress towards regular use	Rarely used and unlikely to become standard in everyday usage	Never used, lacking training or motivation to put into use	I don't know
Equipment	○	○	○	○	○	○
Software	○	○	○	○	○	○
RWD Programs	○	○	○	○	○	○

Questions/Comments:

Question: 23 Average Importance: 4.1 Ranking: 50

23 [Equipment15]In your opinion, is the surveying office adequately staffed to perform the necessary job functions required to submit finalized electronic drawings to Roadway Design? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 15 Average Importance: 4.1 Ranking: 51

15 [Equipment7]What equipment do you need? *

Please write your answer(s) here:

Needed Equipment	
Needed Equipment	
Needed Equipment	
Needed Equipment	
Needed Equipment	

Questions/Comments:

Question: 87 Average Importance: 4.0 Ranking: 52

87 [Processes3]When doing topographic surveys does your crew collect elevations? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 75 Average Importance: 4.0 Ranking: 53

75 [Organzation15]Please give your opinion of the of the following:
1 = DO NOT AGREE
2 = AGREE A LITTLE
3 = AGREE SOMEWHAT
4 = AGREE A LOT
5 = AGREE VERY STRONGLY *

Please choose the appropriate response for each item

	1	2	3	4	5	I Don't Know
My office has an established succession plan for retaining trained and qualified surveyors	○	○	○	○	○	○
I do not have time to attend training classes	○	○	○	○	○	○
Training that I have received in the past does not relate to my day to day job functions	○	○	○	○	○	○
Training is needed and should be required as part of our job classifications	○	○	○	○	○	○

Questions/Comments:

Question: 74 Average Importance: 4.0 Ranking: 54

74 [Organization15]Is a system in place to reward surveyors and technicians who work hard and are willing to attend training to learn how to do their job correctly? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 25 Average Importance: 4.0 Ranking: 55

25 [Equipment17]Does your office need training for DTM use? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

Question: 16 Average Importance: 4.0 Ranking: 56

16 [Equipment8]Check types of equipment regularly used. Specify make and model of equipment if known. *

Please choose all that apply and provide a comment:

- ☐ Make and Model of equipment to collect topo
- ☐ Make and Model of equipment to collect Earthwork Quantities
- ☐ Make and Model of equipment used to set horizontal and vertical control for a project
- ☐ Make and Model of GPS equipment
- Other:

Questions/Comments:

Question: 21 Average Importance: 3.9 Ranking: 57

21 [Equipment13]Does the use of DTM's save your office time? *

Only answer this question if the following conditions are met:
* Answer was 'Yes' at question '20 [Equipment12]' (Do you create DTM's?)

Please choose **only one** of the following:

- ○ Yes
- ○ No

Questions/Comments:

APPENDIX B

SAMPLE MEETING ACTIVITIES USM AND MDOT TAC

The University of Southern Mississippi

Center for Logistics, Trade and Transportation

118 College Drive #5138
Hattiesburg, MS 39406
Tel: 601.266.489
Fax: 601.266.5717
www.cltt.usm.edu

July 5th, 2010

Dear Attendee of
Review Data Collection Instruments 2nd Meeting of Study No. 222

Thank you for your interest in participating in this important two days meeting organized by the Mississippi Department of Transportation (MDOT) in association with The University of Southern Mississippi – Center for Logistics, Trade and Transportation.

The purpose of this meeting is to Review the Data Collection Instruments for the Study No. 222- Best Practices of MDOT's Survey Operation, Organization and Technology Implementation.

The Meeting details are as follows:

Start Date and Time:	Tuesday, July 6th, 2010 at 10:30 am
End Date and Time:	Wednesday, July 7th, 2010 at 12:30am
Directions:	See directions attached
Parking Location:	See map attached
Parking Pass:	Print parking pass attached and put in windshield **(VERY IMPORTANT!)**
Agenda:	See agenda attached
Meeting Location:	The University of Southern Mississippi Trent Lott Center Hattiesburg, MS, 39406 See map attached
Lunch/Dinner:	Will be provided

The following are answers to some of the common questions:

What to Bring?	Yourself and Data Collection instruments given to you during the last meeting
What to Wear?	Business Casual
Is there Internet Access?	There is not free WiFi available, the university charges students for that service
What will be the format of this meeting?	The meeting will consist of a roundtable discussion

If you have additional questions or get lost, please call Dr. Andrew Strelzoff at 601 307-3209.

We look forward to seeing you at the meeting.

Regards,
-Tulio / Andrew

The University of Southern Mississippi

Center for Logistics, Trade and Transportation

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Hattiesburg, MS 39406
Tel: 601.266.489
Fax: 601.266.5717
www.cltt.usm.edu

Directions to Trent Lott Center, USM Campus, Hattiesburg, Ms:

Traveling from Jackson on Hwy 49 S:

-Less than one mile after traveling under I59,and under the bridge of West 4th Street, there will be an entrance on your right to get into the University Campus.
- The Trent Lott Center will be in front of you towards your left
- Park in the spaces reserved behind the building with the Sign "CLTT-MDOT"

Traveling from Gulfport on Hwy 49 N:

- Less than a quarter of a mile after Hardy St. Intersection turn left into the campus.
- The Trent Lott Center will be in front of you towards your left
- Park in the spaces reserved behind the building with the Sign "CLTT-MDOT

Photo of Trent Lott Center

The University of Southern Mississippi

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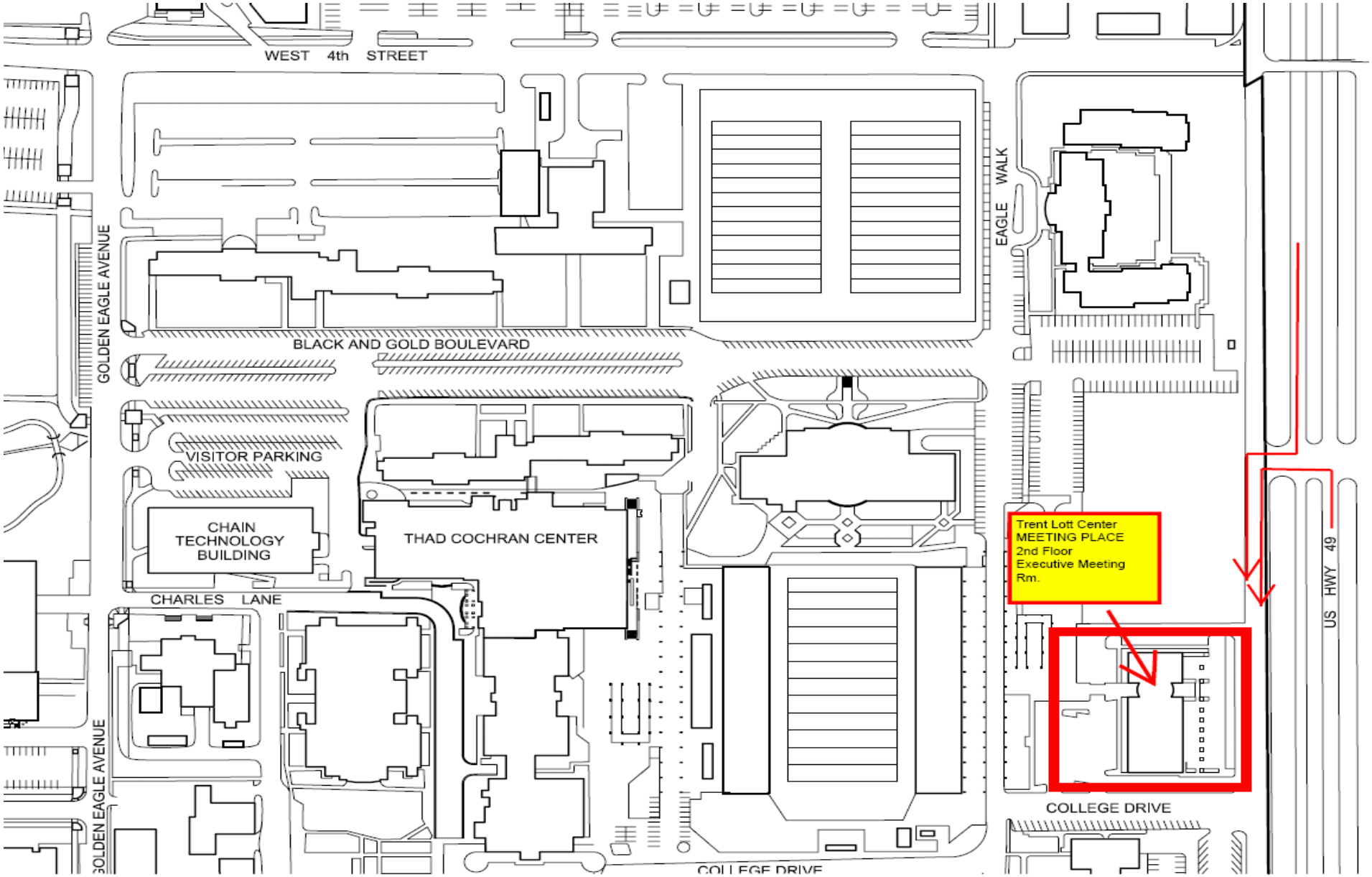

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VALID ONLY
July 6th - 7th, 2010

PARKING PASS

MDOT-CLTT

Study No. 222
Best Practices of MDOT's Survey Operation, Organization and Technology Implementation
Review Data Collection Instruments

The University of Southern Mississippi

Center for Logistics, Trade and Transportation

118 College Drive #5138
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Agenda
Review Data Collection Instruments

Tuesday July 6th, 2010

10:30am – 10:45am	**Session 1 – Overview and Goals of the Meeting**
10:45am – 12:00am	**Session 2 – Part I - Review Field Data Collection Instrument**
12:00am – 12:30am	**Lunch in Meeting Room**
12:30am – 1:30pm	**Session 3 – Part II - Review Field Data Collection Instrument**
1:30pm – 2:30pm	**Session 4 - Part I - Review Admin Data Collection Instrument**
2:30pm – 3:00pm	**Ice Cream Break and Individual Discussions**
3:00pm – 5:00pm	**Session 5 - Part II - Review Admin Data Collection Instrument**
5:15pm – 6:15pm	**Hotel Check In and Break**
6:30pm – 8:30pm	**Dinner at Local Restaurant**

Wednesday July 7th, 2010

7:15am - 7:40am	**Breakfast at Hotel**
8:00am - 9:30am	**Session 6 - Part III - Review Admin Data Collection Instrument**
9:30am - 9:45am	**Coffee Break at Meeting Room**
9:45am - 11:15am	**Session 7 - Part I - Review All Data Collection Instrument**
11:15am - 11:30am	**Session 8 - Discussion of Next Steps Round Table Evaluation and Adjourn**
11:30am - 12:30am	**Lunch (Boxes) at Meeting Room or on the Go**

APPENDIX C

ON-LINE QUESTIONNAIRE DEPLOYED

1- MDOT - State Study 222 - Field (Group 1).

Preamble: Thank you in advance for your commitment to this Mississippi Department of Transportation Survey.

Overview: A critical activity performed by MDOT employees is surveying. MDOT employees use a wide range of surveying methods and technologies throughout the state.

Objective: The objective of this survey is to gather information to identify the best operational approach to use for the range of surveying operations employed by MDOT.

We would appreciate if you could complete the questionnaire by March 28th, 2011.

If you have any questions/concern please direct them to Tulio Sulbaran by e-mail at Tulio.Sulbaran@usm.edu or by phone at (601) 266 6419.

There are 37 questions in this survey

Demographic

1 [D1]First Name *

Please write your answer here:

2 [D2]Last Name *

Please write your answer here:

3 [D3]E-mail Address *

Please write your answer here:

4 [D4]Phone:

Please write your answer here:

5 [D5]

Division/Unit

Please write your answer here:

6 [D6]Position

Please write your answer here:

General Operation

7 [General Operation2a1]What areas of MDOT survey operations are in need of change?

Please choose the appropriate response for each item:

	No Changes	Few Changes	Some Changes	Major Changes	Complete Overhaul	I Don't Know
Surveying Techniques	○	○	○	○	○	○
Surveying Equipment	○	○	○	○	○	○
Organization of Surveying Tasks	○	○	○	○	○	○
Data Delivery Techniques	○	○	○	○	○	○
Training	○	○	○	○	○	○
Personnel policies and job Classifications	○	○	○	○	○	○
Use of Consultants	○	○	○	○	○	○
Division of responsibiliites between District and Project Offices	○	○	○	○	○	○

8 [General Operation2b]Please comment on the major changes needed.

Only answer this question if the following conditions are met:
°

-------- Scenario 1 --------

Answer was 'Complete Overhaul' or 'Major Changes' at question '7 [General Operation2a1]' (What areas of MDOT survey operations are in need of change? (Surveying Techniques))

-------- or Scenario 2 --------

Answer was 'Complete Overhaul' or 'Major Changes' at question '7 [General Operation2a1]' (What areas of MDOT survey operations are in need of change? (Surveying Equipment))

-------- or Scenario 3 --------

Answer was 'Complete Overhaul' or 'Major Changes' at question '7 [General Operation2a1]' (What areas of MDOT survey operations are in need of change? (Organization of Surveying Tasks))

-------- or Scenario 4 --------

Answer was 'Complete Overhaul' or 'Major Changes' at question '7 [General Operation2a1]' (What areas of MDOT survey operations are in need of change? (Data Delivery Techniques))

-------- or Scenario 5 --------

Answer was 'Complete Overhaul' or 'Major Changes' at question '7 [General Operation2a1]' (What areas of MDOT survey operations are in need of change? (Training))

------- or Scenario 6 -------

Answer was 'Complete Overhaul' or 'Major Changes' at question '7 [General Operation2a1]' (What areas of MDOT survey operations are in need of change? (Personnel policies and job Classifications))

------- or Scenario 7 -------

Answer was 'Complete Overhaul' or 'Major Changes' at question '7 [General Operation2a1]' (What areas of MDOT survey operations are in need of change? (Use of Consultants))

------- or Scenario 8 -------

Answer was 'Major Changes' or 'Complete Overhaul' at question '7 [General Operation2a1]' (What areas of MDOT survey operations are in need of change? (Division of responsibiliites between District and Project Offices))

Please write your answer here:

Quality Measures

9 [QualityMeasures1.a]Please give your opinion of the following: *

Please choose the appropriate response for each item:

	STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE	I DON'T KNOW
Production (Speed, completion of tasks, making deadlines, ...) is the most important priority in my unit	○	○	○	○	○	○
Quality of Product (Accuracy, completeness, devliery in proper format) is the most important priority of my unit	○	○	○	○	○	○

10 [QualityMeasures2]Please rank the following based on importance: *

Please number each box in order of preference from 1 to 6

- [ ] Start a survey session with a known point.
- [ ] Check into another known point value at the beginning of survey
- [ ] Recheck known point value at end of survey session
- [ ] Collecting multiple RTK shots from at least two reference stations for critical points
- [ ] Run multiple PVG level runs to ensure accurate Benchmarks throughout the project
- [ ] Use Line codes (LCODES) and/or Point code (PCODE) while collecting topographical information

11 [QualityMeasures3]When establishing secondary control what percentage of the time do you employ resection procedures? *

Please choose **only one** of the following:

- ○ Never
- ○ 10%
- ○ 25%
- ○ 50%
- ○ 75%
- ○ 100%
- ○ I Don't Know

12 [QualityMeasures1.b]Please rate the accuracy of the following statements:

Please choose the appropriate response for each item:

	STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE	I DON'T KNOW
I believe production should be the most important priority in my unit.	○	○	○	○	○	○
I believe quality should be the most important priority in my unit	○	○	○	○	○	○

Equipment

13 [Equipment2]Please indicate which equipment is available to your unit as follows:

*

Please choose the appropriate response for each item:

	Available and in Regualr Use	Available but Rarely Used	Available but Training Needed	Not Available and Not Needed	Not Available but Needed	I Don't Know
GPS Equipment	○	○	○	○	○	○
GPS RTK Equipment	○	○	○	○	○	○
Metal Detectors	○	○	○	○	○	○
Total Station	○	○	○	○	○	○
Digital Levels	○	○	○	○	○	○

14 [Equipment3]Indicate how often you calibrate the following surveying tools? *

Please choose the appropriate response for each item:

	Every Day	Every Week	Every Month	Every Quarter	Every Year	Never	I Don't Know
Total Stations	○	○	○	○	○	○	○
Set Parts per Million Corrections	○	○	○	○	○	○	○
Check and Adjust Prism Poles	○	○	○	○	○	○	○
Baseline Calibrations	○	○	○	○	○	○	○
Fixed High Tripods	○	○	○	○	○	○	○
Levels (Conventional and Digital)	○	○	○	○	○	○	○

15 [Equipment12]Do you create DTM's? *

Please choose **only one** of the following:

○ Yes

○ No

16 [Equipment15a]In your opinion, is the surveying office adequately staffed to perform the necessary job functions required to submit finalized electronic

drawings to Roadway Design? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

17 [Equipment18]What is your level of experience using GPS? *

Please choose **only one** of the following:

- ○ No Experience
- ○ Little Experience (Less than 1 year)
- ○ Some Experience (1-3 years)
- ○ Very Experienced (More than 3 years)

18 [Equipment5b]Does the use of DTM's save your office time?

Only answer this question if the following conditions are met:
° Answer was 'Yes' at question '16 [Equipment15a]' (In your opinion, is the surveying office adequately staffed to perform the necessary job functions required to submit finalized electronic drawings to Roadway Design?)

Please choose **only one** of the following:

- ○ Yes
- ○ No

19 [Equipment19]How does GPS equipment improve productivity compared to conventional equipment? *

Please choose **only one** of the following:

- ○ Much less Production (-50%)
- ○ Less Production (-25%)
- ○ No Change (0%)
- ○ More Production (+25%)
- ○ Very Much Production (+50%)
- ○ Other [ ]

Performance

20 [Performance1]What is your confidence level of the accuracy of the following equipment?
*

Please choose the appropriate response for each item:

	Completely Confident	Very Confident	Confident	Somewhat Confident	Lacking All Confidence
RTK (Vertical)	○	○	○	○	○
RTK (Horizontal)	○	○	○	○	○
Static (Vertical)	○	○	○	○	○
Static (Horizontal)	○	○	○	○	○

21 [Performance2]What vertical accuracy level can you achieve with the following equipment?
*

Please choose the appropriate response for each item:

	.01’	.03’	.05’	.07’	.10’	.50'	I Don't Know
RTK Equipment (Vertical)	○	○	○	○	○	○	○
Total Station (Vertical)	○	○	○	○	○	○	○
Level	○	○	○	○	○	○	○

22 [Performance6]Is your office utilizing the most recent and updated software and RWD programs provided by MDOT? *

Please choose the appropriate response for each item:

	Already well-incorpaorated in everyday operations	Used regularly but still moving towards full integration with operations	Used occasionally and making some progress towards regular use	Rarley used and unlikely to become standard in everyday usage	Never used, lacking training or motivation to put into use	I Don't Know
Equipment	○	○	○	○	○	○
Software	○	○	○	○	○	○
RWD Programs	○	○	○	○	○	○

23 [Performance3]What horizontal accuracy level can you achieve with the

following equipment?
*

Please choose the appropriate response for each item:

	.01’	.03’	.05’	.07’	.10’	.50'	I Don't Know
RTK Equipment (Horizontal)	○	○	○	○	○	○	○
Total Station (Horizontal)	○	○	○	○	○	○	○

Training

24 [Training1]Select the training needs for the following categories of Survey Skills: *

Please choose the appropriate response for each item:

	Yes, Much Training Needed	Yes, Some Training Needed	Yes, A Little Training is Needed	No, Training is Sufficient	No, not used	I don't know
Data collection(3D and/or 2D)	○	○	○	○	○	○
Leveling	○	○	○	○	○	○
Total station	○	○	○	○	○	○
PCODES and Linking codes	○	○	○	○	○	○
DTM	○	○	○	○	○	○
Cogo	○	○	○	○	○	○
Microstation/GeoPak	○	○	○	○	○	○
RWD Codes	○	○	○	○	○	○
Allegro data collectors	○	○	○	○	○	○
Other Survey Equipment	○	○	○	○	○	○
General Survey Procedure	○	○	○	○	○	○
Survey Standards and Practices	○	○	○	○	○	○

Standards: MDOT and Professional

25 [Standards8]Is direct supervision from a licensed surveyor required for the following types of surveys?
*

Please choose the appropriate response for each item:

	Yes	Uncertain	No
Right of Way	○	○	○
Property Maps	○	○	○
Eminent Domain	○	○	○

26 [Standards10a]Do you refer to the Mississippi Board of Licensure for Professional Engineers and Surveyors "Standards of Practice for surveyors" when performing surveys?
*

Please choose **only one** of the following:

- ○ Yes
- ○ No

27 [Standards12]Should MDOT surveying standards exceed the professional surveying standards set forth by the Mississippi Board of Licensure for Professional Engineers and Surveyors?
*

Please choose **only one** of the following:

- ○ Yes
- ○ No

28 [Standards 9]Have you read and understood the standard MDOT's Survey Manual?
*

Please choose **only one** of the following:

- ○ Yes
- ○ No

29 [Standards 10b]Are you following the current MDOT Survey Manual?

Please choose **only one** of the following:

- ○ Yes
- ○ No

30 [Standards 13]What other topics do you think need to be covered or covered in more detail in the MDOT Survey Manual?

Please write your answer(s) here:

31 [StandardsNew1]Is Direct Supervision from a Licensed Surveyor Standard Practice in Your Office for the Following types of Surveys?

Only answer this question if the following conditions are met:
° Answer was 'Yes' or 'Yes' or 'Yes' at question '25 [Standards8]' (Is direct supervision from a licensed surveyor required for the following types of surveys? (Right of Way))

Please choose the appropriate response for each item:

	Yes	Uncertain	No
Right of Way	○	○	○
Property Maps	○	○	○
Eminent Domain	○	○	○

Organizational Structure

32 [16]Should MDOT have a formal career path established for survey technician?
*

Please choose **only one** of the following:

- ○ Yes
- ○ No

33 [Organzation15]Please give your opinion of the following:
*

Please choose the appropriate response for each item:

	STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE	I DON'T KNOW
My office has an established succession plan for retaining trained and qualified surveyors	○	○	○	○	○	○
I do not have time to attend training classes	○	○	○	○	○	○
Training is needed and should be required as part of our job classifications	○	○	○	○	○	○

Survey Processes: Construction, Property, Preliminary & Earthwork

34 [Processes1]Do you agree with the statement "3d field collection procedures and modeling is too complicated and should not be adopted within MDOT"? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

35 [Processes2]Do you perform the following types of surveys? *

Please choose **all** that apply:

- ☐ Topographic surveys
- ☐ Drainage surveys
- ☐ Control surveys
- ☐ Preliminary property surveys
- ☐ Proposed right of way surveys
- ☐ Eminent Domain surveys
- ☐ Construction stake out
- ☐ Surveying to document earthwork pay quantities
- ☐ Surveying to document other pay quantities

36 [Processes3]Does your crew collect topographical elevations and data simultaneously? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

37 [Processes12]What is your preferred method of collecting earthwork? *

Please choose **only one** of the following:

- ○ Spot Shot/Breakline
- ○ Level and Tape Method

- ○ Total Station Dependent
- ○ Total Station In-Dependent

Deliverables

Administration Building

Thank you for your participation

31.12.1969 – 18:00
Please fax your completed survey to: 601 266 5717
Submit your survey.
Thank you for completing this survey.

2- MDOT - State Study 222 - CADD (Group 2).

Preamble: Thank you in advance for your commitment to this Mississippi Department of Transportation Survey.

Overview: A critical activity performed by MDOT employees is surveying. MDOT employees use a wide range of surveying methods and technologies throughout the state.

Objective: The objective of this survey is to gather information to identify the best operational approach to use for the range of surveying operations employed by MDOT.

We would appreciate if you could complete the questionnaire by March 28th, 2011.

If you have any questions/concern please direct them to Tulio Sulbaran by e-mail at Tulio.Sulbaran@usm.edu or by phone at (601) 266 6419.

There are 31 questions in this survey

Demographic

1 [D1]First Name *

Please write your answer here:

2 [D2]Last Name *

Please write your answer here:

3 [D3]E-mail Address *

Please write your answer here:

4 [D4]Phone:

Please write your answer here:

5 [D5]

Division/Unit

Please write your answer here:

6 [D6]Position

Please write your answer here:

General Operation

7 [General Operation2a1]What areas of MDOT survey operations are in need of change?

Please choose the appropriate response for each item:

	No Changes	Few Changes	Some Changes	Major Changes	Complete Overhaul	I Don't Know
Surveying Techniques	○	○	○	○	○	○
Surveying Equipment	○	○	○	○	○	○
Organization of Surveying Tasks	○	○	○	○	○	○
Data Delivery Techniques	○	○	○	○	○	○
Training	○	○	○	○	○	○
Personnel policies and job Classifications	○	○	○	○	○	○
Use of Consultants	○	○	○	○	○	○
Division of responsibiliites between District and Project Offices	○	○	○	○	○	○

8 [General Operation2b]Please comment on the major changes needed.

Please write your answer here:

Equipment

9 [Equipment3]For what percentage of the projects do you create Digital Train Models (DTMs)?

*

Please choose **only one** of the following:

- ○ 1-20%
- ○ 21-40%
- ○ 41-60%
- ○ 61-80%
- ○ 81-100%

10 [4]In your opinion, does your office have adequate CADD staff to perform the necessary job functions required to submit finalized electronic drawings to Roadway Design? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

Performance

11 [Performance5]Your office is utilizing the most recent and updated equipment, software and RWD menus/configurations provided by MDOT. *

Please choose the appropriate response for each item:

	STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE	I DON'T KNOW
Equipment	○	○	○	○	○	○
Software	○	○	○	○	○	○
RWD Programs	○	○	○	○	○	○

Training

12 [6]Please select the training needs for the following categories of Survey Skills: *

Please choose the appropriate response for each item:

	Yes, Much Training Needed	Yes, Some Training Needed	Yes, A Little Training is Needed	No, Training is Sufficient	No, not used	I don't know
Data collection	○	○	○	○	○	○
PCODES and Linking Codes	○	○	○	○	○	○
DTM	○	○	○	○	○	○
Microstation/Geopak	○	○	○	○	○	○
LGO	○	○	○	○	○	○

13 [7]What type of training has your office established in the following areas? *

Please choose the appropriate response for each item:

	Formal training regulalry available	Formal training occasionally available	Formal training rarely available	Currently no formal training - it has been offered in the past	No Formal training	I Don't know
Professional surveying	○	○	○	○	○	○
Special Equipment or Software	○	○	○	○	○	○
Surveying Field Work	○	○	○	○	○	○
CADD	○	○	○	○	○	○

Standards: MDOT and Professional

14 [Standards8]Do you refer to the Mississippi Board of Licensure for Professional Engineers and Surveyors "Standards of Practice for surveyors" when performing surveys? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

15 [9]Have you read and understood the current MDOT Survey Manual? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

16 [10]Are you following the current MDOT Survey Manual?

Only answer this question if the following conditions are met:
° Answer was 'Yes' at question '15 [9]' (Have you read and understood the current MDOT Survey Manual?)

Please choose **only one** of the following:

- ○ Yes
- ○ No

17 [11]Should all surveys be submitted to a Professional Surveyor for verification? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

18 [12]Do you think the MDOT survey Manual covers all surveying topics with enough detail? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

19 [13]What other topics do you think need to be covered or covered in more detail in the MDOT Survey Manual?

Only answer this question if the following conditions are met:
° Answer was 'No' at question '18 [12]' (Do you think the MDOT survey Manual covers all surveying topics with enough detail?)

Please write your answer(s) here:

Organizational Structure

20 [14]In your opinion is your current Organizational model effective and efficient? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

21 [15]Please indicate your opinion of the of the following: *

Please choose the appropriate response for each item:

	STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE	I DON'T KNOW
My office has an established succession plan for retaining trained and qualified surveyors	○	○	○	○	○	○
My time is better spent working than attending training classes	○	○	○	○	○	○
The training that I have received is applicable to my day-to-day job functions	○	○	○	○	○	○
Training is needed and should be required as part of our job classifications	○	○	○	○	○	○

22 [16]Should MDOT have a formal career path established for survey technicians?

*

Please choose **only one** of the following:

- ○ Yes
- ○ No

23 [17]Who is responsible for reviewing in house surveys prior to their final submittal?
*

Please choose **only one** of the following:

- ○ District Surveyor
- ○ CADD Coordinator
- ○ Construction Engineer
- ○ Project or Resident Engineer
- ○ Other (please exlain)

Make a comment on your choice here:

Survey Processes: Construction, Property, Preliminary & Earthwork

24 [18]What is the percentage of the following surveys performed by your office? *

Please choose the appropriate response for each item:

	0-20%	21-40%	41-60%	61-80%	81-100%
Topographic surveys	○	○	○	○	○
Drainage surveys	○	○	○	○	○
Control surveys	○	○	○	○	○
Preliminary property surveys	○	○	○	○	○
Proposed right of way surveys	○	○	○	○	○
Eminent Domain surveys	○	○	○	○	○
Construction stake out	○	○	○	○	○
Surveying to document earthwork pay quantities	○	○	○	○	○
Surveying to document other pay quantities	○	○	○	○	○

25 [19]Please Comment on the following statement: MDOT should require all surveys to be in DTM format?

*

Please choose **only one** of the following:

- ○ Strongly Agree
- ○ Somewhat Agree
- ○ Neither Agree nor Disagree
- ○ Somewhat Disagree
- ○ Strongly Disagree
- ○ I Don't Know

26 [20]Does the RWD 200 checklist contain all necessary elements for survey submittal? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

27 [22]What Elements are missing in the RWD 200 checklist?

Only answer this question if the following conditions are met:
° Answer was 'No' at question '26 [20]' (Does the RWD 200 checklist contain all necessary elements for survey submittal?)

Please write your answer(s) here:

Missing Element	
Missing Element	
Missing Element	
Missing Element	
Missing Element	

28 [21]What is your processing method of earthwork? *

Please choose **only one** of the following:

- ○ DTM
- ○ Cross-section

Deliverables

29 [22]What are the formats and file types of the data exported from the instrument or data collector used in your crew?

Please write your answer(s) here:

Answer 1	
Answer 2	
Answer 3	
Answer 4	
Answer 5	
Answer 6	

30 [23]Will the data exported from your data collector import into Microstation/Geopak without any additional editing?
*****

Please choose **only one** of the following:

- ○ Yes
- ○ No

31 [24]Is there effective communication between your office and Roadway Design, Right of Way and the Districts?
*****

Please choose **only one** of the following:

- ○ Yes
- ○ No

Thank you for your participation

31.12.1969 – 18:00
Please fax your completed survey to: 601 266 5717
Submit your survey.
Thank you for completing this survey.

3- MDOT - State Study 222 - Management (Group 3).

Preamble: Thank you in advance for your commitment to this Mississippi Department of Transportation Survey.

Overview: A critical activity performed by MDOT employees is surveying. MDOT employees use a wide range of surveying methods and technologies throughout the state.

Objective: The objective of this survey is to gather information to identify the best operational approach to use for the range of surveying operations employed by MDOT.

We would appreciate if you could complete the questionnaire by March 28th, 2011.

If you have any questions/concern please direct them to Tulio Sulbaran by e-mail at Tulio.Sulbaran@usm.edu or by phone at (601) 266 6419.

There are 54 questions in this survey

Demographic

1 [D1]First Name *

Please write your answer here:

2 [D2]Last Name *

Please write your answer here:

3 [D3]E-mail Address *

Please write your answer here:

4 [D4]Phone:

Please write your answer here:

5 [D5]

Division/Unit

Please write your answer here:

6 [D6]Position

Please write your answer here:

Quality Measures

7 [QualityMeasures1.b]Please rate the accuracy of the following statements:

Please choose the appropriate response for each item:

	STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE	I DON'T KNOW
Production should be the most important priority in my unit.	○	○	○	○	○	○
Quality should be the most important priority in my unit	○	○	○	○	○	○

8 [QualityMeasures1.a]Please give your opinion of the of the following: *

Please choose the appropriate response for each item:

	STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE	I DON'T KNOW
Production (Speed, completion of tasks, making deadlines, ...) is the most important priority in my unit	○	○	○	○	○	○
Quality of Product (Accuracy, completeness, devliery in proper format) is the most important priority of my unit	○	○	○	○	○	○

Performance

9 [Performance5]Which brand do you think produces the best surveying software?
*

Please choose **only one** of the following:

- ○ SMI
- ○ Carlson
- ○ Topcon
- ○ TDS
- ○ Trimble
- ○ Leica
- ○ Other (specify in comments)

Make a comment on your choice here:

10 [Performance1]What is your confidence level of the accuracy of the following equipment?
*

Please choose the appropriate response for each item:

	Completely Confident	Very Confident	Confident	Somewhat Confident	Lacking All Confidence
RTK (Vertical)	○	○	○	○	○
RTK (Horizontal)	○	○	○	○	○
Static (Vertical)	○	○	○	○	○
Static (Horizontal)	○	○	○	○	○

11 [Performance4]Please give your opinion of the following surveying performance issues: *

Please choose the appropriate response for each item:

	STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE	I DON'T KNOW
Rtk equipment may be suitable for horizontal surveys but is not suitable for vertical surveys.	○	○	○	○	○	○
Rtk equipment is suitable for all surveys with the exception of special situations where class 1 vertical accuracy is required.	○	○	○	○	○	○
Current data collection software used in my office is suitable for daily surveying operations	○	○	○	○	○	○
The data collection software currently used in my office is easy to use	○	○	○	○	○	○

12 [Performance2]What vertical accuracy level can you achieve with the following equipment? *

Please choose the appropriate response for each item:

	.01’	.03’	.05’	.07’	.10’	.50'	I Don't Know
RTK Equipment (Vertical)	○	○	○	○	○	○	○

Total Station (Vertical)	○	○	○	○	○	○	○

13 [Performance3]What horizontal accuracy level can you achieve with the following equipment?
*****

Please choose the appropriate response for each item:

	.01’	.03’	.05’	.07’	.10’	.50'	I Don't Know
RTK Equipment (Horizontal)	○	○	○	○	○	○	○
Total Station (Horizontal)	○	○	○	○	○	○	○

Training

14 [Training2]What formal training has your office established for survey personnel? *

Please choose the appropriate response for each item:

	Formal training regulalry available	Formal training occasionally available	Formal training rarely available	Currently no formal training - it has been offered in the past	No Formal training	I Don't know
Professional	○	○	○	○	○	○
Technical	○	○	○	○	○	○
Field Work	○	○	○	○	○	○
CADD	○	○	○	○	○	○

Standards: MDOT and Professional

15 [Standards6]How often should the MDOT Survey Manual be revised? *

Please choose **only one** of the following:

- ○ Every 6 Months
- ○ Yearly
- ○ Every other Year
- ○ Every 5 Years
- ○ I Don't know

16 [Standards11]Are MDOT surveying practices meeting the professional standards established by the Mississippi Board of Licensure for Professional Engineers and Surveyors? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

Make a comment on your choice here:

17 [Standards12]Should MDOT surveying standards exceed the professional surveying standards set forth by the Mississippi Board of Licensure for Professional Engineers and Surveyors? *

Please choose **only one** of the following:

- ○ Yes

○ No

18 [Standards13]Are all existing and proposed right of way and property line surveys being done by MDOT survey crews under the direct supervision of a Licensed Professional Surveyor?
*

Please choose **only one** of the following:

○ Yes
○ No

19 [Standards14]Please give your opinion of the of the following:
*

Please choose the appropriate response for each item:

	STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE	I DON'T KNOW
Professional Surveyors across the State see MDOT surveying practices as sub-standard	○	○	○	○	○	○
MDOT is leading the way for surveyors across the State with modern surveying equipment	○	○	○	○	○	○
MDOT Survey should set as a goal to lead the state of Mississippi with the best reputation for quality surveys	○	○	○	○	○	○

20 [Standards18]

Have you read and understand the 2008 MDOT's Survey Manual? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

21 [Standards 10]Are the requirements as defined by the current MDOT Survey Manual being met?

Please choose **only one** of the following:

- ○ Yes
- ○ No

22 [Standards9]What other topics do you think need to be covered in more detail in the MDOT Survey Manual?

Please write your answer(s) here:

23 [Standards8]Are all surveying activities within your office being performend under the direct supervision of a professional surveyor? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

Organizational Structure

24 [Organization5]Which organizational survey model is the most efficient in your opinion? *

Please choose **only one** of the following:

- ○ Most of the preliminary survey activities are preformed at the district office and other construction related survey duties are performed at the project office. All survey duties are performed under the direct supervision of a professional surveyor.
- ○ Most of the preliminary survey activities are preformed at the district office under the direct supervision of a professional surveyor and other construction related survey duties are performed at the project office without direct supervision of a professional surveyor
- ○ District office performs some surveying duties primarily establishing project control and performing some boundary surveys under the direct supervision of a professional surveyor
- ○ Project office performing most of the preliminary surveys including boundary surveys without direct supervision of a professional surveyor. District office performs some surveying duties primarily establishing project control
- ○ other (specify in comments)

Make a comment on your choice here:

25 [Organization6]Does the current State Personnel Board job classifications adequately cover the surveying profession? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

26 [Organization10]In your District, which survey operations are centralized and which operations are performed by the individual project offices? *

Please choose the appropriate response for each item:

	Central Office Function	Project Office Function	Function shared by both Central and Project offices	I Don't know
Control Surveys	○	○	○	○
Preliminary surveying for engineering design (topo, drainage, cross sections, etc.)	○	○	○	○
Preliminary Right of Way stakeout for appraisal	○	○	○	○
Eminent Domain Surveys	○	○	○	○
Construction Staking	○	○	○	○
Surveying for earthwork quantities	○	○	○	○

27 [Organization12]Should MDOT have a formal career path establish for survey technicians? *

Please choose **only one** of the following:

○ Yes
○ No

28 [Organization16]Should MDOT have a formal career path for inspection & construction personnel? *

Please choose **only one** of the following:

○ Yes
○ No

29 [Organization20]Should each project office have a PLS in the office? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

30 [Organization22]Do you agree that MDOT should be inspecting survey work performed by consultants? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

31 [Organization:24]Who is responsible for reviewing preliminary topographical surveys prior to their final submittal? *

Please choose **all** that apply:

- ☐ District Surveyor
- ☐ CADD Coordinator
- ☐ Project Engineer
- ☐ Construction Engineer
- ☐ Other: _____

32 [Oraganization23]Is your office adequately staffed to perform these inspections?

Only answer this question if the following conditions are met:
° Answer was 'Yes' at question '30 [Organization22]' (Do you agree that MDOT should be inspecting survey work performed by consultants?)

Please choose **only one** of the following:

- ○ Yes
- ○ No

33 [Organiaztion2]What is the typical number of crew members in your GPS surveying party? *

Please choose **only one** of the following:

- ○ 2
- ○ 3

- ○ 4
- ○ 5
- ○ 6
- ○ Does Not Apply (GPS not used)

34 [Organzation15]Please give your opinion of the following:
*****

Please choose the appropriate response for each item:

	STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE	I DON'T KNOW
My office has an established succession plan for retaining trained and qualified surveyors	○	○	○	○	○	○
I do not have time to attend training classes	○	○	○	○	○	○
Training is needed and should be required as part of our job classifications	○	○	○	○	○	○

35 [Organization4]In your opinion is your current model effective and efficient?
*****

Please choose **only one** of the following:

- ○ Yes
- ○ No

36 [Organization1]What is the typical number of crew members in your conventional survey crew?
*****

Please choose **only one** of the following:

- ○ 2
- ○ 3
- ○ 4
- ○ 5
- ○ 6
- ○ other (specify in comments)

Survey Processes: Construction, Property, Preliminary & Earthwork

37 [Processes1]Do you agree with the statement "3d field collection procedures and modeling is too complicated and should not be adopted within MDOT"? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

38 [Processes4]

Does your crew collect topographical & elevation information at the same time? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

39 [Processes29.a]In your opinion, what percent of ROW markers set by contractors meet MDOT specifications and standards of practice?

***

Please choose **only one** of the following:

- ○ 0-25%
- ○ 26-50%
- ○ 51-75%
- ○ 76-100%

40 [Processes29.b]Should MDOT establish a standard procedure for checking the placement of ROW markers? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

41 [Processes6]In any survey work other than Control Surveys,do the field crews regularly calculate atmospheric corrections in the total stations? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

42 [Processes7]In any survey work other than Control Surveys, do you use an average yearly atmospheric correction factor?

Please choose **only one** of the following:

- ○ Yes
- ○ No

43 [Processess8]In any survey work other than Control Surveys,do you think an average yearly atmospheric correction factor is accurate enough?

Please choose **only one** of the following:

- ○ Yes
- ○ No

Deliverables

44 [Deliverable5]Is there effective communication among Roadway Design, Right of Way and the Districts?
*****

Please choose **only one** of the following:

- ○ Yes
- ○ No

Administration Building

Equipment

45 [Equipment15]In your opinion, is the surveying office adequately staffed to perform the necessary job functions required to submit finalized electronic drawings to Roadway Design? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

46 [Equipment16]If not, what additional staffing needs would improve this workflow? *

Only answer this question if the following conditions are met:
° Answer was 'No' at question '45 [Equipment15]' (In your opinion, is the surveying office adequately staffed to perform the necessary job functions required to submit finalized electronic drawings to Roadway Design?)

Please write your answer here:

47 [Equipment1]Please give your opinion of the following statements regarding Equipment *

Please choose the appropriate response for each item:

	STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE	I DON'T KNOW
MDOT has the proper surveying equipment to perform surveying duties	○	○	○	○	○	○
MDOT is keeping up with modern surveying technologies and equipment	○	○	○	○	○	○
MDOT is providing the necessary surveying	○	○	○	○	○	○

equipment to all survey crews across the State						
MDOT should have GPS equipment available for all surveying operations	○	○	○	○	○	○
MDOT should lease modern surveying equipment such as GPS	○	○	○	○	○	○
MDOT Districts have adequate budgeting for current and future surveying equipment	○	○	○	○	○	○
MDOT staff using modern surveying equipment are being trained to use this equipment properly and effectively	○	○	○	○	○	○
MDOT needs to use the same data collection software for all surveying equipment (total stations, robotics, and GPS)?	○	○	○	○	○	○
The computer hardware and software available to Survey staff is adequate for processing our survey data	○	○	○	○	○	○

48 [Equipment19]What is the productivity of GPS equipment compared to

conventional equipment? *

Please choose **only one** of the following:

- ○ Much less Production (-50%)
- ○ Less Production (-25%)
- ○ No Change (0%)
- ○ More Production (+25%)
- ○ Very Much Production (+50%)
- ○ Other

49 [Equipment18]What is your level of experience using GPS? *

Please choose **only one** of the following:

- ○ No Experience
- ○ Little Experience (Less than 1 year)
- ○ Some Experience (1-3 years)
- ○ Very Experienced (More than 3 years)

General Operation

50 [General Operation2a1]What areas of MDOT survey operations are in need of change?

Please choose the appropriate response for each item:

	No Changes	Few Changes	Some Changes	Major Changes	Complete Overhaul	I Don't Know
Surveying Techniques	○	○	○	○	○	○
Surveying Equipment	○	○	○	○	○	○
Organization of Surveying Tasks	○	○	○	○	○	○
Data Delivery Techniques	○	○	○	○	○	○
Training	○	○	○	○	○	○
Personnel policies and job Classifications	○	○	○	○	○	○
Use of Consultants	○	○	○	○	○	○
Division of responsibiliites between District and Project Offices	○	○	○	○	○	○

51 [General Operation2b]Please comment on the major changes needed.

Please write your answer here:

52 [General Operation3]What should the role of consultants be in MDOT survey operations?

Please choose the appropriate response for each item:

		NEITHER AGREE NOR		I
STRONGLY			STRONGLY	DON'T

	AGREE	AGREE	DISAGREE	DISAGREE	DISAGREE	KNOW
MDOT personnel should perform all surveys	○	○	○	○	○	○
Consultants should perform all MDOT surveys	○	○	○	○	○	○
Both MDOT consultants should perform MDOT surveys	○	○	○	○	○	○
MDOT should contract with consultants to do preliminary surveys	○	○	○	○	○	○
MDOT should contract with consultants to do control surveys	○	○	○	○	○	○

53 [GeneralOperation5]What percent of survey work in your office is currently contracted to outside surveyors? *

Please choose **only one** of the following:

- ○ 0-10%
- ○ 11-25%
- ○ 26-50%
- ○ 51-75%
- ○ 76-100%
- ○ More specific percentage (please enter in comments)

Make a comment on your choice here:

54 [General Operations 4]Select your training needs for the following categories of Survey Skills: *

Please choose the appropriate response for each item:

	Yes, Much Training Needed	Yes, Some Training Needed	Yes, A Little Training is Needed	No, Training is Sufficient	No, not used	I don't know
Data collection(3D and/or 2D)	○	○	○	○	○	○
Leveling	○	○	○	○	○	○
Total station	○	○	○	○	○	○
PCODES and Linking codes	○	○	○	○	○	○
DTM	○	○	○	○	○	○
Cogo	○	○	○	○	○	○
Microstation/GeoPak	○	○	○	○	○	○
RWD Codes	○	○	○	○	○	○
Allegro data collectors	○	○	○	○	○	○
Other Survey Equipment	○	○	○	○	○	○
General Survey Procedure	○	○	○	○	○	○
Survey Standards and Practices	○	○	○	○	○	○

Thank you for your participation

31.12.1969 – 18:00
Please fax your completed survey to: 601 266 5717
Submit your survey.
Thank you for completing this survey.

4- MDOT - State Study 222 - Administration (Group 4).

Preamble: Thank you in advance for your commitment to this Mississippi Department of Transportation Survey.

Overview: A critical activity performed by MDOT employees is surveying. MDOT employees use a wide range of surveying methods and technologies throughout the state.

Objective: The objective of this survey is to gather information to identify the best operational approach to use for the range of surveying operations employed by MDOT.

We would appreciate if you could complete the questionnaire by March 28th, 2011.

If you have any questions/concern please direct them to Tulio Sulbaran by e-mail at Tulio.Sulbaran@usm.edu or by phone at (601) 266 6419.

There are 28 questions in this survey

Demographic

1 [D1]First Name *

Please write your answer here:

2 [D2]Last Name *

Please write your answer here:

3 [D3]E-mail Address *

Please write your answer here:

4 [D4]Phone:

Please write your answer here:

5 [D5]

Division/Unit

Please write your answer here:

6 [D6]Position

Please write your answer here:

Deliverables

7 [Deliverable7]Should a Division in Jackson contact the District if there is an apparent problem with survey data provided by the District? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

8 [Deliverable8]Who should they contact?

Only answer this question if the following conditions are met:
° Answer was 'Yes' at question '7 [Deliverable7]' (Should a Division in Jackson contact the District if there is an apparent problem with survey data provided by the District?)

Please write your answer here:

9 [Deliverable6]Do we have the proper personnel in Roadway Design and Right of Way Divisions handling survey data provided by the Districts? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

10 [Deliverable5]Is there effective communication between your office and Roadway Design, Right of Way? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

Processes

11 [Processes29.a]In your opinion, what percent of ROW markers set by contractors meet MDOT specifications and standards of practice?

*

Please choose **only one** of the following:

- ○ 0-25%
- ○ 26-50%
- ○ 51-75%
- ○ 76-100%

12 [Processes29.b]Should MDOT establish a standard procedure for checking the placement of ROW markers? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

13 [Processes26]What route should project offices use to submit their data to Roadway Design?
*

Please choose **all** that apply:

- ☐ Send Data Directly to Roadway Design
- ☐ Route Data Through the District Office
- ☐ Other
- ☐ I Don't Know

Organization

14 [Organization20]Should each project office have a PLS in the office? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

15 [Organization12]Should MDOT have a formal career path for survey technicians? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

16 [Organization10]In your District, which survey operations are centralized and which operations are performed by the individual project offices? *

Please choose the appropriate response for each item:

	Central Office Function	Project Office Function	Function shared by both Central and Project offices	I Don't know
Control Surveys	○	○	○	○
Preliminary surveying for engineering design (topo, drainage, cross sections, etc.)	○	○	○	○
Preliminary Right of Way stakeout for appraisal	○	○	○	○
Eminent Domain Surveys	○	○	○	○
Construction Staking	○	○	○	○
Surveying for earthwork quantities	○	○	○	○

17 [Organization5]Which organization of survey model is the most efficient in your opinion? *

Please choose **only one** of the following:

- ○ Most of the preliminary survey activities are preformed at the district office and other construction related survey duties are performed at the project office. All survey duties are performed under the direct supervision of a professional surveyor.
- ○ Most of the preliminary survey activities are preformed at the district office under the direct supervision of a professional surveyor and other construction related survey duties are performed at the project office without direct supervision of a professional surveyor
- ○ District office performs some surveying duties primarily establishing project control and performing some boundary surveys under the direct supervision of a professional surveyor
- ○ Project office performing most of the preliminary surveys including boundary surveys without direct supervision of a professional surveyor. District office performs some surveying duties primarily establishing project control
- ○ other (specify in comments)

Make a comment on your choice here:

18 [Organization22]Do you agree that MDOT should be inspecting survey work performed by consultants? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

19 [Oraganization23]Is your office adequately staffed to perform these inspections?

Please choose **only one** of the following:

- ○ Yes

○ No

20 [Organization:24]Who is responsible for reviewing preliminary topographical surveys prior to their final submittal?
*****

Please choose **all** that apply:

☐ District Surveyor
☐ CADD Coordinator
☐ Project Engineer
☐ Construction Engineer
☐ Other:

Equipment

21 [Equipment1]Please give your opinion of the following statements regarding Equipment *

Please choose the appropriate response for each item:

	STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE	I DON'T KNOW
MDOT has the proper surveying equipment to perform surveying duties	○	○	○	○	○	○
MDOT is keeping up with modern surveying technologies and equipment	○	○	○	○	○	○
MDOT is providing the necessary surveying equipment to all survey crews across the State	○	○	○	○	○	○
MDOT should have GPS equipment available for all surveying operations	○	○	○	○	○	○
MDOT should lease modern surveying equipment such as GPS	○	○	○	○	○	○
MDOT Districts have adequate budgeting for current and future surveying equipment	○	○	○	○	○	○

MDOT staff using modern surveying equipment are being trained to use this equipment properly and effectively	○	○	○	○	○	○
MDOT needs to use the same data collection software for all surveying equipment (total stations, robotics, and GPS)?	○	○	○	○	○	○
The computer hardware and software available to Survey staff is adequate for processing our survey data	○	○	○	○	○	○

General Operation

22 [GeneralOperation1]Please give your opinion of the following:

*

Please choose the appropriate response for each item:

	STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE	I DON'T KNOW
Surveying Operations are very important to MDOT	○	○	○	○	○	○
MDOT places a great deal of emhasis on Surveying Operations	○	○	○	○	○	○
MDOT has dedicated enough resource to Surveying Operations	○	○	○	○	○	○

23 [General Operation2a1]What areas of MDOT survey operations are in need of change?

Please choose the appropriate response for each item:

	No Changes	Few Changes	Some Changes	Major Changes	Complete Overhaul	I Don't Know
Surveying Techniques	○	○	○	○	○	○
Surveying Equipment	○	○	○	○	○	○
Organization of Surveying Tasks	○	○	○	○	○	○
Data Delivery Techniques	○	○	○	○	○	○
Training	○	○	○	○	○	○
Personnel policies and job Classifications	○	○	○	○	○	○
Use of Consultants	○	○	○	○	○	○
Division of responsibiliites between District and Project	○	○	○	○	○	○

Offices

24 [General Operation2b]Please comment on the major changes needed.

Please write your answer here:

25 [General Operation3]What should the role of consultants be in MDOT survey operations?

Please choose the appropriate response for each item:

	STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE	I DON'T KNOW
MDOT Personnel Should Perform All MDOT Surveys	○	○	○	○	○	○
Consulatants Should Perform All MDOT Surveys	○	○	○	○	○	○
Both Consultanats and MDOT Personnel Should Perform MDOT Surveys	○	○	○	○	○	○
Consulants Should Perform MDOT Control Surveys	○	○	○	○	○	○
Consultants Should						

Perform MDOT Preliminary Surveys	○	○	○	○	○	○

Standard

26 [Standards12]Should MDOT surveying standards exceed the professional surveying standards set forth by the Mississippi Board of Licensure for Professional Engineers and Surveyors?
*****

Please choose **only one** of the following:

- ○ Yes
- ○ No

27 [Standards13]Are all existing and proposed right of way and property line surveys being performed by
MDOT survey crews under the direct supervision of a Licensed Professional Surveyor?
*****

Please choose **only one** of the following:

- ○ Yes
- ○ No

Training

28 [Training2]What formal training has your office established for survey personnel? *

Please choose the appropriate response for each item:

	Formal training regulalry available	Formal training occasionally available	Formal training rarely available	Currently no formal training - it has been offered in the past	No Formal training	I Don't know
Professional	○	○	○	○	○	○
Technical	○	○	○	○	○	○
Field Work	○	○	○	○	○	○
CADD	○	○	○	○	○	○

Thank you for your participation

31.12.1969 – 18:00
Please fax your completed survey to: 601 266 5717
Submit your survey.
Thank you for completing this survey.

5- MDOT - State Study 222 - Customers (Group 5).

Preamble: Thank you in advance for your commitment to this Mississippi Department of Transportation Survey.

Overview: A critical activity performed by MDOT employees is surveying. MDOT employees use a wide range of surveying methods and technologies throughout the state.

Objective: The objective of this survey is to gather information to identify the best operational approach to use for the range of surveying operations employed by MDOT.

We would appreciate if you could complete the questionnaire by March 28, 2011.

If you have any questions/concern please direct them to Tulio Sulbaran by e-mail at Tulio.Sulbaran@usm.edu or by phone at (601) 266 6419.

There are 16 questions in this survey

Demographic

1 [D1]First Name *

Please write your answer here:

2 [D2]Last Name *

Please write your answer here:

3 [D3]E-mail Address *

Please write your answer here:

4 [D4]Phone:

Please write your answer here:

5 [D5]

Division/Unit

Please write your answer here:

6 [D6]Position

Please write your answer here:

Deliverables

7 [Deliverable7a]Should a Division in Jackson contact the District if there is an apparent problem with survey data provided by the District? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

8 [Deliverable7b] Who should they contact?

Only answer this question if the following conditions are met:
° Answer was 'Yes' or 'Yes' at question '7 [Deliverable7a]' (Should a Division in Jackson contact the District if there is an apparent problem with survey data provided by the District?)

Please write your answer here:

9 [Deliverable5]Is there effective communication between your office and the Districts?
***

Please choose **only one** of the following:

- ○ Yes
- ○ No

10 [8]Do surveys received by you office meet all requirements as outlined in the survey manual and CADD manual? *

Please choose **only one** of the following:

- ○ Yes

○ No

Admin

11 [Admin1a]What problems are your division encountering with Survey data?

*

Please choose **all** that apply:

- ☐ Formats?
- ☐ Accuracy?
- ☐ Timely submittal?
- ☐ Completeness?
- ☐ Other?
- ☐ My Division Has No Problems with Survey Data

12 [Admin1b]Please Comment

Only answer this question if the following conditions are met:
° Answer was 'Other?' at question '11 [Admin1a]' (What problems are your division encountering with Survey data?)

Please write your answer here:

13 [Admin2a]Does the data received from the district require any manipulation, re-formatting or modifications to be used in the design applications? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

14 [Admin2b]Please Comment

Only answer this question if the following conditions are met:
° Answer was 'Yes' at question '13 [Admin2a]' (Does the data received from the district require any manipulation, re-formatting or modifications to be used in the design applications?)

Please write your answer here:

15 [Admin3]Does your office receive all the information required when surveys are originally submitted? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

16 [Admin4a]Are your division's survey needs/requirements outlined in the MDOT Survey Manual? *

Please choose **only one** of the following:

- ○ Yes
- ○ No

Processes

Thank you for your participation

31.12.1969 – 18:00
Please fax your completed survey to: 601 266 5717
Submit your survey.
Thank you for completing this survey.

APPENDIX D

RANKING DESCRIPTIVE STATISTICAL ON-LINE QUESTIONNAIRE

Study No. 222
Best Practices of MDOT's Survey Operation, Organization and Technology Implementation
Questionnaire for Survey Field Staff – Analysis & Summary

- Current Responses – 28
- Questions - 37
- Basic Analysis Approach
    - Step 1 - Categorize Responses to each question in the following broad categories:
        - Consensus (90%+) agreement
        - Emerging Consensus (65%-95%) agreement
        - Controversy (no single response > 64%)
    - Step 2 - Divide Results into three sections as follows:
        - SECTION 1 - MDOT Best Operational Approach
        - SECTION 2 - MDOT Most Effective Organizational Model
        - SECTION 3 - MDOT Best Survey Technology Roll-out Strategy
    - Step 3 - Identity Important, Interrelated and Cross-cutting Results
    - Step 4 - Build Narrative which Explains the Results and draws Conclusions from the Research Instruments

Study No. 222
Best Practices of MDOT's Survey Operation, Organization and Technology Implementation
Questionnaire for Survey Field Staff – Analysis & Summary

SECTION 1 - MDOT Best Operational Approach for Survey

Question #	Question	Results and Characterization	Importance of Result (1-5) & notes
General Operation 2a1	What areas of MDOT survey operations are in need of change?	[Surveying Techniques] - 20 of 28 responses are either 'few' or 'some' changes Emerging Consensus	**4**
		[Surveying Equipment] – 17 of 28 responses are either 'few' on 'none', 10 of 28 are either 'some' or 'major' changes Controversy	**2-3**
		[Data Delivery Techniques] – 16 of 28 responses are 'few' or 'none', 9 of 28 are either 'some' or 'major' Controversy	
Quality Measures 1.a	Please give your opinion of the following:	[Production (Speed, completion of tasks, making deadlines, ...) is the most important priority in my unit] -27 of 60 responses are either 'Strongly Agree' or 'Agree' 20 of 60 are 'Neither agree nor disagree', and 13 are 'Disagree' No Consensus	**4**
		Quality of Product (Accuracy, completeness, delivery in proper format) is the most important priority of my unit – 25 of 27 either 'Strongly Agree' or 'Agree' Consensus	**4**
Quality Measures 2	Please rank the following based on importance (techniques to insure accuracy)	46% rank first 'start from a known point', 36% rank second 'Check into another known point value', then views diverge Controversy	**1**
Quality Measures 3	When establishing secondary control what percentage of the time do you employ resection procedures?	10%, 25%, 50% and 'never' all receive 4+ responses Controversy	**2**
Quality Measures 1.b	Please rate the accuracy of the following statements:	[I believe production <u>should be</u> the most important priority in my unit.] 44% of responses are either 'agree' or 'strongly agree', 23% are 'Neither agree nor Disagree', and 30% are 'Disagree' No Consensus	**4**
		[I believe quality <u>should be</u> the most important priority in my unit] 96% of responses are either 'agree' or 'strongly agree' Strong Consensus	**4**
Equipment 3	Indicate how often you calibrate the following surveying tools?	[Total Stations] 36% of responses are 'yearly', other responses are evenly	**4-5**

		divided including 4/25 responses of 'never' Controversy	
		[Set Parts per Million Corrections] 27% are 'yearly', other responses are evenly divided including 2/25 responses of 'never' Controversy	
		[Check and Adjust Prism Poles] 36% are 'quarterly', other responses are evenly divided including 2/25 responses of 'never' Controversy	**4-5**
		[Baseline Calibrations] 30% are 'yearly', other responses are evenly divided including 23% responses of 'never' Controversy	**4-5**
		[Fixed High Tripods] 20% of responses are 'never', other responses are evenly divided Controversy	**4-5**
		[Levels (Conventional and Digital)] 33% of responses are 'yearly', 30% of responses are 'quarterly', 17% of responses are 'monthly' Controversy	**4-5**
Equipment 12	Do you create DTM's?	15 - yes, 13 - no Controversy	**4**
Performance 2	What vertical accuracy level can you achieve with the following equipment?	[RTK Equipment (Vertical)] responses are evenly divided among .03', .05', .07' and .1' Controversy	**4**
		[Total Station (Vertical)] 46% of responses are .03', all other answers have some responses Controversy	**4**
		[Level(Vertical)] 66% of responses are .01' Emerging Consensus	**4**
Performance 3	What horizontal accuracy level can you achieve with the following equipment?	[RTK Equipment (Horizontal)] 30% of responses are .03' Controversy	**4**
		[Total Station (Horizontal)] 36% of responses are .03' Controversy	**4**
Standards 10a	Do you refer to the Mississippi Board of Licensure for Professional Engineers and Surveyors "Standards of Practice for surveyors" when performing surveys?	14 'yes' 14 'no' Controversy	**4**
Standards 12	Should MDOT surveying standards exceed the professional surveying standards set forth by the Mississippi Board of Licensure for Professional	13 'yes' 15 'no' Controversy	**4**

	Engineers and Surveyors?		
Standards 9	Have you read and understood the standard MDOT's Survey Manual?	15 'yes' 13 'no' Controversy	**4**
Standards 10b	Are you following the current MDOT Survey Manual?	13 'yes' 10 'no answer' Controversy	**4**
Standards 13-1	What other topics do you think need to be covered or covered in more detail in the MDOT Survey Manual?	Comments: • GPS Surveying • construction survey operations • hydrolic surveys • Property Surveys	**1**
Processes 12	What is your preferred method of collecting earthwork?	Spot Shot/Breakline 56%, Total station 26% Controversy	**4**

SECTION 2 - MDOT Most Effective Organizational Model

Question #	Question	Results and Characterization	Importance of Result (1-5) & notes
General Operation 2a1	What areas of MDOT survey operations are in need of change?	[Organization of Surveying Tasks] – 21 of 28 responses are 'few' or 'some' changes Emerging Consensus	**3**
		[Personnel policies and job Classifications] – 13 or 28 responses are either 'few' or 'none', 13 or 28 responses are 'some' or 'major' Controversy	**3**
		[Use of Consultants] – 16 of 28 responses are 'few' or 'none', 9 of 28 are either 'some' or 'major' Controversy	**3**
		[Division of responsibilities between District and Project Offices] – 15 of 28 responses are 'few' or 'none', 11 of 28 are 'some' or 'major' Controversy	**3**
Equipment 15a	In your opinion, is the surveying office adequately staffed to perform the necessary job functions required to submit finalized electronic drawings to Roadway Design?	66% responded 'yes' Emerging Consensus	**4**
Standards 8	Is direct supervision from a licensed surveyor required for the following types of surveys?	[Right of Way] 13 'yes', 8 'no' Controversy	**4**
		[Property Maps] 14 'yes' 5 'no' 9 'uncertain' Controversy	**4**
		[Eminent Domain] 70% 'yes' Emerging Consensus	**4**

Standards New1	Is Direct Supervision from a Licensed Surveyor Standard Practice in Your Office for the Following types of Surveys?	[Right of Way] 8 'yes' 18 'not completed' Controversy	**4**
		[Property Maps] 8 'yes' 18 'not completed' Controversy	**4**
		[Eminent Domain] 70% 'yes' Consensus	**4**
Field summary	Should MDOT have a formal career path established for survey technician?	83% 'yes' Emerging Consensus	**5**
Organization 15	Please give your opinion of the following:	[My office has an established succession plan for retaining trained and qualified surveyors] 33% 'Neither Agree or Disagree', other responses evenly divided Controversy	**1**
		[I do not have time to attend training classes] 17/21 'disagree' or 'strongly disagree' Emerging Consensus	**4**
		[Training is needed and should be required as part of our job classifications] 70% 'agree' or 'strongly agree' Emerging Consensus	**4**

SECTION 3 - MDOT Best Survey Technology Roll-Out Strategy

Question #	Question	Results and Characterization	Importance of Result (1-5) & notes
General Operation 2a1	What areas of MDOT survey operations are in need of change?	[Training] – 18 of 28 responses are either 'some', 'major' or 'complete overhaul', only 3 responses were 'no change' Emerging Consensus Follow-up responses: – I believe the majority of survey parties are your lower level employees. Most of these are not able to understand the goal we are trying to achieve or how to obtain that goal. It is totally on the party chief to check behind every shot we take. I feel that we need higher ranking people in the party or a lot of training. – There needs to be more than one person in the crew that has knowledge of what to do – In house training for surveying techniques.	**4**

Equipment 2	Please indicate which equipment is available to your unit as follows:	[GPS Equipment] 53% of responses are 'Available and in Regular Use', 30% of responses are 'Available but Training Needed' or 'Not Available and Needed', 17% of responses are 'Available but not Needed', 'Available but Rarely Used', or 'Available but Rarely Used' Consensus	**3**
		[Total Station] 76% of responses are 'Available and in Regular Use', 10% of responses are 'Available but Training Needed' or 'Not Available and Needed', 13% of responses are 'Available but not Needed' or 'Available but Rarely Used' Emerging Consensus	**3**
		[GPS RTK Equipment] 47% of responses are 'Available and in Regular Use', 23% of responses are 'Available but Training Needed' or 'Not Available and Needed', 30% of responses are 'Available but not Needed' or 'Available but Rarely Used' Emerging Consensus	**3**
		[Metal Detectors] 67% of responses are 'Available and in Regular Use', 3% are 'Available but Training Needed', 30% of responses are 'Available but not Needed' or 'Available but Rarely Used' Emerging Consensus	**3**
		[Digital Levels] 46% of responses are 'Available and in Regular Use', 14 % of responses are 'Available but Training Needed' or 'Not Available and Needed', 37% of responses are 'Available but not Needed' or 'Available but Rarely Used' Controversy	**3**
Equipment 18	What is your level of experience using GPS?	10 responses '0 -1 years', 8 responses '2-3 years', 10 responses 'more than 3 years' Controversy	**1**
Equipment 5b	Does the use of DTM's save your office time?	12 'yes', 4 'no', all others don't know or no answer Emerging Consensus	**1**
Equipment 19	How does GPS equipment improve productivity compared to conventional equipment?	25 out of 28 responses are 'More Production' or 'Much More Production' Consensus	**2**
Performance 1	What is your confidence level of the accuracy of the following equipment?	[RTK (Vertical)] 19 of 59 responses are 'confident', 'very confident' or 'completely confident', 35 responses are 'Somewhat confidence' Controversy	**2**

		[RTK (Horizontal)] 54 of 59 responses are 'confident', 'very confident' or 'completely confident', 1 response is 'lacking all confidence' Emerging Consensus	**2**
		[Static (Vertical)] 47 of 57 responses are 'confident', 'very confident' or 'completely confident', 1 response is 'lacking all confidence' Consensus	**2**
		[Static (Vertical)] 57 of 59 responses are 'confident', 'very confident' or 'completely confident', 2 response are somewhat confidence' Emerging Consensus	**2**
Performance 6	Is your office utilizing the most recent and updated software and RWD programs provided by MDOT?	[Equipment] 36% of responses are 'already well incorporated', 23% 'used regularly', 13% 'used occasionally' Controversy	**3**
		[Software] 33% of responses are 'already well incorporated', 26% 'used regularly', 23% 'don't know' Controversy	**3**
		[RWD Programs] 30% 'don't know', 26% of responses are 'already well incorporated' Controversy	**3**
Training 1	Select the training needs for the following categories of Survey Skills:	[Data collection(3D and/or 2D)] 39% of responses are 'some training' or 'lots of training', 26% 'training is sufficient Controversy	**3**
		[Leveling] 77% of responses are 'no training' or 'a little training' Emerging Consensus	**3**
		[Total station] 70% of responses are 'no training' or 'a little training' Emerging Consensus	**3**
		[PCODES and Linking codes] 33% of responses are 'no training' 13% of responses are 'lots of training' Controversy	**3**
		[DTM] 33% of responses are 'a little training' other responses are evenly divided Controversy	**3**
		[Cogo] 33% of responses are 'a little training' other responses are evenly divided Controversy	**3**
		[Microstation/GeoPak] 40% of responses are 'a little training' other responses are evenly	**3**

		divided Controversy	
		[RWD Codes] 33% of responses are 'a little training' other responses are evenly divided Controversy	**3**
		[Allegro data collectors] 36% of responses are 'a little training' other responses are evenly divided Controversy	**3**
		[Other Survey Equipment] 33% of responses are 'a little training' other responses are evenly divided Controversy	**3**
		[General Survey Procedure] 30% of responses are 'a little training' other responses are evenly divided Controversy	**3**
		[Survey Standards and Practices] 33% of responses are 'a little training' other responses are evenly divided Controversy	**3**
Processes 1	Do you agree with the statement "3d field collection procedures and modeling is too complicated and should not be adopted within MDOT"?	**9 'yes' 19 'no'** Controversy	**2**
Processes 2	Do you perform the following types of surveys?	**All types are greater than 70% except 'eminent domain' at 60%**	**1**
Processes 3	Does your crew collect topographical elevations and data simultaneously?	**83% 'yes'** Emerging Consensus	**1**

•

Questionnaire for Survey CADD Staff – Analysis & Summary

Question #	Question	Results and Characterization	Importance of Result (1-5) & notes
General Operation 2a1	What areas of MDOT survey operations are in need of change?	[Surveying Techniques] - 25 of 31 responses are either 'few' or 'some' changes Consensus	**2**
		[Surveying Equipment] – 26 of 31 responses are either 'few' or 'some' changes Consensus	**2**
		[Data Delivery Techniques] – 22 of 31 responses are 'few' or 'some', 7 of 31 are either 'none' or 'major' changes Consensus	**2**
Equipment 3b	For what percentage of the projects do you create Digital Train Models (DTMs**)?**	11 of 31 responses are '80-100%', 9 of 31 are '1-20%' and 11 responses are '21-80%' of projects No Consensus	**1**
Standards 10a	Do you refer to the Mississippi Board of Licensure for Professional Engineers and Surveyors "Standards of Practice for surveyors" when performing surveys?	16 'yes' 13 'no' Controversy	**2**
Standards 9	Have you read and understood the standard MDOT's Survey Manual?	20 'yes' 9 'no' Controversy	**4**
Standards 10b	Are you following the current MDOT Survey Manual?	19 'yes' 1 'no answer' Strong Consensus	**4**
Standards 13-1	What other topics do you think need to be covered or covered in more detail in the MDOT Survey Manual?	Comments: • N/A	**1**
Standards 13-2	What other topics do you think need to be covered or covered in more detail in the MDOT Survey Manual?	25% commented, 75% no comment Comments: N/A	**1**
Processes 12	What is your preferred method of collecting earthwork?	59% 'Yes', 41% 'No' Controversy	**1**

Process 20	Does the RWD 200 checklist contain all necessary elements for survey submittal?	97% 'Yes', 3% 'No' Strong Consensus	**3**
Process 22	What Elements are missing in the RWD 200 checklists?	N/A	**1**

SECTION 2 - MDOT Most Effective Organizational Model

Question #	Question	Results and Characterization	Importance of Result (1-5) & notes
General Operation 2a1	What areas of MDOT survey operations are in need of change?	[Organization of Surveying Tasks] – 24 of 31 responses are either 'few' or 'some' changes Consensus	**3**
		[Personnel policies and job Classifications] – 10-31 responses are 'none' or 'few', 17 of 31 are 'some' or 'major' changes No Consensus	**3**
		[Use of Consultants] – 15 of 31 responses are 'no' or 'few' , 9 of 31 are 'some' or 'major' No Consensus	**3**
		[Division of responsibilities between District and Project Offices] - 23-31 responses are either 'few' or 'some' changes Consensus	**3**
Equipment 4	In your opinion, does your office have adequate CADD staff to perform the necessary job functions required to submit finalized electronic drawings to Roadway Design?	65% are 'yes' and 35% 'no' Consensus	**4**
Field summary	Should MDOT have a formal career path established for survey technician?	97% 'yes' Consensus	**5**

Standards 11	Should all surveys be submitted to a Professional Surveyor for verification?	65% 'yes' Emerging Consensus	**2**
Standards 12	Do you think the MDOT survey Manual covers all surveying topics with enough detail?	68 % 'yes',25 % 'no' Emerging Consensus	**3**
Organization 14	In your opinion is your current Organizational model effective and efficient?	62% 'yes', 38% 'no' Emerging Consensus	**3**
Organization 15	Please give your opinion of the following:	[My office has an established succession plan for retaining trained and qualified surveyors] 41 % 'Disagree',17% 'Strongly Disagree' and other responses evenly divided Controversy	**4**
		[My time is better spent working than attending training classes] 17%'Agree,'62% ' Disagree' Emerging Consensus	**4**
		[The Training that I have received is applicable to my day- to- day job functions] 44% 'Agree', 27% 'Neither agree nor disagree', 10% Disagree Controversy	**4**
		[Training is needed and should be required as part of our job classifications] 80% 'agree' or 'strongly agree' Consensus	**4**
Organization 17	Who is responsible for reviewing in house surveys prior to their final submittal?	[District Surveyor] – 48% [CADD Coordinator] – 24% [Project & Resident Engineer] – 14% [Other] – 14% Controversy	**1**

Deliverables 24	Is there effective communication between your office and Roadway Design, Right of Way and the Districts?	57% ' Yes' and 43% 'No' Controversy	**4**

SECTION 3 - MDOT Best Survey Technology Roll-Out Strategy

Question #	Question	Results and Characterization	Importance of Result (1-5) & notes
General Operation 2a1	What areas of MDOT survey operations are in need of change?	[Training] – 24 of 31 responses are either 'some', 'major' or 'complete overhaul', 5 responses are 'few changes' Emerging Consensus	**4**
Performance 5	Your office is utilizing the most recent and updated equipment, software and RWD menus/configurations provided by MDOT.	[Equipment] 58% of responses are 'Agree', 23% Strongly Agree', 10% are 'Neither agree or disagree', 10% are Disagree No Consensus	**4**
		[Software] 88% of responses are either 'agree' or ' strongly agree', 12% 'disagree', 10% 'neither agree nor disagree' Consensus	**4**
		[RWD Programs] 82% either 'Strongly agree' or ' Agree', 10% 'disagree' 6% 'neither agree nor Disagree' Consensus	**4**
Training 1	Select the training needs for the following categories of Survey Skills:	[Data collection(3D and/or 2D)] 55% of responses are 'some training' or 'lots of training', 44 % are little training and 'no training' No Consensus	**3**
		[PCODES and Linking codes] 26 % of responses are 'no training' 46% of responses are 'some training', 12% are 'lots of training' Consensus	**3**
		[DTM] 69% of responses are either 'lots of training' or 'some training', 13% are	**3**

		'no training' Consensus	
		[Microstation/GeoPak] 49% of responses are 'some training' , 23% are 'lot of training', 12% are' no training' No Consensus	**3**
		[LGO] 33% of responses are 'I don't know', 30 are 'some training' other responses are evenly divided No Consensus	**3**
Training 7	What type of training has your office established in the following areas?	[Professional surveying] 10% are 'formal trainings regularly', 20% 'formal training occasionally', and 10% 'formal trainings rarely', 45% are 'no formal trainings No Consensus	**3**
		[Special Equipment or Software] 16% are 'formal trainings regularly', 32% 'formal training occasionally', and 26% 'formal trainings rarely', 23% are 'no formal trainings' No Consensus	**3**
		[Surveying Field Work] 38% are 'formal trainings rarely', others are evenly distributed No Consensus	**3**
		[CADD] 39% are 'formal training occasionally', and 36% 'formal trainings rarely', and 6% are 'no formal Consensus	3
Processes 18	What is the percentage of the following surveys performed by your office?	[Topographic surveys] 12 of 30 responses are '0-20%', 7 0f 30 are ' 81-100%' and others are evenly distributed Controversy	2
		[Drainage surveys] 17 of 30 responses are ' 0-20%', 4 of 30 are '21-40%', and others are evenly distributed Controversy	**2**
		[Control surveys] 16 of 30 responses are ' 0-20%', 5 of 30 are '21-40%', and others are evenly distributed Controversy	**2**
		[Preliminary property surveys] 14 of 30 responses are ' 0-20%', 12 of 30 are either '21-40%' or '81-100%', and others	**2**

		are evenly distributed No Consensus	
		[Proposed right of way surveys] 20 of 30 responses are either ' 0-20%' or '21-40%', 8 of 30 are either '61-80' or '81-100%', Controversy	**2**
		[Eminent Domain surveys] 17 of 30 responses are ' 0-20%' and other are evenly distributed , Controversy	**2**
		[Construction stake out] 15 of 30 response are ' 0-20%', 10 of 30 are '21-60%', other are evenly distributed Controversy	**2**
		[Surveying to document earthwork pay quantities] 6 of 30 response are ' 0-20%', 10 of 30 are '81-100%', other are evenly distributed Controversy	**2**
		[Surveying to document other pay quantities] 10 of 30 response are ' 0-20%', 8 of 30 are '81-100%', 12 of 30 are ' 21-80' No Consensus	**2**
Processes 23	Will the data exported from your data collector import into Microstation/Geopak without any additional editing?	75% 'yes' and 25% 'No'	**1**

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Study No. 222
Best Practices of MDOT's Survey Operation, Organization and Technology Implementation
Questionnaire for Survey Management (Group 3) – Analysis & Summary

- Current Responses – 59
- Questions - 37
- Basic Analysis Approach
    - Step 1 - Categorize Responses to each question in the following broad categories:
        - Consensus (90%+) agreement
        - Emerging Consensus (65%-95%) agreement
        - Controversy (no single response > 64%)
    - Step 2 - Divide Results into three sections as follows:
        - SECTION 1 - MDOT Best Operational Approach
        - SECTION 2 - MDOT Most Effective Organizational Model
        - SECTION 3 - MDOT Best Survey Technology Roll-out Strategy
    - Step 3 - Identity Important, Interrelated and Cross-cutting Results
    - Step 4 - Build Narrative which Explains the Results and draws Conclusions from the Research Instruments

Study No. 222
Best Practices of MDOT's Survey Operation, Organization and Technology Implementation
Questionnaire for Survey Management (Group 3) – Analysis & Summary
SECTION 1 - MDOT Best Operational Approach for Survey

Question #	Question	Results and Characterization	Importance of Result (1-5) & notes
General Operation 2a1	What areas of MDOT survey operations are in need of change?	[Surveying Techniques] – 73% responses are either 'few' or 'some' changes Emerging Consensus	
		[Surveying Equipment] – 76% responses are either 'few' or 'some' changes Emerging Consensus	
		[Data Delivery Techniques] – 73% responses are either 'few' or 'some' changes Emerging Consensus	
General Operation 3	What should the role of consultants be in MDOT survey operations?	16% of responses are 'MDOT personnel should perform all surveys' ,7% are 'Consultants should perform all MDOT surveys', 19% are 'Both MDOT consultants should perform MDOT surveys', 12% are 'MDOT should contract with consultants to do preliminary surveys', 14% are ' MDOT should contract with consultants to do control surveys', and 33% are 'No answer' Controversy	
General Operation 4	Select your training needs for the following categories of Survey Skills:	**[Data collection(3D and/or 2D)]**59% of responses are 'some training' or 'lots of training', 24% are 'Little Training, and 14% 'training is sufficient Controversy	
		[Leveling] 57% of responses are 'some training' or 'little training', 5% are 'much Training, and 35% 'training is sufficient No Consensus	
		[Total station] 63% of responses are 'some training' or 'little training', 5% are 'much Training, and 28% 'training is sufficient Consensus	
		[PCODES and Linking codes] 62% of responses are 'some training' or 'little training', 7% are 'much Training, and 27% 'training is sufficient Consensus	
		[DTM] 62% of responses are 'some training' or 'little training', 22% are 'much Training, and 14% 'training is sufficient	

		Consensus	
		[Cogo] 63% of responses are 'some training' or 'little training', 11% are 'much Training, and 17% 'training is sufficient Consensus	
		[Microstation/GeoPak] 57% of responses are 'some training' or 'little training', 30% are 'much Training, and 12% 'training is sufficient No Consensus	
		[RWD Codes] 70% of responses are 'some training' or 'little training', 9% are 'much Training, and 14% 'training is sufficient Consensus	
		[Allegro data collectors] 72% of responses are 'some training' or 'little training',2% are 'much Training, and 19% 'training is sufficient Consensus	
		[Other Survey Equipment] 69% of responses are 'some training' or 'little training',8% are 'much Training, and 17% 'training is sufficient Consensus	
		[General Survey Procedure] 70% of responses are 'some training' or 'little training',10% are 'much Training, and 17% 'training is sufficient Consensus	
		[Survey Standards and Practices] 62% of responses are 'some training' or 'little training',17% are 'much Training, and 19% 'training is sufficient Consensus	
Quality Measures 1.a	Please give your opinion of the following:	[Production (Speed, completion of tasks, making deadlines, ...) is the most important priority in my unit] -27 of 60 responses are either 'Strongly Agree' or 'Agree' 20 of 60 are 'Neither agree nor disagree', and 13 are 'Disagree' No Consensus	
		Quality of Product (Accuracy, completeness, delivery in proper format) is the most important priority of my unit – 25 of 27 either 'Strongly Agree' or 'Agree' Consensus	
Quality Measures 1.b	Please rate the accuracy of the following statements:	[I believe production <u>should be</u> the most important priority in my unit.] 44% of	

		responses are either 'agree' or 'strongly agree', 23% are 'Neither agree nor Disagree', and 30% are 'Disagree' No Consensus	
		[I believe quality should be the most important priority in my unit] 96% of responses are either 'agree' or 'strongly agree' Strong Consensus	
Performance 2	What vertical accuracy level can you achieve with the following equipment?	[RTK Equipment (Vertical)] 14% responses are .05', 17% are .07', 36% are .10' and 34% are 'I don't Know' Controversy	
		[Total Station (Vertical)] 37% of responses are .03'and 27% are .05' , all other answers have some responses Controversy	
Performance 3	What horizontal accuracy level can you achieve with the following equipment?	[RTK Equipment (Horizontal)] 35% of responses are .03' Controversy	
		[Total Station (Horizontal)] 37% of responses are .03' Controversy	
Standards 9-1	What other topics do you think need to be covered in more detail in the MDOT Survey Manual?	14 'yes' 45 ''no Answer ' Consensus	
Standards 9-2	What other topics do you think need to be covered in more detail in the MDOT Survey Manual?	5 'yes' 54 ''no Answer ' Consensus	
Standards 9-3	What other topics do you think need to be covered in more detail in the MDOT Survey Manual?	2 'yes' 57 'no Answer' Consensus	
Standards 9-4	What other topics do you think need to be covered in more detail in the MDOT Survey Manual?	59 'no Answer ' Consensus	
Standards 9-5	What other topics do you think need to be covered in more detail in the MDOT Survey Manual?	59 'no Answer ' Consensus	

Standards 10	Are the requirements as defined by the current MDOT Survey Manual being met?	25 'yes' ,6 'no' and 28 'I don't know' Controversy	
Standards 11	Are MDOT surveying practices meeting the professional standards established by the Mississippi Board of Licensure for Professional Engineers and Surveyors?	52 'yes', 8 'no' Consensus	
Standards 12	Should MDOT surveying standards exceed the professional surveying standards set forth by the Mississippi Board of Licensure for Professional Engineers and Surveyors?	22 'yes' 37 'no' Controversy	
Standards 6	How often should the MDOT Survey Manual be revised?	1 1.69% responses are 'Every 6 Months' 23.73% are 'Yearly', 18.64% are 'Every other Year', 20 33.90% 'Every 5 Years', and 13 22.03% are 'I Don't know' No Consensus	
Standards 18	Have you read and understood the standard MDOT's Survey Manual?	44 'yes' 56 'no' Controversy	
Standards 13	Are all existing and proposed right of way and property line surveys being done by MDOT survey crews under the direct supervision of a Licensed Professional Surveyor?	35 'yes' 24 'no' Controversy	
Standards 14	Please give your opinion of the of the following:	**[Professional Surveyors across the State see MDOT surveying practices as sub-standard]** 1.69% response are ' STRONGLY AGREE' 20.34% are ' AGREE' 30.51% are ' NEITHER AGREE', 27.12% are ' NOR DISAGREE', 3 5.08% are DISAGREE STRONGLY DISAGREE,15.25% are ' I DON'T KNOW ' No Consensus	
		[MDOT is leading the way for surveyors across the State with modern surveying equipment] 10% response are ' STRONGLY AGREE' 22% are ' AGREE' 30% are ' NEITHER AGREE', 27% are ' NOR DISAGREE', 4% are DISAGREE	

		STRONGLY DISAGREE,7% are ' I DON'T KNOW ' No Consensus	
		[MDOT Survey should set as a goal to lead the state of Mississippi with the best reputation for quality surveys] 85 % response are either' STRONGLY AGREE' or ' AGREE' 15% are ' NEITHER AGREE', Consensus	
Processes 1	Do you agree with the statement "3d field collection procedures and modeling is too complicated and should not be adopted within MDOT"?	2 'yes', 57 'no' Consensus	
Processes 4	Does your crew collect topographical & elevation information at the same time?	54 'yes', 5 'no' Consensus	
Deliverable 5	Is there effective communication among Roadway Design, Right of Way and the Districts?	23 'yes', 36 'No' Controversy	

SECTION 2 - MDOT Most Effective Organizational Model

Question #	Question	Results and Characterization	Importance of Result (1-5) & notes
General Operation 2a1	What areas of MDOT survey operations are in need of change?	[Organization of Surveying Tasks] – 77% responses are 'few' or 'some' changes Emerging Consensus	
		[Personnel policies and job Classifications] – 66% responses are either 'few' or 'some', 42 responses are 'some' or 'major' Controversy	
		[Use of Consultants] – 34% responses are 'few' or 'none', 37% are either 'some' or 'major' Controversy	
		[Division of responsibilities between District and Project Offices] – 56% responses are 'few' or 'none', 33 % are either 'some' or 'major' Controversy	
Standards 8	Are all surveying activities within	58 'yes', 42 'no' Controversy	

	your office being performed under the direct supervision of a professional surveyor?		
Organization 1	What is the typical number of crew members in your conventional survey crew?	3% responses are '2', 36%are '3' and 46% are '4'and others have some values Controversy	
Organization 2	What is the typical number of crew members in your GPS surveying party?	17% responses are '2', 34%are '3' and 19% are '4' Controversy	
Organization 4	In your opinion is your current model effective and efficient?	33 'yes', 26 'no' Controversy	
Organization 5	Which organizational survey model is the most efficient in your opinion?	16.95% responses say 'Most of the preliminary survey activities are preformed at the district office and other construction related survey duties are performed at the project office. All survey duties are performed under the direct supervision of a professional surveyor.' 20 33.90% say 'Most of the preliminary survey activities are preformed at the district office under the direct supervision of a professional surveyor and other construction related survey duties are performed at the project office without direct supervision of a professional surveyor' 18.64% say 'District office performs some surveying duties primarily establishing project control and performing some boundary surveys under the direct supervision of a professional surveyor' and 20.34% say 'Project office performing most of the preliminary surveys including boundary surveys without direct supervision of a professional surveyor. District office performs some surveying duties primarily establishing project control ' No Consensus	
Organization 6	Does the current State Personnel Board job classification adequately	10 'yes', 49 'no' consensus	

	cover the surveying profession?		
Organization 10	In your District, which survey operations are centralized and which operations are performed by the individual project offices?	[Control Surveys] 78 % responses are 'Central office functions', only 2% are 'project office functions' and 20% are Both Emerging Consensus	
		[Preliminary surveying for engineering design (topo, drainage, cross sections, etc.)] 17 % responses are 'Central office functions', 51 % are 'project office functions' and 32% are Both No Consensus	
		[Preliminary Right of Way stakeout for appraisal] 25 % responses are 'Central office functions', 51 % are 'project office functions' and 24% are Both No Consensus	
		[Eminent Domain Surveys] 64 % responses are 'Central office functions', 48 % are either 'project office functions' or 'Both' Consensus	
		[Construction Staking] 90 % responses are 'project office functions' Consensus	
		[Surveying for earthwork quantities] 100 % responses are 'project office functions' Strong Consensus	
Organization 12	Should MDOT have a formal career path establish for survey technicians?	57 'yes', 2 'no' Consensus	
Organization 16	Should MDOT have a formal career path for inspection & construction personnel?	57 'yes', 2 'no' Consensus	
Organization 20	Should each project office have a PLS in the office?	39 'yes', 20 'no' Controversy	
Organization 22	Do you agree that MDOT should be inspecting survey work performed by consultants?	43 'yes', 16 'no' Controversy	
Organization 23	Is your office adequately staffed to perform these inspections?	21 'yes', 13 'no' Controversy	
Organization 24	Who is responsible for reviewing preliminary topographical surveys prior to their final submittal?	43% responses are 'District Surveyor' 33% are 'CADD Coordinator' 34% are 'Project Engineer' and 13% are	

		'Construction Engineer' No Consensus	
Organization 15	Please give your opinion of the following:	[My office has an established succession plan for retaining trained and qualified surveyors] 48% 'Disagree', other responses evenly divided Controversy	
		[I do not have time to attend training classes] 76% are either 'disagree' or 'strongly disagree' Emerging Consensus	
		[Training is needed and should be required as part of our job classifications] 80% 'agree' or 'strongly agree' Emerging Consensus	

SECTION 3 - MDOT Best Survey Technology Roll-Out Strategy

Question #	Question	Results and Characterization	Importance of Result (1-5) & notes
General Operation 2a1	What areas of MDOT survey operations are in need of change?	[Training] – 71% responses are 'few' or 'some' changes Emerging Consensus	
Equipment 15	In your opinion, is the surveying office adequately staffed to perform the necessary job functions required to submit finalized electronic drawings to Roadway Design?	44 'yes', 15 'no' Consensus	
Equipment 16	If not, what additional staffing needs would improve this workflow?	100 % responses are 'yes' Strong Consensus	
Equipment 18	What is your level of experience using GPS?	4 responses '0 -1 years', 24 responses '2-3 years', 13 responses 'more than 3 years' Controversy	
Equipment 19	How does GPS equipment improve productivity compared to conventional equipment?	80% responses are 'More Production' or 'Much More Production' Consensus	
Performance 1	What is your confidence level of the accuracy of the	[RTK (Vertical)] 19 of 59 responses are 'confident', 'very confident' or 'completely confident', 35 responses are 'Somewhat	

	following equipment?	confidence' Controversy	
		[RTK (Horizontal)] 54 of 59 responses are 'confident', 'very confident' or 'completely confident', 1 response is 'lacking all confidence' Emerging Consensus	
		[Static (Vertical)] 47 of 57 responses are 'confident', 'very confident' or 'completely confident', 1 response is 'lacking all confidence' Consensus	
		[Static (Vertical)] 57 of 59 responses are 'confident', 'very confident' or 'completely confident', 2 response are somewhat confidence' Emerging Consensus	
Performance 4	Please give your opinion of the following surveying performance issues:	[Rtk equipment may be suitable for horizontal surveys but is not suitable for vertical surveys.] 46% are 'Strongly agree' or 'agree', 36% are 'Neither agree nor disagree', 15% are 'Disagree' No Consensus	
		[Rtk equipment is suitable for all surveys with the exception of special situations where class 1 vertical accuracy is required.] 56% are 'Strongly agree' or 'agree', 20% are 'Neither agree nor disagree', 20% are 'Disagree' No Consensus	
		[Current data collection software used in my office is suitable for daily surveying operations] 79% are 'Strongly agree' or 'agree', 11% are 'Neither agree nor disagree', 8% are 'Disagree' Consensus	
		[The data collection software currently used in my office is easy to use] 52% are 'Strongly agree' or 'agree', 20% are 'Neither agree nor disagree', 15% are 'Disagree' No Consensus	
Performance 5	Which brand do you think produces the best surveying software?	32 % of responses are SMI, 24 % are Calson, 10 % are Topcon, 5% are TDS, and 17% are Leica No Concenses	
Training 2	**What formal training has your office established for survey**	**[Professional]** 10% are 'formal trainings regularly', 36% 'formal training occasionally', and	

	personnel?	37% 'formal trainings rarely', 9% are 'no formal trainings Controversy	
		[Technical] 7% are 'formal trainings regularly', 36% 'formal training occasionally', and 10% 'formal trainings rarely', 45% are 'no formal trainings No Consensus	
		[Field Work] 64% responses are either 'formal training occasionally' or 'formal trainings rarely', other responses have some values Emerging Consensus	
		[CADD]] 82% responses are either 'formal training occasionally' or 'formal trainings rarely', other responses have some values Emerging Consensus	
Processes 29a	In your opinion, what percent of ROW markers set by contractors meet MDOT specifications and standards of practice?	2 responses are '0-25%',12 are '26-50%', 17 are '51-75%', 28 are '76-100%' Controversy	
Processes 29b	Should MDOT establish a standard procedure for checking the placement of ROW markers?	52 'yes', 7 'no' Consensus	
Processes 6	In any survey work other than Control Surveys, do the field crews regularly calculate atmospheric corrections in the total stations?	12 'yes', 47 'no' Consensus	
Processes 7	In any survey work other than Control Surveys, do you use an average yearly atmospheric correction factor?	20 'yes', 25'no' Controversy	
Processes 8	In any survey work other than Control Surveys, do you think an average yearly atmospheric correction factor is accurate enough?	24 'yes', 13 'no' Controversy	
Equipment 1	Please give your opinion of the following statements	[MDOT has the proper surveying equipment to perform surveying duties] 75% responses	

	regarding Equipment	are either 'strongly agree', or 'Agree', Consensus	
		[MDOT is keeping up with modern surveying technologies and equipment] 68% responses are either 'strongly agree', or 'Agree', 22% are 'neither agree nor disagree', Consensus	
		[MDOT is providing the necessary surveying equipment to all survey crews across the State] 42% responses are either 'strongly agree', or 'Agree', 25% are 'neither agree nor disagree', and 11% are 'disagree' No Consensus	
		[MDOT should have GPS equipment available for all surveying operations] 84% responses are either 'strongly agree', or 'Agree', Consensus	
		[MDOT should lease modern surveying equipment such as GPS] 20% responses are 'strongly agree', 14% are 'Agree', 39% are 'neither agree nor disagree', and 27% are 'disagree' No Consensus	
		[MDOT Districts have adequate budgeting for current and future surveying equipment] 25% responses are either 'strongly agree' or 'Agree' 29% are 'neither agree nor disagree', No Consensus	
		[MDOT staff using modern surveying equipment are being trained to use this equipment properly and effectively]] 40% responses are either 'strongly agree', or 'Agree', 22% are 'neither agree nor disagree', and 36% are 'disagree' No Consensus	
		[MDOT needs to use the same data collection software for all surveying equipment (total stations, robotics, and GPS)?]] 66% responses are either 'strongly agree', or 'Agree', Consensus	

		[The computer hardware and software available to Survey staff is adequate for processing our survey data]] 68% responses are either 'strongly agree', or 'Agree', Consensus	

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Question #	*Question*	*Results and Characterization*	*Importance of Result (1-5) & notes*
General Operation 1	Please give your opinion of the following:	[Surveying Operations are very important to MDOT] 99% responses are either 'strongly agree', or 'Agree' Strong Consensus	**3**
		[MDOT places a great deal of emphasis on Surveying Operations] 63% responses are either 'strongly agree', or 'Agree', 16% are 'neither agree nor disagree', and 12% are 'disagree' No Consensus	**3**
		[MDOT has dedicated enough resource to Surveying Operations] 55% responses are either 'strongly agree', or 'Agree', 22 are 'neither agree nor disagree', and 22% are 'disagree' No Consensus	**3**
General Operation 2a1	What areas of MDOT survey operations are in need of change?	[Surveying Techniques] – 88% responses are either 'few' or 'some' changes Consensus	**3**
		[Surveying Equipment] – 66% responses are either 'few' or 'some' changes , Consensus	**3**
		[Data Delivery Techniques] – 56% responses are 'few' or 'some', 27% either 'none' or 'major' changes No Consensus	**3**
General Operation 3	What should the role of consultants be in MDOT survey operations?	4% of responses are 'MDOT personnel should perform all surveys' , 19% are 'Consultants should perform all MDOT surveys', 22% are 'Both MDOT consultants should perform MDOT surveys',	**1**

		28% are 'MDOT should contract with consultants to do preliminary surveys', 14% are ' MDOT should contract with consultants to do control surveys', and 17% are 'No answer' Controversy	
Standards 12	Should MDOT surveying standards exceed the professional surveying standards set forth by the Mississippi Board of Licensure for Professional Engineers and Surveyors?	27 'yes' 73 'no' Consensus	**3**
Standards 13	All exist and proposed right of way and property line surveys being done by MDOT survey crews under the direct supervision of a Licensed Professional Surveyor?	*83% 'Yes', 17% 'No' Consensus*	**4**
Processes 26	What route should project offices use to submit their data to Roadway Design?	3 responded 'Send Data Directly to Roadway Design', 13 responded 'Route Data Through the District Office' 3 responded 'Other' Consunsus	**1**
Processes 29a	In your opinion, what percent of ROW markers set by contractors meet MDOT specifications and standards of practice?	4 of 18 responses are '26-50%' 6 of 18 are '51-75%' and, 8 are '76-100%' No Consensus	**4**
Processes 29b	Should MDOT establish a standard procedure for checking the placement of ROW markers?	*14 'yes', 4 'no'. Consensus*	**4**

SECTION 2 - MDOT Most Effective Organizational Model

Question #	Question	Results and Characterization	Importance of Result (1-5) & notes
General Operation 2a1	What areas of MDOT survey operations are in need of change?	[Organization of Surveying Tasks] – 66% responses are either 'few' or 'some' changes Consensus	**3**
		[Personnel policies and job Classifications] – 5% responses are 'no' or 'few' 71% are 'some' or 'major' Consensus	**5**
		[Use of Consultants] – 50% responses are 'few' ,33% are 'some' others evenly distributed No Consensus	**3**
		[Division of responsibilities between District and Project Offices] – 66% responses are either 'few' or 'some' changes Consensus	**3**
Organization 5	Which organizational survey model is the most efficient in your opinion?	[Most of the preliminary survey activities are preformed at the district office and other construction related survey duties are performed at the project office. All survey duties are performed under the direct supervision of a professional surveyor.] 17%	**4**
		[Most of the preliminary survey activities are preformed at the district office under the direct	

		supervision of a professional surveyor and other construction related survey duties are performed at the project office without direct supervision of a professional surveyor] 17%	**4**
		[District office performs some surveying duties primarily establishing project control and performing some boundary surveys under the direct supervision of a professional surveyor] 17%	**4**
		[Project office performing most of the preliminary surveys including boundary surveys without direct supervision of a professional surveyor. District office performs some surveying duties primarily establishing project control] 17%	**4**
		[Eminent Domain Surveys] 10 of 18 responses are 'central office functions', 3 responses are 'Functions shared by both central & project offices '11% No Consensus	**4**
Organization 20	Should each project office have a PLS in the office?	39 'yes', 61 'no'. Controversy	**4**

Organization 22	Do you agree that MDOT should be inspecting survey work performed by consultants?	61 'yes', 39 'no' Controversy	**2**
Organization 23	Is your office adequately staffed to perform these inspections?	28 'yes', 61 'no' , and 11 'no answer' Controversy	**2**
Organization 24	Who is responsible for reviewing preliminary topographical surveys prior to their final submittal?	50% responses are 'District Surveyor', 22% are 'CADD coordinator', 28% are 'project Engineer' , 11% 'construction Engineer' No Consensus	**1**
Deliverables 5	Is there effective communication between your office and Roadway Design, Right of Way?	72% 'yes', 23 'no' consensus	**4**
Deliverables 6	Should a Division in Jackson contact the District if there is an apparent problem with survey data provided by the District?	94.44% 'yes' , 5.56% 'no' Strong Consensus	**1**

SECTION 3 - MDOT Best Survey Technology Roll-Out Strategy

Question #	Question	Results and Characterization	Importance of Result (1-5) & notes
General Operation 2a1	What areas of MDOT survey operations are in need of change?	[Training] – 27% responses are either 'some', 'major' or 'complete overhaul', 48% responses are 'few or Some changes' No Consensus	**1**
Equipment 1	Please give your opinion of the following statements regarding Equipment	[MDOT has the proper surveying equipment to perform surveying duties] 100% responses are either 'strongly agree', or 'Agree', Strong Consensus	**1**
		[MDOT is keeping up with modern surveying technologies and equipment] 88% responses are either 'strongly agree', or 'Agree', 22% are 'neither agree nor disagree', Consensus	**1**
		[MDOT is providing the necessary surveying equipment to all survey crews across the State] 88% responses are either 'strongly agree', or 'Agree', 16% are 'neither agree nor disagree', and 16% are 'disagree' No Consensus	**1**
		[MDOT should have GPS equipment available for all surveying operations] 70% responses are either 'strongly agree', or 'Agree', Consensus	**1**
		[MDOT should lease modern surveying equipment such as GPS] 6% responses are 'strongly agree', 14%	

		are 'Agree', 39% are 'neither agree nor disagree', and 27% are 'disagree' No Consensus	**1**
		[MDOT Districts have adequate budgeting for current and future surveying equipment] 39% are 'neither agree nor disagree', other responses are evenly distributed No Consensus	**1**
		[MDOT staff using modern surveying equipment are being trained to use this equipment properly and effectively]] 44% responses are either 'strongly agree', or 'Agree', 22% are 'neither agree nor disagree', and 32% are 'disagree' No Consensus	**5**
		[MDOT needs to use the same data collection software for all surveying equipment (total stations, robotics, and GPS)?]] 88% responses are either 'strongly agree', or 'Agree', Consensus	**1**
		[The computer hardware and software available to Survey staff is adequate for processing our survey data]] 73% responses are either 'strongly agree', or 'Agree', Consensus	**1**

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Questionnaire for Customers (Group 5) – Analysis & Summary

SECTION 1 - MDOT Best Operational Approach for Survey

Question #	*Question*	*Results and Characterization*	*Importance of Result (1-5) & notes*
Admin1a	What problems is your division encountering with Survey data?	10% responses are 'Formats' 20% are 'Accuracy' 10% are 'Timely submittal' 70% are ' Completeness' and the 20% are 'Other' No Consensus	**5**
Admin1b	*Please Comment*	*N/A*	**3**
Admin2a	Does the data received from the district require any manipulation, re-formatting or modifications to be used in the design applications?	*20% 'yes', 80% 'No'* Strong Consensus	
Admin2b	*Please Comment*	N/A	
Admin3	Does your office receive all the information required when surveys are originally submitted?	*20% 'yes', 80% 'No'* Strong Consensus	**5**
Admin4	Are your division's survey needs/requirements outlined in the MDOT Survey Manual?	100% 'yes' Strong Consensus	**5**

SECTION 2 - MDOT Most Effective Organizational Model

Question #	*Question*	*Results and Characterization*	*Importance of Result (1-5) & notes*
Deliverable 5	*Is there effective*	*90% 'Yes' , 10% 'No' Strong*	

	communication among Roadway Design, Right of Way and the Districts?	*Consensus*	**5**
Deliverable 7a	*Should a Division in Jackson contact the District if there is an apparent problem with survey data provided by the District?*	*90% 'yes', 10 'no' Strong Consensus*	**1**
Deliverable 7b	*Who should they contact*	*N/A*	
Field summary 8	Do surveys received by you office meet all requirements as outlined in the survey manual and CADD manual?	*30 'yes', 70 'no' Strong Consensus*	**5**

APPENDIX E

GROUPED DESCRIPTIVE STATISTICAL

SECTION 1 - MDOT Best Operational Approach for Survey

General Operation 2a1	What areas of MDOT survey operations are in need of change?	[Surveying Equipment] – 17 of 28 responses are either 'few' on 'none', 10 of 28 are either 'some' or 'major' changes Controversy	**2-3**
Quality Measures 3	When establishing secondary control what percentage of the time do you employ resection procedures?	10%, 25%, 50% and 'never' all receive 4+ responses Controversy	**2**

- 60 % of the field staff (Group1) believe that 'few' or 'no changes' are required in the case Surveying Equipments used in MDOT survey operations while 35% responded that 'some' or 'major changes are needed. This showed that there was some kind controversy in the responses but majority of responses suggest few changes are needed for surveying Equipment.
- The field staff also gave another controversial response regarding the percentage of time spent while employing resection procedures when establishing secondary control. But '50% of time' received the highest number of responses that is 7. Others have values 4 or above except '75% of time'. This indicate the time spent on the procedures vary depending on some other factors.

SECTION 2 - MDOT Most Effective Organizational Model

General Operation 2a1	What areas of MDOT survey operations are in need of change?	[Organization of Surveying Tasks] – 21 of 28 responses are 'few' or 'some' changes Emerging Consensus	**3**
		[Personnel policies and job Classifications] – 13 or 28 responses are either 'few' or 'none', 13 or 28 responses are 'some' or 'major' Controversy	**3**
		[Use of Consultants] – 16 of 28 responses are 'few' or 'none', 9 of 28 are either 'some' or 'major' Controversy	**3**
		[Division of responsibilities between District and Project Offices] – 15 of	

		28 responses are 'few' or 'none', 11 of 28 are 'some' or 'major' Controversy	**3**

- On various areas of MDOTS operations, 75% the field staff agrees on the need of 'few' or 'some' changes on Organization of Surveying tasks but other responses show controversy.

SECTION 3 - MDOT Best Survey Technology Roll-Out Strategy

Equipment 2	Please indicate which equipment is available to your unit as follows:	[GPS Equipment] 53% of responses are 'Available and in Regular Use', 30% of responses are 'Available but Training Needed' or 'Not Available and Needed', 17% of responses are 'Available but not Needed', 'Available but Rarely Used', or 'Available but Rarely Used' Consensus	**3**
		[Total Station] 76% of responses are 'Available and in Regular Use', 10% of responses are 'Available but Training Needed' or 'Not Available and Needed', 13% of responses are 'Available but not Needed' or 'Available but Rarely Used' Emerging Consensus	**3**
		[GPS RTK Equipment] 47% of responses are 'Available and in Regular Use', 23% of responses are 'Available but Training Needed' or 'Not Available and Needed', 30% of responses are 'Available but not Needed' or 'Available but Rarely Used' Emerging Consensus	**3**
		[Metal Detectors] 67% of responses are 'Available and in Regular Use', 3% are 'Available but Training Needed', 30% of responses are 'Available but not Needed' or 'Available but Rarely Used'	**3**

		Emerging Consensus	
		[Digital Levels] 46% of responses are 'Available and in Regular Use', 14 % of responses are 'Available but Training Needed' or 'Not Available and Needed', 37% of responses are 'Available but not Needed' or 'Available but Rarely Used' Controversy	**3**
Equipment 19	How does GPS equipment improve productivity compared to conventional equipment?	25 out of 28 responses are 'More Production' or 'Much More Production' Consensus	**2**
Performance 1	What is your confidence level of the accuracy of the following equipment?	[RTK (Vertical)] 19 of 59 responses are 'confident', 'very confident' or 'completely confident', 35 responses are 'Somewhat confidence' Controversy	**2**
		[RTK (Horizontal)] 54 of 59 responses are 'confident', 'very confident' or 'completely confident', 1 response is 'lacking all confidence' Emerging Consensus	**2**
		[Static (Vertical)] 47 of 57 responses are 'confident', 'very confident' or 'completely confident', 1 response is 'lacking all confidence' Consensus	**2**
		[Static (Vertical)] 57 of 59 responses are 'confident', 'very confident' or 'completely confident', 2 response are somewhat confidence' Emerging Consensus	**2**
Performance 6	Is your office utilizing the most recent and updated software and RWD programs provided by	[Equipment] 36% of responses are 'already well incorporated', 23% 'used regularly', 13% 'used occasionally' Controversy	**3**

	MDOT?		
		[Software] 33% of responses are 'already well incorporated', 26% 'used regularly', 23% 'don't know' Controversy	**3**
		[RWD Programs] 30% 'don't know', 26% of responses are 'already well incorporated' Controversy	**3**
Training 1	Select the training needs for the following categories of Survey Skills:	[Data collection(3D and/or 2D)] 39% of responses are 'some training' or 'lots of training', 26% 'training is sufficient Controversy	**3**
		[Leveling] 77% of responses are 'no training' or 'a little training' Emerging Consensus	**3**
		[Total station] 70% of responses are 'no training' or 'a little training' Emerging Consensus	**3**
		[PCODES and Linking codes] 33% of responses are 'no training' 13% of responses are 'lots of training' Controversy	**3**
		[DTM] 33% of responses are 'a little training' other responses are evenly divided Controversy	**3**
		[Cogo] 33% of responses are 'a little training' other responses are evenly divided Controversy	**3**
		[Microstation/GeoPak] 40% of responses are 'a little training' other responses are evenly divided Controversy	**3**

		[RWD Codes] 33% of responses are 'a little training' other responses are evenly divided Controversy	**3**
		[Allegro data collectors] 36% of responses are 'a little training' other responses are evenly divided Controversy	**3**
		[Other Survey Equipment] 33% of responses are 'a little training' other responses are evenly divided Controversy	**3**
		[General Survey Procedure] 30% of responses are 'a little training' other responses are evenly divided Controversy	**3**
		[Survey Standards and Practices] 33% of responses are 'a little training' other responses are evenly divided Controversy	**3**
Processes 1	Do you agree with the statement "3d field collection procedures and modeling is too complicated and should not be adopted within MDOT"?	**9 'yes' 19 'no'** Controversy	**2**

- On the Availability and Training needs on some of the surveying skills and equipments on average 33 % of the field staff responded that equipment is available and ready to use and 'little training' is needed on most of the skills and 70 % said 'no training ' or 'little training' required for leveling and total station skills. Other values are evenly distributed.
- 67 % of the crew didn't agree with the statement "3d field collection procedures and modeling is too complicated and should not be adopted within MDOT"
- Only 33% of the Field crew responses indicate that their office is utilizing the most recent and updated software and RWD programs provided by MDOT.

- 89% reached on a consensus that GPS equipment will help get 'More Production' or 'Much More Production' on survey operations

Questionnaire for Survey Field Staff – Analysis & Summary

SECTION 1 - MDOT Best Operational Approach for Survey

Question #	Question	Results and Characterization	Importance of Result (1-5) & notes
General Operation 2a1	What areas of MDOT survey operations are in need of change?	[Surveying Techniques] - 20 of 28 responses are either 'few' or 'some' changes Emerging Consensus	**4**
Quality Measures 1.a	Please give your opinion of the following:	[Production (Speed, completion of tasks, making deadlines, ...) is the most important priority in my unit] -27 of 60 responses are either 'Strongly Agree' or 'Agree' 20 of 60 are 'Neither agree nor disagree', and 13 are 'Disagree' No Consensus	**4**
		Quality of Product (Accuracy, completeness, delivery in proper format) is the most important priority of my unit – 25 of 27 either 'Strongly Agree' or 'Agree' Consensus	**4**
Quality Measures 1.b	Please rate the accuracy of the following statements:	[I believe production should be the most important priority in my unit.] 44% of responses are either 'agree' or 'strongly agree', 23% are 'Neither agree nor Disagree', and 30% are 'Disagree' No Consensus	**4**
		[I believe quality should be the most important priority in my unit] 96% of responses are either 'agree' or 'strongly agree' Strong Consensus	**4**
Equipment 3	Indicate how often you calibrate the following surveying tools?	[Total Stations] 36% of responses are 'yearly', other responses are evenly divided including 4/25 responses of	**4-5**

		'never' Controversy	
		[Set Parts per Million Corrections] 27% are 'yearly', other responses are evenly divided including 2/25 responses of 'never' Controversy	
		[Check and Adjust Prism Poles] 36% are 'quarterly', other responses are evenly divided including 2/25 responses of 'never' Controversy	**4-5**
		[Baseline Calibrations] 30% are 'yearly', other responses are evenly divided including 23% responses of 'never' Controversy	**4-5**
		[Fixed High Tripods] 20% of responses are 'never', other responses are evenly divided Controversy	**4-5**
		[Levels (Conventional and Digital)] 33% of responses are 'yearly', 30% of responses are 'quarterly', 17% of responses are 'monthly' Controversy	**4-5**
Equipment 12	Do you create DTM's?	15 - yes, 13 - no Controversy	**4**
Performance 2	What vertical accuracy level can you achieve with the following equipment?	[RTK Equipment (Vertical)] responses are evenly divided among .03', .05', .07' and .1' Controversy	**4**
		[Total Station (Vertical)] 46% of responses are .03', all other answers have some responses Controversy	**4**
		[Level(Vertical)] 66% of responses are .01' Emerging	**4**

		Consensus	
Performance 3	What horizontal accuracy level can you achieve with the following equipment?	[RTK Equipment (Horizontal)] 30% of responses are .03' Controversy	**4**
		[Total Station (Horizontal)] 36% of responses are .03' Controversy	**4**
Standards 10a	Do you refer to the Mississippi Board of Licensure for Professional Engineers and Surveyors "Standards of Practice for surveyors" when performing surveys?	14 'yes' 14 'no' Controversy	**4**
Standards 12	Should MDOT surveying standards exceed the professional surveying standards set forth by the Mississippi Board of Licensure for Professional Engineers and Surveyors?	13 'yes' 15 'no' Controversy	**4**
Standards 9	Have you read and understood the standard MDOT's Survey Manual?	15 'yes' 13 'no' Controversy	**4**
Standards 10b	Are you following the current MDOT Survey Manual?	13 'yes' 10 'no answer' Controversy	**4**
Processes 12	What is your preferred method of collecting earthwork?	Spot Shot/Breakline 56%, Total station 26% Controversy	**4**

-

- 70 % of the field crew believes that 'few' or 'some' changes are needed in the area of surveying techniques of MDOT survey operations.
- Over 90% of the Field crew believe that Quality of Product should be the most important priority of my unit
- 66% of the field crew can achieve a vertical accuracy level of .01' on Level (vertical) equipment. But other responses about accuracy levels on equipments show controversy. Reponses were evenly distributed among other values.
- Half of the field crew answered yes to the statement "Do you refer to the Mississippi Board of Licensure for Professional Engineers and Surveyors "Standards of Practice for surveyors" when performing surveys?" and half don't agree which shows controversy.
- 53% of the crew answered 'no' to the question "Should MDOT surveying standards exceed the professional surveying standards set forth by the Mississippi Board of Licensure for Professional Engineers and Surveyors?"
- Only 54% of the field crew have read and understood and follow the standard current standard MDOT's Survey Manual.
- Over 50% of the crew prefer using Spot Shot/Breakline as method of collecting earthwork compared to other methods like Total station.

SECTION 2 - MDOT Most Effective Organizational Model

Equipment 15a	In your opinion, is the surveying office adequately staffed to perform the necessary job functions required to submit finalized electronic drawings to Roadway Design?	66% responded 'yes' Emerging Consensus	**4**
Standards 8	Is direct supervision from a licensed surveyor required for the following types of surveys?	[Right of Way] 13 'yes', 8 'no' Controversy	**4**
		[Property Maps] 14 'yes' 5 'no' 9 'uncertain' Controversy	**4**
		[Eminent Domain] 70% 'yes' Emerging Consensus	**4**
Standards New1	Is Direct Supervision from a Licensed Surveyor Standard Practice in Your Office for the	[Right of Way] 8 'yes' 18 'not completed' Controversy	

	Following types of Surveys?		**4**
		[Property Maps] 8 'yes' 18 'not completed' Controversy	**4**
		[Eminent Domain] 70% 'yes' Consensus	**4**
Field summary	Should MDOT have a formal career path established for survey technician?	83% 'yes' Emerging Consensus	**5**
Organization 15	Please give your opinion of the following:	[I do not have time to attend training classes] 17/21 'disagree' or 'strongly disagree' Emerging Consensus	**4**
		[Training is needed and should be required as part of our job classifications] 70% 'agree' or 'strongly agree' Emerging Consensus	**4**

- 66% of the field personnel believe that the surveying office is adequately staffed to perform the necessary job functions required to submit finalized electronic drawings to Roadway Design
- 70 % responded that direct supervision from a licensed surveyor is a standard practice and required for Eminent Domain survey types.
- 83% responded "yes" to the question 'Should MDOT have a formal career path established for survey technician?'
- 70% of field personnel agree on the fact that Training is needed and should be required as part of their job classifications while 80% don't have time to attend training classes.

SECTION 3 - MDOT Best Survey Technology Roll-Out Strategy

Question #	Question	Results and Characterization	Importance of Result (1-5) & notes
General Operation 2a1	What areas of MDOT survey operations are in	[Training] – 18 of 28 responses are either 'some', 'major' or 'complete	

	need of change?	overhaul', only 3 responses were 'no change' Emerging Consensus Follow-up responses: – I believe the majority of survey parties are your lower level employees. Most of these are not able to understand the goal we are trying to achieve or how to obtain that goal. It is totally on the party chief to check behind every shot we take. I feel that we need higher ranking people in the party or a lot of training. – There needs to be more than one person in the crew that has knowledge of what to do – In house training for surveying techniques.	**4**

- More than 60 % of the crew believes that the lower level survey parties don't fully understand the goal of the surveying operation and lot of in house training is needed. They also believe that higher ranking people with knowledge of the operation should be part of the survey party

SECTION 1 - MDOT Best Operational Approach for Survey

General Operation 2a1	**What areas of MDOT survey operations are in need of change?**	[Surveying Techniques] - 25 of 31 responses are either 'few' or 'some' changes Consensus	**2**
		[Surveying Equipment] – 26 of 31 responses are either 'few' or 'some' changes Consensus	**2**
		[Data Delivery Techniques] – 22 of 31 responses are 'few' or 'some', 7 of 31 are either 'none' or 'major' changes Consensus	**2**
Standards 10a	Do you refer to the Mississippi Board of Licensure for Professional Engineers and Surveyors "Standards of Practice for surveyors" when performing surveys?	16 'yes' 13 'no' Controversy	**2**

- 80% of the CADD staff agreed on the need of 'few' or 'some' changes on Surveying techniques, Surveying Equipment, and Data Delivery Techniques.
- There was controversy in the responses on the statement "Do you refer to the Mississippi Board of Licensure for Professional Engineers and Surveyors "Standards of Practice for surveyors" when performing surveys?"; 55% say 'yes', 45% ' no'

SECTION 2 - MDOT Most Effective Organizational Model

General Operation 2a1	What areas of MDOT survey operations are in need of change?	**[Organization of Surveying Tasks] – 24 of 31 responses are either 'few' or 'some' changes** Consensus	**3**
		[Personnel policies and job Classifications] – 10-31 responses are 'none' or 'few', 17 of 31 are 'some' or 'major' changes **No Consensus**	**3**
		[Use of Consultants] – 15 of 31 responses are 'no' or 'few' , 9 of 31 are 'some' or 'major' No Consensus	**3**
		[Division of responsibilities between District and Project Offices] - 23-31 responses are either 'few' or 'some' changes Consensus	**3**
Standards 11	**Should all surveys be submitted**	65% 'yes' Emerging Consensus	

	to a Professional Surveyor for verification?		**2**
Standards 12	**Do you think the MDOT survey Manual covers all surveying topics with enough detail?**	68 % 'yes',25 % 'no' Emerging Consensus	**3**
Organization 14	**In your opinion is your current Organizational model effective and efficient?**	62% 'yes', 38% 'no' Emerging Consensus	**3**

- 77% of the CADD staff reached on a consensus that Organization of surveying tasks and Division of responsibilities between District and Project Offices need only 'some' of 'few' changes while responses on other areas showed controversy.
- About 65% of the staff agreed on the need of submittal of all surveys to a professional Surveyor for verification, adequacy of MDOT survey manual, and effectiveness of the current organizational model.

SECTION 3 - MDOT Best Survey Technology Roll-Out Strategy

Training 1	Select the training needs for the following categories of Survey Skills:	[Data collection(3D and/or 2D)] 55% of responses are 'some training' or 'lots of training', 44 % are little training and 'no training' No Consensus	**3**
		[PCODES and Linking codes] 26 % of responses are 'no training' 46% of responses are 'some training', 12% are 'lots of training' Consensus	**3**
		[DTM] 69% of responses are either 'lots of training' or 'some training', 13% are 'no training' Consensus	**3**
		[Microstation/GeoPak] 49% of responses are 'some training' , 23% are 'lot of training', 12% are' no training' No Consensus	**3**
		[LGO] 33% of responses are 'I don't know', 30 are 'some training' other responses are evenly divided No Consensus	**3**
Training 7	**What type of training has your office established in the following areas?**	[Professional surveying] 10% are 'formal trainings regularly', 20% 'formal training occasionally', and 10% 'formal trainings rarely', 45% are 'no formal trainings No	**3**

		Consensus	
		[Special Equipment or Software] 16% are 'formal trainings regularly', 32% 'formal training occasionally', and 26% 'formal trainings rarely', 23% are 'no formal trainings' No Consensus	**3**
		[Surveying Field Work] 38% are 'formal trainings rarely', others are evenly distributed No Consensus	**3**
		[CADD] 39% are 'formal training occasionally', and 36% 'formal trainings rarely', and 6% are 'no formal Consensus	3
Processes 18	**What is the percentage of the following surveys performed by your office?**	**[Topographic surveys] 12 of 30 responses are '0-20%', 7 0f 30 are ' 81-100%' and others are evenly distributed** Controversy	2
		[Drainage surveys] 17 of 30 responses are ' 0-20%', 4 of 30 are '21-40%', and others are evenly distributed Controversy	**2**
		[Control surveys] 16 of 30 responses are ' 0-20%', 5 of 30 are '21-40%', and others are evenly distributed Controversy	**2**
		[Preliminary property surveys] 14 of 30 responses are ' 0-20%', 12 of 30 are either '21-40%' or '81-100%', and others are evenly distributed No Consensus	**2**
		[Proposed right of way surveys] 20 of 30 responses are either ' 0-20%' or '21-40%', 8 of 30 are either '61-80' or '81-100%', Controversy	**2**
		[Eminent Domain surveys] 17 of 30 responses are ' 0-20%' and other are evenly distributed , Controversy	**2**
		[Construction stake out] 15 of 30 response are ' 0-20%', 10 of 30 are '21-60%', other are evenly distributed Controversy	**2**
		[Surveying to document earthwork pay quantities] 6 of 30 response are ' 0-20%', 10 of 30 are '81-100%', other are evenly	**2**

		distributed Controversy	
		[Surveying to document other pay quantities] 10 of 30 response are ' 0-20%', 8 of 30 are '81-100%', 12 of 30 are ' 21-80' No Consensus	**2**

- A key finding of technology Rollout section of the study is a consensus of 65% of field staff who believe that MDOT should modify the current training regime. Although most CADD operators believe their offices are well equipped with software many operators believe there is a lack of up to date

SECTION 1 - MDOT Best Operational Approach for Survey

Standards 9	Have you read and understood the standard MDOT's Survey Manual?	20 'yes' 9 'no' Consensus	**4**
Standards 10b	Are you following the current MDOT Survey Manual?	19 'yes' 1 'no answer' Strong Consensus	**4**

- 70% of the CADD staff responded that they have read and understood and following the current standard MDOT's survey Manual.

SECTION 2 - MDOT Most Effective Organizational Model

Equipment 4	In your opinion, does your office have adequate CADD staff to perform the necessary job functions required to submit finalized electronic drawings to Roadway Design?	65% are 'yes' and 35% 'no' Consensus	**4**
Organization 15	Please give your opinion of the following:	[My office has an established succession plan for retaining trained and qualified surveyors] 41 % 'Disagree',17% 'Strongly Disagree' and other responses evenly divided Controversy	**4**
		[My time is better spent working than attending training classes] 17%'Agree,'62% ' Disagree' Emerging Consensus	**4**
		[The Training that I have received is applicable to my day- to- day job functions] 44% 'Agree', 27% 'Neither agree nor disagree', 10% Disagree Controversy	**4**
		[Training is needed and should be required as part of our job classifications] 80% 'agree' or 'strongly agree' Consensus	**4**

Deliverables 24	Is there effective communication between your office and Roadway Design, Right of Way and the Districts?	57% ' Yes' and 43% 'No' Controversy	**4**

- 65% of the CADD staff believe that they have adequate CADD staff to perform the necessary job functions required to submit finalized electronic drawings to Roadway Design
- 62% believe that time spent attending training classes is better that time spent working and 80% of the staff believe that training is needed and should be required as part of our job classifications. But other responses about the current training programs and their application on day to day work showed some controversy.
- 57% of the CADD staff answered 'yes' to the question 'Is there effective communication between your office and Roadway Design, Right of Way and the Districts?'

SECTION 3 - MDOT Best Survey Technology Roll-Out Strategy

Question #	Question	Results and Characterization	Importance of Result (1-5) & notes
General Operation 2a1	What areas of MDOT survey operations are in need of change?	**[Training] – 24 of 31 responses are either 'some', 'major' or 'complete overhaul', 5 responses are 'few changes'** Emerging Consensus	**4**
Performance 5	**Your office is utilizing the most recent and updated equipment, software and RWD menus/configurations provided by MDOT.**	[Equipment] 58% of responses are 'Agree', 23% Strongly Agree', 10% are 'Neither agree or disagree', 10% are Disagree No Consensus	**4**
		[Software] 88% of responses are either 'agree' or ' strongly agree', 12% 'disagree', 10% 'neither agree nor disagree' Consensus	**4**
		[RWD Programs] 82% either 'Strongly agree' or ' Agree', 10% 'disagree' 6% 'neither agree nor Disagree' Consensus	**4**

- 77% of the CADD staff responded that major changes are needed regarding training.

- On Average, more than 85% of the CADD staff responded that their office is utilizing the most recent and updated software and RWD Programs provided by MDOT. Only 58% responded that the most recent and updated Equipments are used.

SECTION 1 - MDOT Best Operational Approach for Survey

General Operation 2a1	What areas of MDOT survey operations are in need of change?	[Surveying Techniques] – 73% responses are either 'few' or 'some' changes Emerging Consensus	**3**
		[Surveying Equipment] – 76% responses are either 'few' or 'some' changes Emerging Consensus	**3**
		[Data Delivery Techniques] – 73% responses are either 'few' or 'some' changes Emerging Consensus	**3**
Quality Measures 1.a	Please give your opinion of the following:	[Production (Speed, completion of tasks, making deadlines, ...) is the most important priority in my unit] -27 of 60 responses are either 'Strongly Agree' or 'Agree' 20 of 60 are 'Neither agree nor disagree', and 13 are 'Disagree' No Consensus	**2**
Quality Measures 1.b	Please rate the accuracy of the following statements:	[I believe production should be the most important priority in my unit.] 44% of responses are either 'agree' or 'strongly agree', 23% are 'Neither agree nor Disagree', and 30% are 'Disagree' No Consensus	**2**
Standards 11	Are MDOT surveying practices meeting the professional standards established by the Mississippi Board of Licensure for Professional Engineers and Surveyors?	52 'yes', 8 'no' Consensus	**3**
Standards 12	Should MDOT surveying standards exceed the professional surveying standards set forth by the Mississippi Board of Licensure for Professional Engineers and Surveyors?	22 'yes' 37 'no' Controversy	**3**

Processes 1	Do you agree with the statement "3d field collection procedures and modeling is too complicated and should not be adopted within MDOT"?	2 'yes', 57 'no' Consensus	**2**
Processes 4	Does your crew collect topographical & elevation information at the same time?	54 'yes', 5 'no' Consensus	**2**

- 73% of Management staff believes few changes in areas of surveying techniques, Surveying Equipment, and Data Delivery methods are needed. And 45% believe that Production should be the most important priority in their unit.
- 86% consensus was found on the statement "Are MDOT surveying practices meeting the professional standards established by the Mississippi Board of Licensure for Professional Engineers and Surveyors?" and 90 % of the staff agree on the statement "Does your crew collect topographical & elevation information at the same time?"
- 95% responded 'no' on the statement "3d field collection procedures and modeling is too complicated and should not be adopted within MDOT"?

SECTION 2 - MDOT Most Effective Organizational Model

General Operation 2a1	What areas of MDOT survey operations are in need of change?	[Organization of Surveying Tasks] – 77% responses are 'few' or 'some' changes Emerging Consensus	**3**
		[Use of Consultants] – 34% responses are 'few' or 'none', 37% are either 'some' or 'major' Controversy	**3**
		[Division of responsibilities between District and Project Offices] – 56% responses are 'few' or 'none', 33 % are either 'some' or 'major' Controversy	**3**
Standards 8	**Are all surveying activities within your office being performed under the direct supervision of a professional surveyor?**	58 'yes', 42 'no' Controversy	**2**

Organization 22	**Do you agree that MDOT should be inspecting survey work performed by consultants?**	43 'yes', 16 'no' Controversy	**3**
Organization 23	**Is your office adequately staffed to perform these inspections?**	21 'yes', 13 'no' Controversy	**3**
Training 2	**What formal training has your office established for survey personnel?**	**[Professional]** 10% are 'formal trainings regularly', 36% 'formal training occasionally', and 37% 'formal trainings rarely', 9% are 'no formal trainings Controversy	**3**
		[Technical] 7% are 'formal trainings regularly', 36% 'formal training occasionally', and 10% 'formal trainings rarely', 45% are 'no formal trainings No Consensus	**3**
		[Field Work] 64% responses are either 'formal training occasionally' or 'formal trainings rarely', other responses have some values Emerging Consensus	**3**
		[CADD]] 82% responses are either 'formal training occasionally' or 'formal trainings rarely', other responses have some values Emerging Consensus	**3**

- 77% of responses confirmed that some changes are needed in the Organization of surveying tasks in Survey operation. But other responses on similar issues showed some controversy regarding the use of consultants and the division of responsibilities between District and Project Offices.
- The staff also reached on consensus on the establishment of formal training for field work and CADD personnel

SECTION 3 - MDOT Best Survey Technology Roll-Out Strategy

Equipment 15	In your opinion, is the surveying office adequately staffed to perform the necessary job functions required to	44 'yes', 15 'no' Consensus	**2**

	submit finalized electronic drawings to Roadway Design?		
Equipment 16	If not, what additional staffing needs would improve this workflow?	100 % responses are 'yes' Strong Consensus	**2**
Equipment 18	What is your level of experience using GPS?	4 responses '0 -1 years', 24 responses '2-3 years', 13 responses 'more than 3 years' Controversy	**2**
Equipment 19	How does GPS equipment improve productivity compared to conventional equipment?	80% responses are 'More Production' or 'Much More Production' Consensus	**3**
Performance 1	What is your confidence level of the accuracy of the following equipment?	[RTK (Vertical)] 19 of 59 responses are 'confident', 'very confident' or 'completely confident', 35 responses are 'Somewhat confidence' Controversy	**2**
		[RTK (Horizontal)] 54 of 59 responses are 'confident', 'very confident' or 'completely confident', 1 response is 'lacking all confidence' Emerging Consensus	**2**
		[Static (Vertical)] 47 of 57 responses are 'confident', 'very confident' or 'completely confident', 1 response is 'lacking all confidence' Consensus	**2**
		[Static (Vertical)] 57 of 59 responses are 'confident', 'very confident' or 'completely confident', 2 response are somewhat confidence' Emerging Consensus	**2**
Processes 6	In any survey work other than Control Surveys, do the field crews regularly calculate atmospheric corrections in the total stations?	12 'yes', 47 'no' Consensus	**2**
Processes 7	In any survey work other than Control Surveys, do	20 'yes', 25'no' Controversy	

	you use an average yearly atmospheric correction factor?		**2**
Processes 8	In any survey work other than Control Surveys, do you think an average yearly atmospheric correction factor is accurate enough?	24 'yes', 13 'no' Controversy	**2**

- 85% of the staff responded that they have the required confidence level on equipments like RKT(horizontal) and Static(vertical/horizontal)
- Reponses on level of experience on GPS usage and average yearly accuracy of atmospheric factor showed controversy
- 80% of the staff also believed that the use of GPS equipment will result in more production

SECTION 1 - MDOT Best Operational Approach for Survey

Performance 2	What vertical accuracy level can you achieve with the following equipment?	[RTK Equipment (Vertical)] 14% responses are .05', 17% are .07', 36% are .10' and 34% are 'I don't Know' Controversy	**4**
		[Total Station (Vertical)] 37% of responses are .03'and 27% are .05' , all other answers have some responses Controversy	**4**
Performance 3	What horizontal accuracy level can you achieve with the following equipment?	[RTK Equipment (Horizontal)] 35% of responses are .03' Controversy	**4**
		[Total Station (Horizontal)] 37% of responses are .03' Controversy	**4**
Standards 10	Are the requirements as defined by the current MDOT Survey Manual being met?	25 'yes' ,6 'no' and 28 'I don't know' Controversy	**4**
Standards 18	Have you read and understood the standard MDOT's Survey Manual?	44 'yes' 56 'no' Controversy	**4**
Standards 13	All existing and proposed right of way and property line surveys being done by MDOT survey crews under the direct supervision of a Licensed Professional Surveyor?	35 'yes' 24 'no' Controversy	**4**

- Management staff response showed controversy regarding the accuracy levels that could be achieved using various equipments like RKT and total station. Reponses were distributed among different values
- About 48% of the Management staff believes that the requirements defined by the current MDOT Survey Manual being met while more than 50% are not sure about that.
- 56% of management staff responded that they haven't read and understood the standard MDOT's survey manual

- 60% responded 'yes' to the statement 'Are all existing and proposed right of way and property line surveys being done by MDOT survey crews under the direct supervision of a Licensed Professional Surveyor?'

SECTION 2 - MDOT Most Effective Organizational Model

Organization 4	In your opinion is your current model effective and efficient?	33 'yes', 26 'no' Controversy	**4**
Organization 5	Which organizational survey model is the most efficient in your opinion?	16.95% responses say 'Most of the preliminary survey activities are preformed at the district office and other construction related survey duties are performed at the project office. All survey duties are performed under the direct supervision of a professional surveyor.' 20 33.90% say 'Most of the preliminary survey activities are preformed at the district office under the direct supervision of a professional surveyor and other construction related survey duties are performed at the project office without direct supervision of a professional surveyor' 18.64% say 'District office performs some surveying duties primarily establishing project control and performing some boundary surveys under the direct supervision of a professional surveyor' and 20.34% say 'Project office performing most of the preliminary surveys including boundary surveys	**4**

		without direct supervision of a professional surveyor. District office performs some surveying duties primarily establishing project control ' No Consensus	
Organization 6	Does the current State Personnel Board job classification adequately cover the surveying profession?	10 'yes', 49 'no' consensus	**5**
Organization 10	In your District, which survey operations are centralized and which operations are performed by the individual project offices?	[Control Surveys] 78 % responses are 'Central office functions', only 2% are 'project office functions' and 20% are Both Emerging Consensus	**4**
		[Preliminary surveying for engineering design (topo, drainage, cross sections, etc.)] 17 % responses are 'Central office functions', 51 % are 'project office functions' and 32% are Both No Consensus	**4**
		[Preliminary Right of Way stakeout for appraisal] 25 % responses are 'Central office functions', 51 % are 'project office functions' and 24% are Both No Consensus	**4**
		[Eminent Domain Surveys] 64 % responses are 'Central office functions', 48 % are either 'project office functions' or 'Both' Consensus	**4**
		[Construction Staking] 90 % responses are 'project office functions' Consensus	**4**
		[Surveying for earthwork quantities] 100 % responses are 'project office functions' Strong Consensus	**4**
Organization 12	**Should MDOT have a formal career path establish for**	57 'yes', 2 'no' Consensus	

	survey technicians?		**5**
Organization 16	**Should MDOT have a formal career path for inspection & construction personnel?**	57 'yes', 2 'no' Consensus	**5**
Organization 20	**Should each project office have a PLS in the office?**	39 'yes', 20 'no' Controversy	**5**
Organization 15	Please give your opinion of the following:	[My office has an established succession plan for retaining trained and qualified surveyors] 48% 'Disagree', other responses evenly divided Controversy	**5**
		[I do not have time to attend training classes] 76% are either 'disagree' or 'strongly disagree' Emerging Consensus	**4**
		[Training is needed and should be required as part of our job classifications] 80% 'agree' or 'strongly agree' Emerging Consensus	**4**

- 56% of the management staff responded that the current model effective and efficient.
- Reponses about the efficacy of the organizational survey model were somehow evenly distributed among the options project offices or district office performing the preliminary survey operations
- 83% don't believe that the current State Personnel Board job classifications adequately cover the surveying profession?
- 78% of the management staff responded that Control Surveys and Eminent Domain Surveys are central office functions while more than 90% responded that Surveying for earthwork quantities and Construction Staking are project office functions.
- 96 % of responded 'yes' to the question 'Should MDOT have a formal career path established for survey technicians?'
- 96 % of management staff responded 'yes' to the question 'Should MDOT have a formal career path for inspection & construction personnel?**'**
- 66% of management staff believe that each office should have a PLS

- 80% of the management staff agree that training is needed and should be required as part of their job classification and believe they have time to attend training classes. But 48% responded that their office doesn't have an established succession plan for retaining trained and qualified surveyors.

SECTION 3 - MDOT Best Survey Technology Roll-Out Strategy

Question #	Question	Results and Characterization	Importance of Result (1-5) & notes
General Operation 2a1	What areas of MDOT survey operations are in need of change?	[Training] – 71% responses are 'few' or 'some' changes Emerging Consensus	**4**
Processes 29a	**In your opinion, what percent of ROW markers set by contractors meet MDOT specifications and standards of practice?**	2 responses are '0-25%',12 are '26-50%', 17 are '51-75%', 28 are '76-100%' Controversy	**4**
Processes 29b	**Should MDOT establish a standard procedure for checking the placement of ROW markers?**	52 'yes', 7 'no' Consensus	**4**

- 71% of management staff believe that 'few' or 'some' changes are needed on training operations
- Majority of the management staff believes that 76-100% of ROW markers set by contractors meet MDOT specifications and standards of practice.
- 88 % answered 'yes' to the statement 'Should MDOT establish a standard procedure for checking the placement of ROW markers?**'**

SECTION 1 - MDOT Best Operational Approach for Survey

General Operation 1	**Please give your opinion of the following:**	[Surveying Operations are very important to MDOT] 99% responses are either 'strongly agree', or 'Agree' Strong Consensus	**3**
		[MDOT places a great deal of emphasis on Surveying Operations] 63% responses are either 'strongly agree', or 'Agree', 16% are 'neither agree nor disagree', and 12% are 'disagree' No Consensus	**3**
		[MDOT has dedicated enough resource to Surveying Operations] 55% responses are either 'strongly agree', or 'Agree', 22 are 'neither agree nor disagree', and 22% are 'disagree' No Consensus	**3**
General Operation 2a1	**What areas of MDOT survey operations are in need of change?**	[Surveying Techniques] – 88% responses are either 'few' or 'some' changes Consensus	**3**
		[Surveying Equipment] – 66% responses are either 'few' or 'some' changes , Consensus	**3**
		[Data Delivery Techniques] – 56% responses are 'few' or 'some', 27% either 'none' or 'major' changes No Consensus	**3**
Standards 12	Should MDOT surveying standards exceed the professional surveying standards set forth by the Mississippi Board of Licensure for Professional Engineers and Surveyors?	27 'yes' 73 'no' Consensus	**3**

- Strong Consensus was reached on the importance of surveying operations for MDOT and 63% believe that MDOT places a great deal of emphasis on Surveying Operations
- 70% agreed on the need of some changes on Surveying Equipments and data delivery methods

- Majority of the staff disagreed on the statement "Should MDOT surveying standards exceed the professional surveying standards set forth by the Mississippi Board of Licensure for Professional Engineers and Surveyors?"

SECTION 2 - MDOT Most Effective Organizational Model

General Operation 2a1	What areas of MDOT survey operations are in need of change?	**[Organization of Surveying Tasks] – 66% responses are either 'few' or 'some' changes** Consensus	**3**
		[Use of Consultants] – 50% responses are 'few' ,33% are 'some' others evenly distributed No Consensus	**3**
		[Division of responsibilities between District and Project Offices] – 66% responses are either 'few' or 'some' changes Consensus	**3**
Organization 22	**Do you agree that MDOT should be inspecting survey work performed by consultants?**	61 'yes', 39 'no' Controversy	**2**
Organization 23	**Is your office adequately staffed to perform these inspections?**	28 'yes', 61 'no' , and 11 'no answer' Controversy	**2**

- The staff also believes on the need of changes on organization of survey tasks and division of responsibilities between District and project offices
- Other responses regarding the need of inspection of survey work by consultants and the adequacy of the staff which perform the inspection, showed some controversy

Questionnaire for Administration (Group 4) – Analysis & Summary

SECTION 1 - MDOT Best Operational Approach for Survey

Question #	*Question*	*Results and Characterization*	*Importance of Result (1-5) & notes*
Standards 13	**All exist and proposed right of way and property line surveys being done by MDOT survey crews under the direct supervision of a Licensed Professional Surveyor?**	*83% 'Yes', 17% 'No'* *Consensus*	**4**
Processes 29a	**In your opinion, what percent of ROW markers set by contractors meet MDOT specifications and standards of practice?**	4 of 18 responses are '26-50%' 6 of 18 are '51-75%' and, 8 are '76-100%' No Consensus	**4**
Processes 29b	**Should MDOT establish a standard procedure for checking the placement of ROW markers?**	*14 'yes', 4 'no'. Consensus*	**4**

- 83% of Administration personnel responded 'yes' to the statement 'All exist and proposed right of way and property line surveys being done by MDOT survey crews under the direct supervision of a Licensed Professional Surveyor?'
- Only 44 % believe that 76-100% of ROW markers set by contractors meet MDOT specifications and standards of practice
- Majority of the administration personnel responded 'yes' to the question 'Should MDOT establish a standard procedure for checking the placement of ROW markers?'

SECTION 2 - MDOT Most Effective Organizational Model

General Operation 2a1	What areas of MDOT survey operations are in need of change?	**[Personnel policies and job Classifications] – 5% responses are 'no' or 'few' 71% are 'some' or 'major' Consensus**	**5**
Organization 5	**Which organizational survey model is the most efficient in your opinion?**	[Most of the preliminary survey activities are preformed at the district office and other construction related survey duties are performed at the project office. All survey duties are performed under the direct supervision of a professional surveyor.] 17%	**4**
		[Most of the preliminary survey activities are preformed at the district office under the direct supervision of a professional surveyor and other construction related survey duties are performed at the project office without direct supervision of a professional surveyor] 17%	**4**
		[District office performs some surveying duties primarily establishing project control and performing some boundary surveys under the direct supervision of a professional surveyor] 17%	**4**
		[Project office performing most of the preliminary surveys including boundary surveys without direct supervision of a professional surveyor. District office performs some surveying duties primarily establishing project control] 17%	**4**
Organization 10	In your District, which survey operations are centralized and which operations are	**[Eminent Domain Surveys] 10 of 18 responses are 'central office functions', 3 responses are**	**4**

	performed by the individual project offices?	**'Functions shared by both central & project offices '11% No Consensus**	
Organization 20	**Should each project office have a PLS in the office?**	39 'yes', 61 'no'. Controversy	**4**
Deliverables 5	**Is there effective communication between your office and Roadway Design, Right of Way?**	72% 'yes', 23 'no' consensus	**4**

- Reponses regarding the most efficient organizational survey model were evenly distributed among answer options some showing that most of the preliminary survey activities are preformed at the district office and other construction related survey duties are performed at the project office. Some also responded that most of the preliminary survey activities are preformed at the district office under the direct supervision of a professional surveyor and other construction related survey duties are performed at the project office without direct supervision of a professional surveyor. Another set of responses also showed that district office performs some surveying duties primarily establishing project control and performing some boundary surveys under the direct supervision of a professional surveyor. And the remaining responses indicated that project office performing most of the preliminary surveys including boundary surveys without direct supervision of a professional surveyor. District office performs some surveying duties primarily establishing project control.
- 55% of the Administration's responses indicated that Eminent Domain Surveys are central office functions.
- 61% believe that each project office should have PLS
- 72% of responses from the administration personnel indicated that there is an effective communication between their office and Roadway Design, Right of Way

SECTION 3 - MDOT Best Survey Technology Roll-Out Strategy

		[MDOT staff using modern surveying equipment are being trained to use this equipment properly and effectively]] 44% responses are either 'strongly agree', or 'Agree', 22% are 'neither agree nor disagree', and 32% are 'disagree' No Consensus	**5**

- The administration personnel did not reach on consensus on the statement 'MDOT staffs using modern surveying equipment are being trained to use this equipment properly and effectively'. 44% agree on the statement while 32% disagree and the remaining neither agreed nor disagreed.

SECTION 1 - MDOT Best Operational Approach for Survey

Admin1b	*Please Comment*	*N/A*	**3**

SECTION 2 - MDOT Most Effective Organizational Model

SECTION 1 - MDOT Best Operational Approach for Survey

Question #	*Question*	*Results and Characterization*	*Importance of Result (1-5) & notes*
Admin1a	**What problems is your division encountering with Survey data?**	10% responses are 'Formats' 20% are 'Accuracy' 10% are 'Timely submittal' 70% are ' Completeness' and the 20% are 'Other' No Consensus	**5**
Admin3	**Does your office receive all the information required when surveys are originally submitted?**	*20% 'yes', 80% 'No'* Strong Consensus	**5**
Admin4	**Are your division's survey needs/requirements outlined in the MDOT Survey Manual?**	100% 'yes' Strong Consensus	**5**

- 70% of customer responses indicate that they encountering problems in their division because of incompleteness of survey data.
- 80% of the customers responded 'no' to the statement 'Does your office receive all the information required when surveys are originally submitted?'
- All customers agree that their your division's survey needs/requirements outlined in the MDOT Survey Manual

SECTION 2 - MDOT Most Effective Organizational Model

Question #	*Question*	*Results and Characterization*	*Importance of Result (1-5) & notes*
Deliverable 5	**Is there effective communication among Roadway Design, Right of Way and the Districts?**	90% 'Yes' , 10% 'No' Strong Consensus	**5**
Field summary 8	**Do surveys received by you office meet all requirements as outlined in the survey manual and CADD manual?**	*30 'yes', 70 'no' Strong Consensus*	**5**

- 90% of customer responses show that there is an effective communication among Roadway Design, Right of Way and the Districts
- 70% of customers answered 'no' to the question 'Do surveys received by you office meet all requirements as outlined in the survey manual and CADD manual'