Survey Practices implemented in an MDOT Project

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Abstract – Surveys/questionnaires can serve as good sources of information when doing research papers and projects. Some of the common applications of surveys/questionnaires are in problem identification, customer feedback analysis about products/services, and to obtain statistical data. Surveys/questionnaire responses gather from the targeted group provide information regarding the current or past conditions. This information allows the research team to identify existing problems, opportunities and/or facts to evaluate certain hypothesis and or to establish trends and conditions. But in order to gather appropriate vital information the research team has to prepare and include the right questions with defined objectives in the survey/questionnaire.

This paper focuses on the good practices of a success full set of survey/questionnaire as they were implemented in the funded project from MDOT titled "Best Practices of MDOT's Survey Operation, Organization and Technology Implementation." The following are some of the aspects discussed in this report: 1- Clearly define objectives and goals of the survey/questionnaire;2- Know what types of answers or responses we need; 3- Select the time frame by which the survey should be completed; 4- Know how we present the survey/questionnaire and 5- Set the budget for resources we need. In addition to the aspects previously mentioned, a systematic step by step procedure must be used to prepare the survey/questionnaire. These steps include the following: 1- Identifying the target group, 2- Selecting the right survey/questionnaire type; 3- Asking the right questions, and 4-Analyzing the questions and presenting the result: Surveys/questionnaires are meaningless if they are not analyzed correctly. The best analysis is possible for numerical values, for example you can determine the median, average or deviation value. After analyzing the answers, it is important to present the result graphically, because there might be also other parties interested in the result.

Keywords: Survey, Practice, Questionnaire, Transportation

INTRODUCTION

Before describing the surveys/questionnaires, is it important to understand that a critical activity performed by employees of the Mississippi Department of Transportation is land surveying. Land Surveying in some instances needs to be performed in hazardous environments such as rugged terrain and high-speed traffic. New land surveying technologies (i.e.: Global Positioning System) are increasingly being adopted by land surveying units of departments of transportation around the nation, because it has demonstrated increased efficiency and cost savings in topographical surveys [JCEM2008, TR2007, TXDOT2007, NCHRP2004, MDOT2002].

MDOT employees use a wide range of land surveying methods and technologies throughout the state. Land surveying operations vary within MDOT from manual conventional land 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 land surveying operations employed by MDOT.

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In addition, land surveying at the district level within MDOT is organized in many different ways. For example, in some districts land 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 land surveying operations.

Some MDOT locations have embraced modern land 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 was 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 the project was to evaluate the land surveying processes throughout MDOT to move toward providing electronic 3D surveys, improve accuracy and increase efficiency in MDOT land 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.

This paper focuses on the sub-set of the project related to the good practices of a success survey/questionnaire as they were implemented in this project.

OVERVIEW SURVEYS/QUESTIONNAIRE

Survey/questionnaire is a method of collecting data in a consistent, or systematic, way. This usually involves constructing a set of questions that are either asked by means of a questionnaire or through an interview. It is a non-experimental, descriptive research method. Surveys/questionnaires can be useful when a researcher wants to collect data on phenomena that cannot be directly observed (such as opinions on library services). Surveys/questionnaires are used extensively in library and information science to assess attitudes and characteristics of a wide range of subjects, from the quality of user-system interfaces to library user reading habits. In a survey/questionnaire, researchers *sample* a *population*. Basha and Harter (1980) state that "a *population* is any set of persons or objects that possesses at least one common characteristic." Surveys /questionnaire can be conducted by mail, face-to-face, telephone, email, Web, observation, focus groups, content analysis, or other methods.

TYPES OF SURVEYS AND COLLECTED DATA

There are several different approaches to conducting a survey/questionnaire. One very common approach is the cross-sectional survey, where a set of information is collected for a sample at one point in time. Data may be collected from a sample of the population or from the entire population or community. When the data can be collected from an entire population, as may be the case in the small community or tribe, then the survey/questionnaire is sometimes called a census. When the data are analyzed from a cross-sectional survey/questionnaire, the results can vary from tabulations of answers on single questions to a more complex analysis exploring the relationships between variables. Even though the data are collected at one point in time with the cross-sectional survey there are methods of comparing items or looking for change. For example, the questions asked may be time-ordered, referring to events in the past, present, or the future. The responses on such questions can provide a basis for looking at change, but with the disadvantage that the person answering the questions may distort impressions of an event over time.

The longitudinal survey/questionnaire provides another means of looking at changes Survey Research over time. With this type of survey/questionnaire, the data are actually collected at different points in time. This can be accomplished by either sampling from a population at different points in time, or by following-up on a group of individuals at different points in time. The main problem seen with follow-up on a group of individuals is loss of participants (also known as drop-out or attrition). With the small community, it may be possible to follow-up with nearly the entire population and tracking those who may have moved through the community network. Sometimes it may be possible to use the results of a previous study for a past perspective, followed up with the same questions in

a current study. Although this method carries the advantage of reduced time and funds, it also requires caution in seeing that the questions are asked in the same way for the different points in time. An example of a longitudinal survey/questionnaires would be a study of native language use within the community, where questions on language use are asked five years apart to see if there had been any change in the amount of language use. Such a study might look at reasons for decreased or increased language use and relate these changes to cultural change. The data obtained from such a study could be useful in documenting the structure of a bilingual education program. Several distinctions are sometimes made within the longitudinal survey design.

SURVEY/QUESTIONNAIRE METHODOLOGY

Different approaches can be used for conducting surveys. Some of the common survey/questionnaire methods include mail questionnaire, face to face interviews, telephone interviews, and Email and web surveys. The brief description of these common survey/questionnaire methodologies along with their advantage and disadvantages is presented as follows.

Mail Questionnaires

This method involves sending questionnaires to a large sample of people covering a wide geographical area. Mail questionnaire are usually received 'cold', without any previous contact between researchers and respondents. The response rate for this type of method is usually low as 20%, depending on the context and length of the questionnaire. As responses rates are low usually large sample is required when using mail questionnaires. This is to ensure that the demographic profiles of the survey respondents reflect that of the survey population and to provide a sufficiently large data set for analysis. The Table 1 summarizes the advantages and disadvantages of Mail Questionnaires.

Table 1. Advantages and Disadvantages of Mail Questionnaires

Advantages	**Disadvantages**
• Mail surveys are among the least expensive. • This is the only kind of survey you can do if you have the names and addresses of the target population, but not their telephone numbers. • The questionnaire can include pictures - something that is not possible over the phone. • Mail surveys allow the respondent to answer at their leisure, rather than at the often inconvenient moment they are contacted for a phone or personal interview. For this reason, they are not considered as intrusive as other kinds of interviews.	• Time! Mail surveys take longer than other kinds. You will need to wait several weeks after mailing out questionnaires before you can be sure that you have gotten most of the responses. • In populations of lower educational and literacy levels, response rates to mail surveys are often too small to be useful. This, in effect, eliminates many immigrant populations that form substantial markets in many areas. Even in well-educated populations, response rates vary from as low as 3% up to 90%. As a rule of thumb, the best response levels are achieved from highly-educated people and people with a particular interest in the subject (which, depending on your target population, could lead to a biased sample).

Face-to-face interviews

Face to face interviews involve the researcher approaching respondents personally. Personal interviews can take place in the home, at a shopping mall, on the street, outside a movie theater or polling place, and so on. The researcher then asks the respondents a series of questions and notes their responses. The response rate is higher than that of mail questionnaire as the researcher has the opportunity to sell the research to potential respondent. Face to face interviewing is a more costly and time consuming method than the postal survey; however the researches can select the sample of respondents in order to balance the demographic profile of the sample. The Table 2 summarizes the advantages and disadvantages of Face-to-Face Interviews.

Table 2. Advantages and Disadvantages of Face-to-Face Interviews

Advantages	Disadvantages
• The ability to let the Interviewee see, feel and/or taste a product. • The ability to find the target population. For example, you can find people who have seen a film much more easily outside a theater in which it is playing than by calling phone numbers at random. • Longer interviews are sometimes tolerated. Particularly with in-home interviews that have been arranged in advance. People may be willing to talk longer face-to-face than to someone on the phone.	• Personal interviews usually cost more per interview than other methods. This is particularly true of in-home interviews, where travel time is a major factor. • Each mall has its own characteristics. It draws its clientele from a specific geographic area surrounding it, and its shop profile also influences the type of client. These characteristics may differ from the target population and create a non-representative sample.

Telephone interviews

Telephone survey, like face to face interviews, allows a two-way interaction between research and respondent. Telephone survey is cheaper than face to face interviewing. While this method has a higher response rate than postal surveys, telephone surveys often attract a higher level of refusals than face to face interview as people feel less inhibited about refusing to take part when approached over the telephone. The Table 3 summarizes the advantages and disadvantages of Telephone Interviews.

Table 3. Advantages and Disadvantages of Telephone Interviews

Advantages	Disadvantages
• People can usually be contacted faster over the telephone than with other methods. If the Interviewers are using CATI (computer-assisted telephone interviewing), the results can be available minutes after completing the last interview. • You can dial random telephone numbers when you do not have the actual telephone numbers of potential respondents. • CATI software, such as The Survey System, makes complex questionnaires practical by offering many logic options. It can automatically skip questions, perform calculations and modify questions based on the answers to earlier questions. It can check the logical consistency of answers and can present questions or answers choices in a random order (the last two are sometimes important for reasons described later). • Skilled interviewers can often elicit longer or more complete answers than people will give on their own to mail, email surveys (though some people will give longer answers to Web page surveys). Interviewers can also ask for clarification of unclear responses. • Some software, such as The Survey System, can combine survey answers with pre-existing information you have about the people being interviewed.	• Many telemarketers have given legitimate research a bad name by claiming to be doing research when they start a sales call. Consequently, many people are reluctant to answer phone interviews and use their answering machines to screen calls. Since over half of the homes in the USA have answering machines, this problem is getting worse. • The growing number of working women often means that no one is home during the day. This limits calling time to a "window" of about 6-9 p.m. (when you can be sure to interrupt dinner or a favorite TV program). • You cannot show or sample products by phone.

Email Surveys

Email surveys are both very economical and very fast. More people have email than have full Internet access. This makes email a better choice than a Web page survey for some populations. On the other hand, email surveys are limited to simple questionnaires, whereas Web page surveys can include complex logic. Although use of email is growing very rapidly, it is not universal and is even less so outside the USA. Many average citizens still do not possess email facilities, especially older people and those in lower income and education groups. So email surveys do not reflect the population as a whole. At this stage they are probably best used in a corporate environment where email is common or when most members of the target population are known to have email. The Table 4 summarizes the advantages and disadvantages of E-mail Surveys.

Table 4. Advantages and Disadvantages of E-mails Surveys

Advantages	**Disadvantages**
• Speed. An email questionnaire can gather several thousand responses within a day or two. • There is practically no cost involved once the set up has been completed. • You can attach pictures and sound files. • The novelty element of an email survey often stimulates higher response levels than ordinary "snail" mail surveys.	• You must possess (or purchase) a list of email addresses. • Some people will respond several times or pass questionnaires along to friends to answer. Many programs have no check to eliminate people responding multiple times to bias the results. The Survey System's Email Module will only accept one reply from each address sent the questionnaire. It eliminates duplicate and pass along questionnaires and checks to ensure that respondents have not ignored instructions (e.g., giving 2 answers to a question requesting only one). • Many people dislike unsolicited email even more than unsolicited regular mail. You may want to send email questionnaires only to people who expect to get email from you. • You cannot use email surveys to generalize findings to the whole populations. People who have email are different from those who do not, even when matched on demographic characteristics, such as age and gender. • Email surveys cannot automatically skip questions or randomize question or answer choice order or use other automatic techniques that can enhance surveys the way Web page surveys can. • Many email programs are limited to plain ASCII text questionnaires and cannot show pictures. Email questionnaires from The Survey System can attach graphic or sound files. Although use of email is growing very rapidly, it is not universal - and is even less so outside the USA (three-quarters of the world's email traffic takes place within the USA). Many "average" citizens still do not possess email facilities, especially older people and those in lower income and education groups. So email surveys do not reflect the population as a whole. At this stage they are probably best used in a corporate environment where email is common or when most members of the target population are known to have email.

Web/internet surveys

Web surveys are rapidly gaining popularity. They have major speed, cost, and flexibility advantages, but also significant sampling limitations. These limitations make software selection especially important and restrict the groups you can study using this technique. Internet surveys are usually used when your target population consists entirely or almost entirely of Internet users. Business-to-business research and employee attitude surveys can often meet this requirement. Surveys of the general population usually will not. Another reason to use a Web page survey is when you want to show video or both sound and graphics. A Web page survey may be the only practical way to have many people view and react to a video. The Table 4 summarizes the advantages and disadvantages of Web/Internet Surveys.

Table 5. Advantages and Disadvantages of Telephone Web/Internet Surveys

Advantages	**Disadvantages**
• Web page surveys are extremely fast. A questionnaire posted on a popular Web site can gather several thousand responses within a few hours. Many people who will respond to an email invitation to take a Web survey will do so the first day, and most will do so within a few days. • There is practically no cost involved once the set up has been completed. Large samples do not cost more than smaller ones (except for any cost to acquire the sample). • You can show pictures. Some Web survey software can also show video and play sound. • Web page questionnaires can use complex question skipping logic, randomizations and other features not possible with paper questionnaires or most email surveys. These features can assure better data. • Web page questionnaires can use colors, fonts and other formatting options not possible in most email surveys. • A significant number of people will give more honest answers to questions about sensitive topics, such as drug use or sex, when giving their answers to a computer, instead of to a person or on paper. • On average, people give longer answers to open-ended questions on Web page questionnaires than they do on other kinds of self-administered surveys. • Some Web survey software, such as The Survey System, can combine the survey answers with pre-existing information you have about individuals taking a survey.	• Current use of the Internet is far from universal. Internet surveys do not reflect the population as a whole. This is true even if a sample of Internet users is selected to match the general population in terms of age, gender and other demographics. • People can easily quit in the middle of a questionnaire. They are not as likely to complete a long questionnaire on the Web as they would be if talking with a good interviewer. • If your survey pops up on a web page, you often have no control over who replies - anyone from Antarctica to Zanzibar, cruising that web page may answer. • Depending on your software, there is often no control over people responding multiple times to bias the results.

Each methodology describe above has its on advantages and disadvantages. One should be able to select the appropriate methodology that best suits the survey research based on the objective of the survey.

SURVEY/QUESTIONNAIRE DESIGN PROCESS FOR BEST PRACTICES OF MDOT SURVEY

The major objective of this project was to evaluate the land surveying processes throughout MDOT to move toward providing electronic 3D surveys, improve accuracy and increase efficiency in MDOT land 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 wanted to 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?

The questionnaire preparation process for the MDOT project was based on pre-defined tasks with set of goals to accomplish. Each data collection activity for this project was based on the idea of dividing the project into tasks and each task had tangible deliverables. 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. 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.

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 a 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. 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.

A series of meetings were held between the MDOT TAC and the USM research team to further reduce the number of question for each target 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 numbers of questions for each of the five online questionnaires were as follows:

- **Group 1 – Field Personnel**: questions for field crew members and other personnel. There were 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 had 31 questions.
- **Group 3 – Management**: mainly for management personnel involved in managing projects. This survey had 54 questions.
- **Group 4 – Administration**: For all personnel involved in the organization and administration of the working staff in each district. There were 28 questions in this survey.
- **Group 5 – Internal Customers**: this survey group was for internal customers of MDOT that are also involved in the operations of the organizations. There were 16 questions in this survey.

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 were 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 were 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 required improvements and/or modifications.

LESSON LEARNED FROM THE SURVEY PROCESS

Lime Survey was used as a tool to prepare the survey questions. Lime Survey is an advanced online survey system to create quality online surveys. The software is downloaded 10,000 times every month and is used all over the world by companies, universities and individuals. Lime Survey is Open Source Software and completely free to use. It allows users to quickly create intuitive, powerful, online question-and-answer surveys that can work for tens to thousands of participants without much effort. The survey software itself is self-guiding for the respondents who are participating. It also shows statistical information based on responses from participants (target groups). This makes the data analysis process much easier.

The lesson learned from this survey process is that survey questionnaires are very important in conducting research in any discipline. Questionnaires will allow us to easily identify existing problems and current condition about the area of study. Once we gather the information using the questionnaire, we can use that information to make analysis to solve existing problems. The major advantage of using questionnaire of this is that we can collect responses from each and every member of our target group. This means that statements and responses will somehow be free from bias that might exist in a target group if we were using random sampling to collect data. Hence, the data we collect shows different perspectives of the subject matter. This allows us to come to reasonable analysis and conclusions at the end of the process.

CONCLUSION

Questionnaire survey is one type of methodology that can be used in conducting research study. However questionnaires should be short and simple (usually proves to be the best general approach to take when designing an effective print survey questionnaire. Many other research professionals agree that when content and design complexity increase; one can expect to see a correspondent decline in both the number of completed responses and the quality of those responses. Keeping a survey questionnaire as short as possible is also just as important as keeping it simple. Certainly we understand and appreciate the fact that sometimes keeping a survey short, say, to just one or two pages in length, isn't always possible. But there are techniques that can be employed which will result in

a shorter survey. For instance, the way questions are asked can result in a shorter survey without forfeiting effectiveness. And also it is very important that the entire research project be carefully designed, and that the survey questions be well written, it's equally important that the questionnaire itself be well designed, too. Adhering to this principle will result in more and better responses for all your print surveys, which, in turn, can make the researcher a whole lot more creditable.

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