Enhancing the Oregon Crash Reporting Process: A Feasibility Study

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ABSTRACT

In most states, police officers and trained investigators complete crash reports for nearly all reportable crashes that occur on public roads. Many states have made significant improvements in the quality and timeliness of their crash data systems by implementing, in addition to other improvements, electronic filing of these reports by police officers. Oregon relies on citizen reports for a majority of their crash data and paper forms must be submitted to the responsible state agency and are then manually coded into the crash data system. Police reports are also paper based. This process limits the improvements that can be made in both the quality and timeliness of data unless enhancements can be made to the reporting process. This paper summarizes the preliminary results of a study on the feasibility of implementing a web-based system for reporting crashes, with a focus on citizen reporting and to a lesser extent police reporting.

INTRODUCTION

Improving highway safety is a stated goal of many transportation agencies. All safety improvement activities, whether using an engineering, education, or enforcement approach, are enhanced with more accurate, timely, and robust crash data. Crash data have traditionally been plagued with missing information, inaccurate or incomplete location data, and various other errors with are both systematic and random. In most states, the primary source of data for crashes is a report completed by police officers. Oregon is unique, however, in relying on citizens reports for data on the majority (70%) of approximately 50,000 crashes that are coded each year by Oregon Department of Transportation (ODOT).

This high level of citizen reporting and the paper-based records system used at ODOT presents unique challenges to improving data quality and timeliness. First, many crash records inaccurately locate the crash on the roadway network. In the existing process, location information must be translated from literal text descriptions to one of three referencing systems for state, county, and city streets. Second, errors are common because of the highly manual process. The crash data entry form is designed to check for obvious errors (e.g. night code when crash occurred during day hours), but human errors are still common. Third, because of the sheer level of effort required to compile, code, and maintain the data, users of these data and reports do not receive them in a timely manner.

The research described in this paper documents the preliminary results of a feasibility study of implementing a web-based system for reporting crashes, with a focus on citizen reporting and to a lesser extent police reporting.. The following section summarizes our review of crash reporting process in other states. The next section documents the results

of extensive interviews with Oregon DOT staff involved in the crash reporting and coding process. We then summarize a detailed review of the literature related to collecting information over the internet – reviewing studies on form design, internet access and e-government. Next, some preliminary results from our comparison of police and completed citizen reports of actual crashes are presented. Finally, the paper presents some initial conclusions for the research.

MOTOR VEHICLE CRASH REPORTING

As part of the research, a review was conducted to identify states that allow or require citizen reporting of motor vehicle crashes. The driver manuals posted on the internet were reviewed for the current state law regarding motor vehicle crashes. Surprisingly, it appears that in almost every state some citizen reporting is allowed. In many cases these forms are available for when no police officer completes or submits a report. However, the amount of information required on the forms varies. Most citizen report forms that we obtained were short and only collect basic information about the crash and insurance status. For purposes of this research, it was assumed that if detailed information is requested, then it is more likely the state is collecting crash data from the citizen report forms. Based on these criteria, eight states appear to use the citizen reports for data purposes. These states have extensive crash report forms similar to Oregon's and are shown in Figure 1. However, our knowledge of the crash data systems in these states is that these states do not rely on citizen reports for much data. Oregon is probably the only state that relies on them for so much of the data.

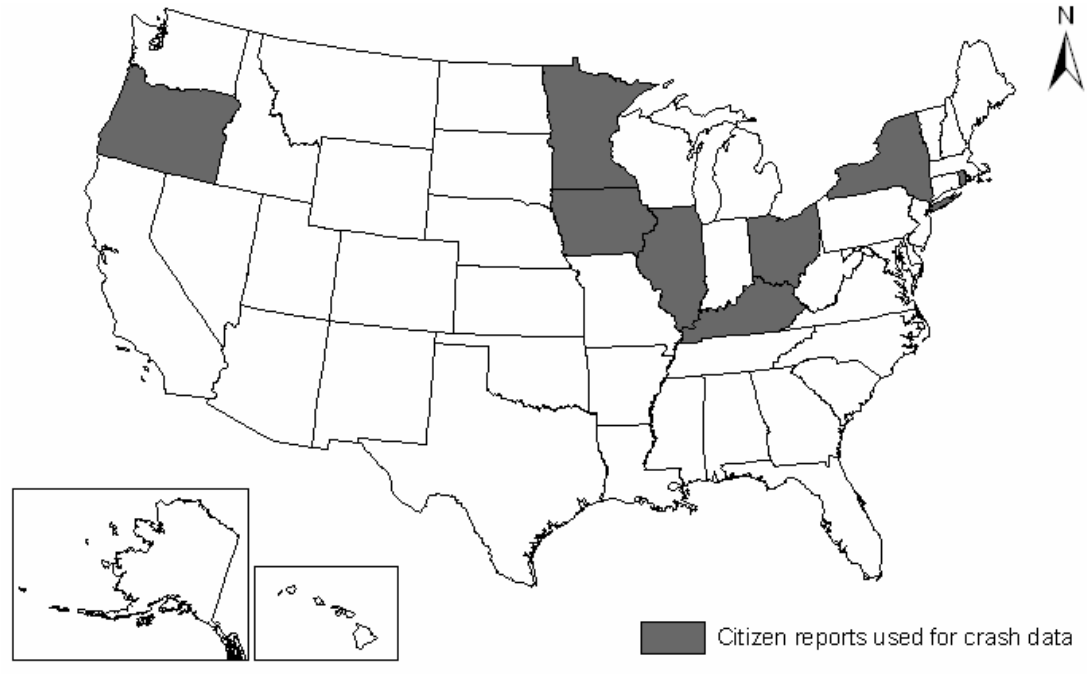

Figure 1. States Using Citizen Reports of Motor Vehicle Crashes for Data

In terms of web-based forms, the review found that seventeen states make their citizen crash report forms available online, usually in PDF. In most states it must be printed and filled out by hand before returning it to the appropriate agency. Only Colorado allows reports to be submitted via the internet as shown in the Figure 2. Citizens in Colorado have the option of filing a crash report but the state does not rely heavily on their information for crash data. Colorado receives most of their crash data from police, and utilizes electronic reporting for law enforcement (Conner, 2005).

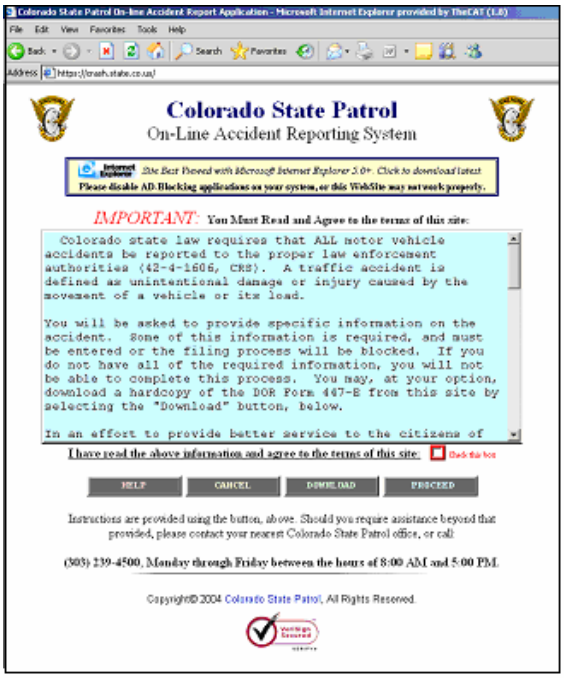

Figure 2. Colorado's Online Report System Screen Capture

Given that Colorado is the only state using an online component for citizen crash reporting, the next step was to review the technology for electronic crash reporting used by police agencies. This application is far more common since most states rely on police information for their crash data. Several states use a computer or web-based system created for law enforcement such as Traffic and Criminal Software (TraCS) and ReportBeam in order for state agencies to record and collect crash data from police while they are in the field. TraCS is a national model program currently used in 17 states, with at least 10 states in the process of implementation (TraCS, 2005). Currently, TraCS is not available for citizen reporting or public access to the central database.

ReportBeam is also used by police agencies in 16 states, and it "provides an automated internet-based distribution system to remove the burden from the records departments" (ReportBeam, 2005). Some of the states with agencies currently using this system include: Arizona, California, Mississippi, North Carolina, Nebraska, New Jersey, New York, and Washington State. ReportBeam automatically submits collision records to the state data archives, while providing a secure method to distribute these reports to the public. It reduces the amount of walk-in report requests, because citizens are now able to download their report from the internet. Iowa is considering looking at the creation of a web-based system that would enable citizens to submit reports online (Jensen, 2004)

OREGON MOTOR VEHICLE CRASH REPORTING PROCESS

As part of this research, we conducted detailed interviews with staff and managers with responsibility and oversight of crash reporting, the Department of Motor Vehicles (DMV) and the Crash Analysis and Reporting Unit (CAR). The legal authority to require drivers to file a report rests with DMV. Current Oregon law requires drivers involved in a crash that results in injury, death, more than $1500 damage to their vehicle, or more than $1500 damage and towing of another vehicle to file an Oregon Traffic Accident and Insurance Report within 72 hours. If a police officer responds to the scene, he or she completes the Oregon Police Traffic Crash Report which is more detailed than the citizen report. A citizen must file a report even if a police officer is present and completes a form.

DMV and CAR have different data needs. DMV is primarily interested in making sure drivers comply with Oregon law requiring motor vehicle insurance and filing of a report. CAR needs the information on the form to populate the statewide crash file. As such, the form is designed to capture both insurance information and details about the crash. The form, *Oregon Traffic Accident and Insurance Report*, is shown in Figure 3. The form has two pages of instructions, and three pages of requested information. The two pages about the crash are front-to-back and the third page is supplemental if more than 2 vehicles are involved (not shown in figure). The form has a place for a narrative and numerous check boxes to characterize what happened in the crash. One required field is that drivers submitting the form must list the other drivers involved.

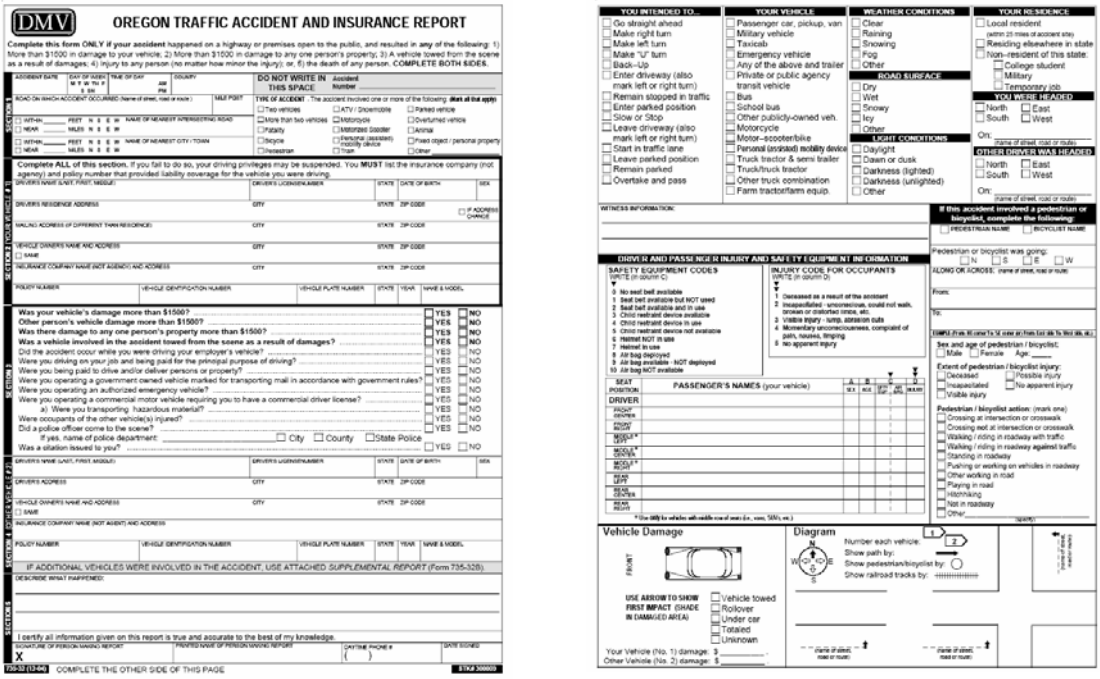

Figure 3. Oregon DMV Traffic Accident and Insurance Report Form

The Oregon process for compiling, processing, and transferring forms is entirely manual and described in the next few paragraphs and shown graphically in Figure 4. When a driver, police officer, or insurance agency submits the Traffic Accident and Insurance Report form to DMV the form is placed in a central filing system by county and month. Sometime later, DMV staff in the Accident Reporting and Insurance Verification unit begin the process of manually assembling reports that describe the same crash into a unique case. A case file cover sheet is prepared listing the drivers involved and insurance information is verified using the Automobile Liability Insurance Reporting (ALIR) system or the insurance company. If there is a violation of insurance law or one driver has failed to file the required report, suspension action is taken against the driver. Once all drivers insurance has been verified and reports received, the case considered complete and will be sent to the Crash Analysis and Reporting (CAR) Unit to synthesize the data into one comprehensive crash. It is interesting to note that there are a number of crash cases that do not get sent to CAR for coding because the file is not complete or was not received by DMV in a timely manner. There are currently twenty-one staff working in the DMV Accident Reporting and Insurance Verification unit. At any given time, there are three years of crash reports are kept in the office, two additional years of private vehicle crashes and seven additional years of commercial vehicle crashes kept in an offsite storage unit.

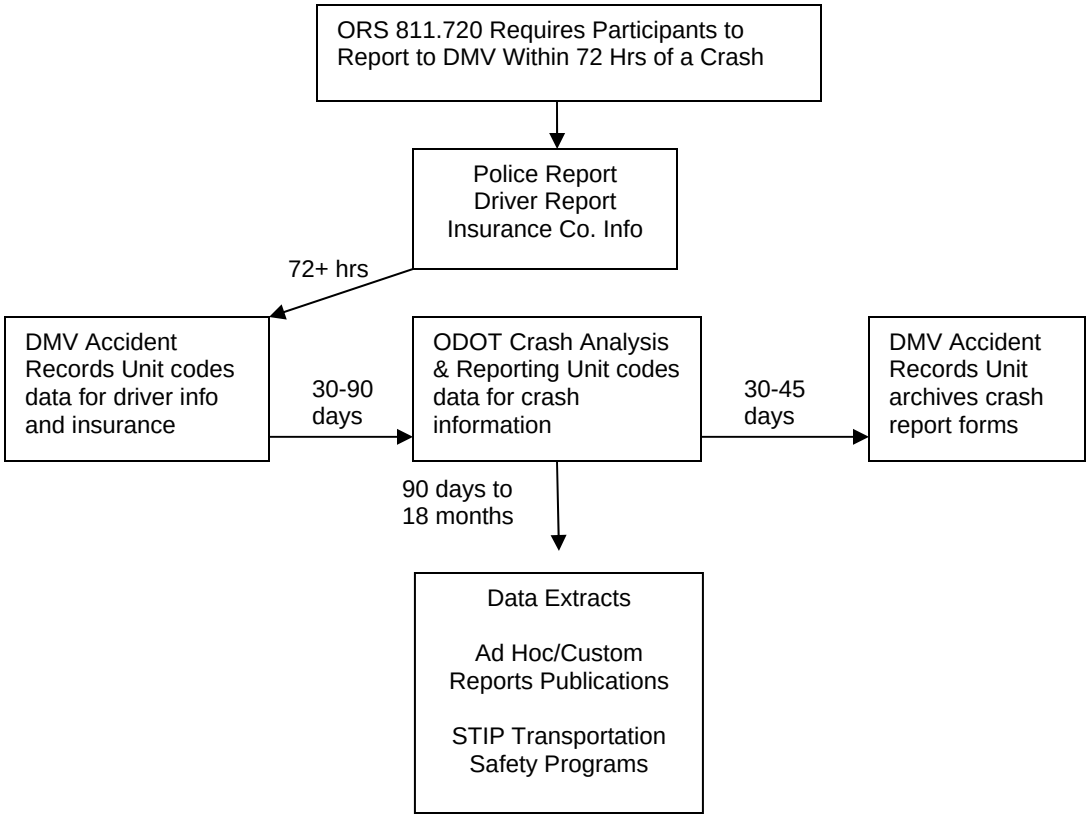

Figure 4. Oregon DOT Crash Reporting and Coding Process

When a set of crash forms is considered complete, the forms are sent in batches to CAR by shuttle. CAR is interested in recording all of the information from the form, except for the insurance information. Essentially, CAR is interested in everything that DMV is not. When forms arrive at CAR, the coders verify that it is reportable in the statewide file. Examples of incidents that are not recorded are those that occurred on private property and intentional crashes. These non-recordable crashes are sent back to the DMV. Next, the crash coder must weave together the citizen and police reports into composite picture of a crash. There are frequently discrepancies between the information given by the police and the information given by the drivers which forces the coders to use discretion to sort out the details of the incident. Experience is very useful and coders use online and paper maps to pinpoint the location of an incident. As one would expect, creating useable data completed by essentially untrained citizens can be a challenge. Fourteen staff at CAR work on coding the approximately 50,000 crash records each year in Oregon.

Our interviews with both divisions revealed that there would be substantial improvements in process flow and accuracy if Oregon was to move to some form of electronic capture of crash reports. Staff time is duplicated at CAR and DMV since information is recorded at both agencies. The DMV's manual check-out process for recording when files are moved is highly staff-intensive. At CAR, the information is first coded by hand onto a paper form and then from the paper form onto the computer. The more times data is manually coded, the more likely it is that mistakes will be made (Griffith, 2003; Pettit, 2002).

In our opinion, web-based capture of citizen reports would need to be integrated with an completely new electronic process to be most efficient. However, just having an electronic copy of the crash report would provide many benefits. Electronic forms would eliminate manual shuttle transfer of records and result in a more predictable work flow, which requires overtime by the CAR coders each year. It would eliminate the need to manual track and store all movements of the crash form. Additionally, it would allow more data capture since it would allow DMV to release "incomplete" crash records where not all drivers have filed or had an insurance violation. CAR would not need a complete case to code a crash and electronic copies could be easily exchanged between drivers. The final report will explore these benefits in more detail.

COLLECTING INFORMATION OVER THE INTERNET

There is limited research available on the topic of online motor vehicle crash reporting for citizens. There was no research available specifically about auto crash reporting. Therefore, we focused our research on the areas of data collection, form design with respect to error reduction, internet access, and e-government.

Data Collection and Form Design

Although there is no research on the accuracy of online crash reports versus paper crash reports, there is some research about survey and test results from different mediums. Most of the research comparing traditional paper and pencil surveys to internet surveys shows that the method of data collection does not significantly affect the answers given, and that there is no statistical difference between the two sets (Ballard & Prine, 2002; Pettit, 2002; Gosling & Vaxire & Srivastava & John 2004; Knapp 2003).

Additionally, the literature shows that response times to online surveys is faster than mail surveys, and completeness is higher as well (Truell & Bartlett & Alexander, 2002). Research of testing online versus traditional paper and pencil tests shows that online tests measure the same constructs as traditional paper and pencil tests. However, the research also shows that there can be differences between internet and traditional tests related to an individual's familiarity with using the internet (Buchanan, 2003).

Regarding differences in form design between online and traditional forms, the research shows that questionnaires that are reliable and valid for self reporting with paper are most likely to be valid over the internet. However, some individuals are not familiar with using the internet and the forms should be adjusted for their benefit (Strickland et al, 2003). Reliable and valid quantitative data collection over the internet requires that respondents have the ability to navigate the Internet to the extent that they can access and use the web site.

Collecting data over the internet is much less expensive than paper data collection. This is due to elimination of the costs of paper, stamps, and processing time (Cobanoglu, 2002; Pettit, 2002). Additional savings also come from the ease with which forms and templates can be updated (Pettit, 2002). Also, electronic archives can replace the need for paper archives and storage. Electronic archives have many benefits, but do require effort and cost to design, populate, and maintain.

Besides cost savings, Internet data collection can eliminate the errors that occur from manual coding. Errors associated with manual coding multiply as data passes through additional agencies where it is manually coded at each (Griffith, 2003; Pettit, 2002). New technology also makes it possible for data to be collected and disseminated to multiple agencies quickly and at a much lower cost than paper transfer (Griffith, 2003). Forms can be set up so that the data is directly sent to data management programs at one or more agencies at the same time (Pettit, 2002).

Internet Access

As internet access becomes the norm, Americans are increasingly using the internet to make transactions and use services. According to the Pew Institute, in 2002 70% of American households owned a home computer, and nearly half use the internet (Ballard & Prine, 2002). However, even as access grows, we must consider that there are segments of the population that lag behind in internet access. Education and income are the most important indicators of internet access (Best & Krueger & Hubbard & Smith, 2001; Lloyd & Hellwig, 2000; Briggs 2004).

Although nearly half of the population uses the internet, 24% have no direct or indirect experience with the internet (Lenhart, 2003). The internet may be misleading in the impression that anyone can access it anywhere. Importantly, there is a portion of the population who may never be able to access it for a wide variety of reasons, including disabilities and education level (West, 2000).

Publicly available internet, such as through libraries, can help alleviate some of this disparity. According to the Pew Institute, 60% of non-users know of a place in their community where internet access is publicly available. Among internet users, 76% knew

of a public access site, which indicates that there is still a large gap in public accessibility between users and non-users (Lenhart, 2003).

Among those without internet access, Americans with disabilities have the lowest levels of access. The Pew Institute has quantified that 58% of all Americans are online, but only 38% of Americans with disabilities. 28% of Americans with disabilities say that their disability makes it difficult or impossible for them to go online (Lenhart, 2003). The internet can offer valuable services and resources to people with disabilities, but their specific needs must be taken into account when government is considering policies related to internet access and communication (Borchert, 1998).

E-Government

As internet use becomes more prevalent, the use of the internet by government agencies to deliver resources and services is increasing. This is known as e-government. David McClure, an Associate Director of the US General Accounting Office defines e-government as "government's use of technology, particularly web-based Internet applications to enhance the access to and delivery of government information and service to citizens, business partners, employees, other agencies, and government entities" (West, 2000).

The government is already a major provider of internet content, and offering more services is the next step (Brannen, 2001). Processing transaction electronically may create a more efficient and cost effective method than the traditional paper process. However, in order to reach the potential of e-government, government must make sites more user friendly (Information Management Journal, 2004).

E-government has the potential to help build better relationships between government and the public by making interaction with citizens smoother, easier, and more efficient (West, 2000). In surveys conducted by the Pew Institute and other groups, citizens and businesses say they want information access and transaction support from the government. The Pew Institute has also found that 77% of Internet users have gone online to search for government info or communicate with government. Government agencies already use the internet for electronic commerce and information delivery. According to Information Impacts Magazine, the two most common initiatives for e-government are providing information and facilitation of general compliance (Cook & LaVigne & Pagano & Dawes & Pardo, 2002).

Of course, there are limitations to e-government that include technological investments, personal preferences, and the wide range of services the government provides (West, 2003). Some literature found that experiences with e-government initiatives have been chaotic and unmanageable. E-government presents some unique challenges for administrators, including how to provide universal access, privacy and confidentiality, and a citizen focus in government management. Other major barriers to e-government are lack of finances, technical support, and personnel capacity (West, 2000; Kaylor et al, 2001; Edmiston, 2003; Cook et al, 2000).

Besides the barriers within government, there are barriers to citizen use of e-government due to concerns about security and privacy (Dawes, 2002). Other societal barriers to e-government include: affordability, accessibility, and anonymity. If citizens have a low

trust in government they are less likely to want to use the internet as a means of communication with various government agencies (Edmiston, 2003). E-government must also be easy for the average citizen to use, which means that the reading level must suit most Americans. Additional improvements should include disability access, clear privacy policies, and translations (Pardo 2000).

Acceptance of e-government is growing and becoming accepted by all levels of government. The US Census Bureau is now mandated by law to make web-based data collection an available alternative to more traditional collection techniques. The Census Bureau experimented with online reporting in its 2000 Census of Population and Housing (Richard & Hancock, 2002). Additionally, more than half of all Americans filed their 2005 taxes online (IRS, 2005).

Future Survey of Oregon Drivers

In order to gauge the acceptance of an enhanced system a survey will be developed at Portland State University and distributed by the DMV. Because we are specifically interested in using an internet component it is also important to know the level of internet access and comfort that DMV customers have. The survey will be mailed to a random list of drivers. The results of this survey will be used to quantify the public acceptance of completing crash forms over the internet. Sample questions included in the survey may include:

- Are you aware of the requirement to report a crash to DMV?
- Would you prefer to report accidents to the DMV online?
- Do you have access to the internet?
- Do you know how to access the internet?
- Which do you feel is easier: Reporting using the internet, Reporting using paper
- Do you have any concerns with using the internet for accident reporting?

PRELIMINARY COMPARISON OF CITIZEN AND POLICE REPORTS

One of the goals of this research is to quantify the potential improvements in accuracy of data collected if it were a web-based form. The literature certainly implies that most information captured over the internet is as good as or better than paper-based collection. Our research method was to compare citizen reports to police reports to establish which errors were common on the reports by citizens. The possibility of reducing these identified errors with a web-based system will be estimated and quantified. At the time of this writing, only 30 reports have been reviewed but several key issues were identified in data quality with both the citizen and police report forms.

The major issue with the citizen reports was lack of information. Many citizens entirely skipped page two of the form, which is where the majority of the specific information about the crash is recorded. The DMV is not concerned with this information, and therefore it is not considered out of compliance with the state reporting law. Without these data and if there is no police report – there is essentially no data about the crash for CAR to code. In some citizen report forms the location information was very specific, and exactly matched the police report form. It appears that in some jurisdictions the

citizens have access to the police report, or the officer is giving them some basic information at the scene.

A high degree of discrepancy between forms within case files was noted, especially there was a wide range of injury severity. Although CAR coders are training to evaluate forms and figure out the most likely version of events, they were not present at the incident and this can be a difficult process. Police reports are generally, but not always, considered more reliable than citizen reports. It was also found that some police agencies have their own forms besides the Oregon Police Traffic Crash Reporting form. Some appear to be generated from their own law enforcement records system and would already be available electronically. The difference in forms can cause additional work for crash coders. There is also a statewide effort to create a fillable PDF form that contains data tags. Some agencies are using software to help diagram crashes, while other officers from other agencies are hand-drawing diagrams of the incidents. There is a wide variety in the level of information provided by different police agencies.

This preliminary review of reports indicates that there could be substantial improvements in data quality from a web-based form. First, since it appears that many drivers did not notice the second page of the form a web form would increase data capture. Some important fields could be made required and automated fields created to reduce citizen burden. For example, if the crash occurred in parking lot, DMV requires insurance information but CAR does not code these crashes. An online form would prompt drivers to only fill out information needed. A map-based location tool might also improve accuracy. The sketch box allowed for crashes is at intersection and many drivers had to modify the area to fit their crash description. An online form would have many "prepared" sketches that would be easy to adapt and improve descriptions of the crash.

CONCLUSIONS

Oregon is one of only a few states that rely on citizen reporting for crash information. All parties would agree that accurate crash data is essential to Oregon's highway safety. Major issues with the current system include data quality, data capture, paper generation, and lack of backup copies of crash report forms. There are three major areas for improvement in the system: errors made on report by police officer or citizen, errors occurring during manual coding processes, and the delay in receiving crash data because of the amount of time required for the manual coding process. Our initial research indicates that all three of these could be improved by moving to some form of electronic capture of crash reporting information.

This project could save money in the long run, through the elimination of paper, mailing costs, transportation costs for paper records, and some staff time. Implementing a new system for crash reporting would require development and implementation of a new system. The start-up costs for the new system would include: software and hardware purchases, staff time for development, staff time for training, staff time for reorganization of existing crash units. Additionally, the public would require information about using the new system, which could be delivered through a public education campaign. Security and privacy concerns of citizens must be dealt with as well. A pilot project in certain jurisdictions may be the best way to test this program. A new system could not entirely

phase out the paper method. Some citizens will need to use paper, which will require manual coding by the DMV and CAR. An alternative or complement to an online reporting system could be a scanning system to facilitate the processing of paper forms.

The overall benefits of the enhanced system will include higher data quality due to less opportunity for error, ease of collection, ease of information transfer between agencies, and improved customer service. There are many other enhancements available that could improve data collection: GPS devices in police cars, in-vehicle reporting for police, a simplified form for citizens, online reporting for citizens, scanning for paper forms, electronic versions of forms transferred between DMV and CAR and archived. The final report on this research will recommend the feasibility and possible implementation path for these technologies and crash reporting in Oregon.

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REFERENCES

Ballard, Chet and Rudy Prine. (2002). Citizen Perceptions of community policing: Comparing Internet and mail survey responses. Social Science Computer Review, 20 (4), 485-493.

Best, Samuel, Brian Krueger, Clark Hubbard, & Andrew Smith. (2001). An Assessment of the Generalizability of Internet Surveys." Social Science Computer Review, 19 (2), 131-145

Borchert, Mark (1998). The challenge of cyberspace: Internet access and persons with disabilities. Cyberghetto or cybertopia?: Race, class, and gender on the Internet. Westport, CT, US: Praeger Publishers/Greenwood Publishing Group, Inc.

Brannen, Anna (2001). E-Government in California: Providing Services to Citizens through the Internet. Spectrum: Journal of State Government, Spring2001, Vol. 74 Issue 2, p6, 5p

Briggs, Kara. (2004, November 22). Housing, Internet connect for poor. The Oregonian.

Buchanan, Tom. (2003). Internet-based Questionnaire Assessment: Appropriate Use in Clinical Contexts. Cognitive Behaviour Therapy, 32 (3), p100, 10p

Cobanoglu, C., Warde, B., & Moreo, P. J. (2001). A comparison of mail, fax, and web-based survey methods. International Journal of Market Research, 43 (4), 441-452.

Conner, Al (2005), personal interview, April 12, 2005.

Cook, Meghan E. & Mark F. LaVigne & Christina M. Pagano & Sharon S. Dawes & Theresa A. Pardo. (2002) Making a Case for Local E-Government. Center for

Technology in Government, University at Albany/SUNY. Albany, NY: Center for Technology in Government.

Cook, Meghan E. (2000) What Citizens Want from E-Government: Current Practice Research. Center for Technology in Government, University at Albany/SUNY. Albany, NY: Center for Technology in Government.

Dawes, Sharon S. (2002). The Future of E-Government. Center for Technology in Government, University at Albany/SUNY. Albany, NY: Center for Technology in Government.

Edmiston, K.D. (2003). State And Local E-Government: Prospects and Challenges. The American Review of Public Administration, 33 (1), 20-45.

E-Gov Slowly Gaining Acceptance, but Must Mature. (2004). Information Management Journal, 38 (4), 16.

Gosling, Samuel D., Simine Vaxire, Sanjay Srivastava, & Oliver John. (2004). Should We Trust Web-Based Studies?: A Comparative Analysis of Six Preconceptions About Internet Questionnaires. American Psychologist, 59 (2), 93-104.

Griffith, Michael S. (2003). Data is key to understanding and improving road safety. Public Roads, US Department of Transportation, Vol. 66 (4). Retrieved April 21st, 2005 from http://www.tfhrc.gov/pubrds/03jan/09.htm

Internal Revenue Service, United States Government, Retrieved May 5, 2005 from http://www.irs.gov/newsroom/article/0,,id=138112,00.html

Jensen, Mary (2004) Personal email, November 14, 2004.

Kaylor, Charles, Randy Deshazo, and David Van Eck. (2001). Gauging e-government: A report on implementing services among American cities. Government Information Quarterly, 18, 293-307.

Knapp, Herschel et al. "Using pencil and paper, Internet and touch-tone phones for self-administered surveys: does methodology matter?" Computers in Human Behavior. Jan2003, Vol. 19 Issue 1, p117, 18p

Lenhart, Amanda (2003, April 16). The Ever-Shifting Internet Population. The Pew Institute & American Life Project. Retrieved April 21, 2005 from http://www.pewinternet.org/pdfs/PIP_Shifting_Net_Pop_Report.pdf

Lloyd, Rachel & Otto Hellwig. (2000). Barriers to the Take-Up of New Technology. National Centre for Social and Economic Modeling, University of Canberra. Discussion Paper no. 53.

Pardo, Theresa A. (2000 October). Realizing the Promise of Digital Government: It's More than Building a Web Site. Information Impacts Magazine, 10.

Pettit, Frances Anne (2002). A Comparison of World-Wide Web and paper-and-pencil personality questionnaires. Behavior Research Methods, Instruments, & Computers, 34 (1), 50-54.

ReportBeam Electronic Reporting System for Law Enforcement. Retrieved May 5, 2005 from http://www.reportbeam.com/

Richard, W and Charles Hancock. (2002) Data collection through web-based technology. Swartz Statistical Journal of the UN Economic Commission for Europe, 19 (3) p153, 7p

Strickland, Ora L et al. (2003) Measurement Issues Related to Data Collection on the World Wide Web. Advances in Nursing Science, 26 (4), p246, 11p

TraCS National Model Traffic and Criminal Software. Retrieved May 5, 2005 from http://www.dot.state.ia.us/natmodel/tracs.htm

Truell, Allen D., James E. Bartlett II, & Melody W. Alexander. (2002). Response rate, speed, and completeness: A comparison of internet-based and mail surveys. Behavior Research Methods, Instruments & Computers, 34 (1), 46-49.

West, Darrell M (2000). Assessing E-government: The Internet, Democracy, and Service Delivery by State and Federal Governments. Retrieved April 21, 2005 from http://www1.worldbank.org/publicsector/egov/EGovReportUS00.htm

West, Darrell M. (2003). Global E-Government, 2003. Center for Public Policy Brown University. Providence, RI.

West, Darrell M. (2003). State and Federal E-Government in the United States, 2003. Center for Public Policy Brown University. Providence, RI.

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