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Texas Core Traffic Records Database Linkage Feasibility Study

Final Report

TxDOT Project # 2017-TTI-G-1YG-0096

Author:
Jon Graber, M.A.

Texas A&M Transportation Institute

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Principal Investigator

Jon Graber, M.A.
Assistant Transportation Scientist
Texas A&M Transportation Institute

Contributors

Eva Shipp, Ph.D., Director Crash Analysis Team
Troy Walden, Ph.D., Director C.A.D.E.S.
Cynthia Roberto-Soares, M.P.S.A., C.A.D.E.S.
Paige Ericson-Graber, M.A., C.A.D.E.S.

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TEXAS A&M TRANSPORTATION INSTITUTE
College Station, TX 77843-3135

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Section 1: Executive Summary

In today's world, one of the most important assets an organization possesses is data. Highway traffic safety decision makers use data to develop and evaluate engineering, enforcement, education, and emergency medical service safety countermeasures. Presently, there are multiple major traffic records databases spread across several different agencies in Texas. These databases are not linked. Without effective data linking tools and strategies, traffic safety stakeholders simply cannot utilize their information stores effectively, which greatly undermines their overall ability to improve traffic safety and efficiently use government resources.

The Texas A&M Transportation Institute (TTI) conducted this feasibility study as a first step towards identifying the best way to link traffic records databases in Texas. This feasibility study identifies the best practices and lessons learned from other states that have integrated their traffic records databases as well as the needs, concerns, and interests of integrating databases from the current owners of the six core traffic records databases in Texas.

Key Terms

The six core traffic records databases are defined as: citation, crash, driver, injury surveillance, roadway, and vehicle.

- Citation – The Texas Office of Court Administration (OCA) is currently developing a statewide citation repository.

- Crash – The Texas Department of Transportation (TxDOT) Traffic Operations Division maintains the Crash Records Information System (CRIS).

- Driver – The Texas Department of Public Safety (DPS) Driver License Division maintains driver licensing and driver history.

- Injury Surveillance - The Department of State Health Services (DSHS) Injury Epidemiology and Surveillance Branch houses the EMS and Trauma Registries (MAVEN).

- Roadway – TxDOT Roadway Records Branch maintains the Geographical Roadway Inventory Data (GRID) and associated roadway systems.

- Vehicle – The Department of Motor Vehicles (DMV) oversees vehicle titling and registration, and motor carriers.

TTI uses the following key terms and definitions throughout this report. These key terms and definitions are consistent with the terminology outlined by the National Highway Traffic Safety Administration

(NHTSA) Traffic Records Program Assessment Advisory which NHTSA uses to guide the evaluation of states' traffic records programs.[1]

- Data linkages: The links established by matching at least one data element in a record in one file with the corresponding element or elements in one or more records in another file or files. Linkages may be further described as "interface" or "integration" depending on the nature and desired outcome of the connection.

- Data interface: A seamless, on-demand connectivity and a high degree of interoperability between systems that supports critical business processes and enhances data quality.

- Data integration: The discrete linking of databases for analytic purposes. When appropriate, the report will specify if the integration is physical or if the integration is completed through linking dataset extracts.

Summary of Findings

Main Finding on the Feasibility of Linking Traffic Records Databases in Texas

In the short-term, Texas should continue and expand the availability of data extracts from each of the traffic records databases to be shared with other departments and agencies. This will improve the quality of analyses performed by traffic safety stakeholders in multiple agencies and can be completed immediately with little cost.

In the mid-term, there are opportunities for the creation and improvement of interfaces that transmit data from one database to another. This would save time creating and updating records and improve the accuracy of those records.

In the long term, Texas should consider the development of a centralized traffic records repository that will pull information from multiple traffic safety-related databases, similar to Virginia's Traffic Records Electronic Data System (TREDS).

Overview of Linkage Models

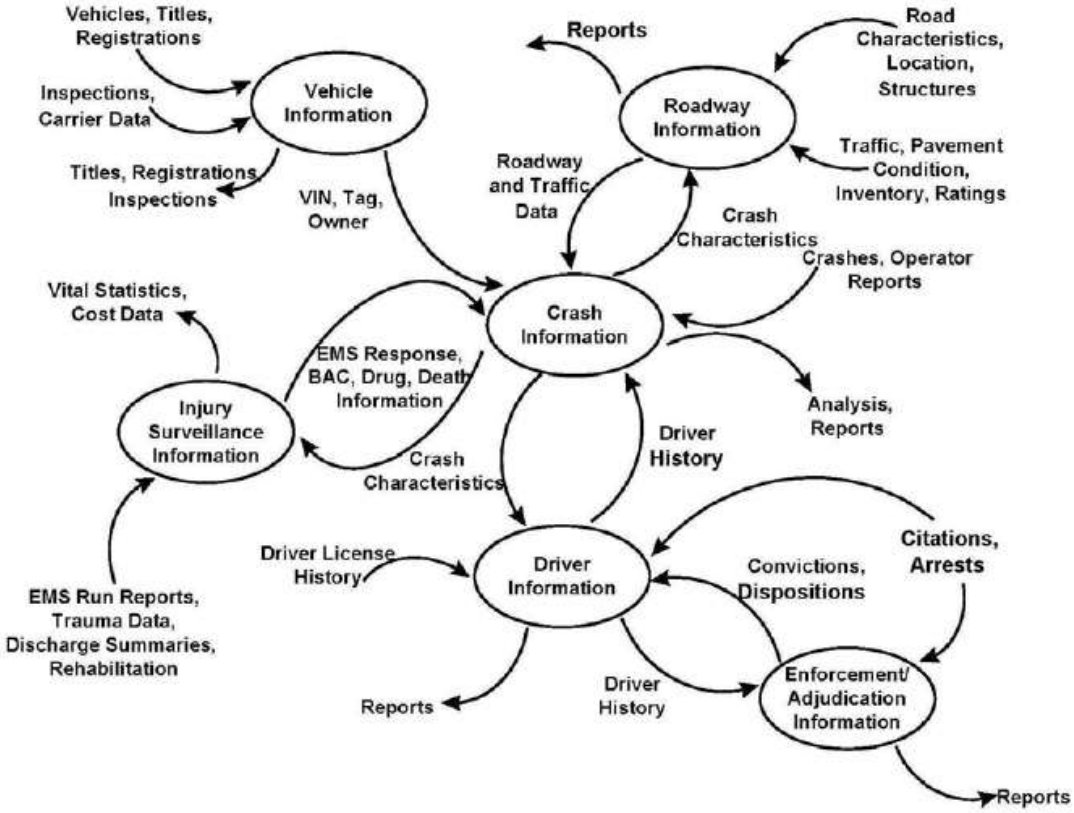
TTI found that states are using several different ways to link their traffic records databases.

The first method is through the use of interfaces which transmit data from one database to the other. Interfaces were the most commonly cited method for linking traffic records databases in other states. Some traffic records interfaces exist in Texas, for example, law enforcement officers who use Crash Reporting and Analysis for Safer Highways (CRASH) can use an interface to pull data from the driver and vehicle files to auto-populate those fields on a crash report. Interfaces are popular because they serve immediate business needs, such as reduced time to complete reports and increased accuracy over manually entry. The state of Idaho has published its ideal standards depicting how the State will plan on

[1] National Highway Traffic Safety Administration. (2012). *Traffic Records Program Assessment Advisory*. Page iii. https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/811644

linking its traffic records databases through interfaces and what information will be transmitted between each database.

Model of Distributed Data Processing in a Traffic Records System (NHTSA Advisory)[2]

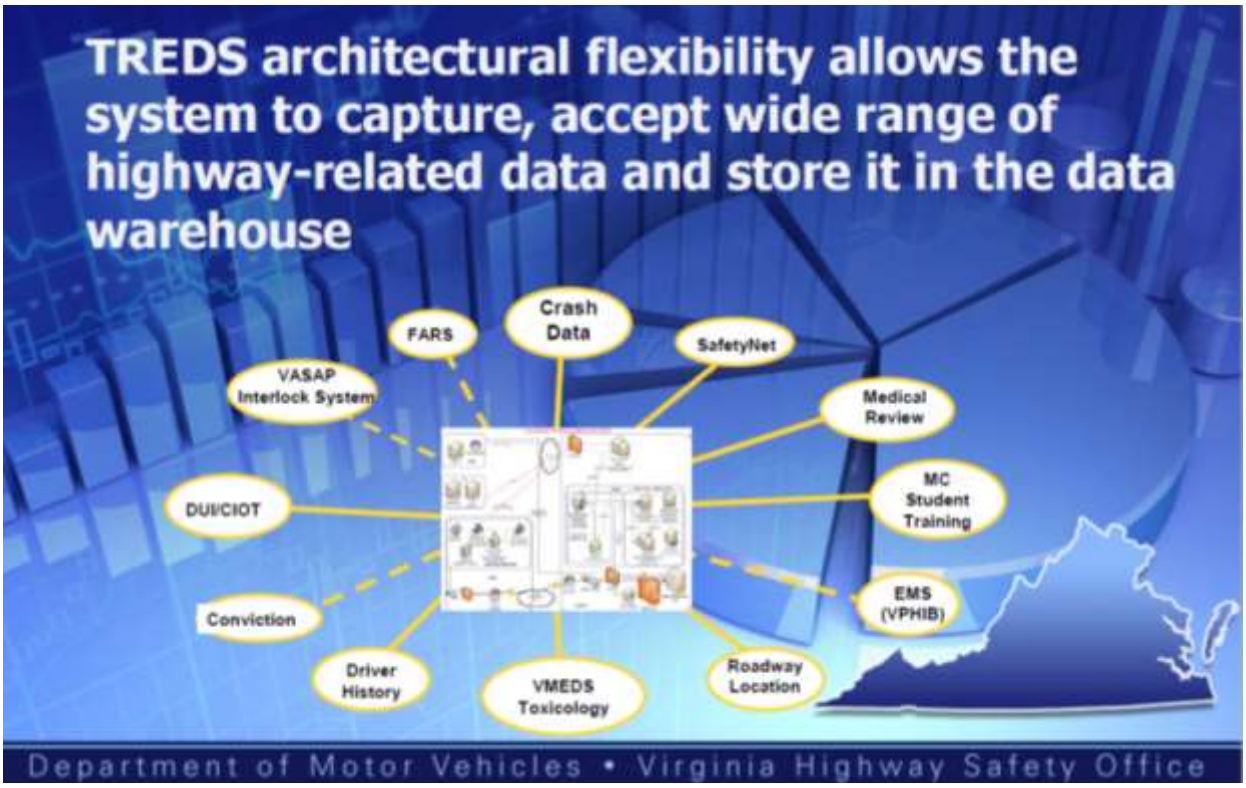


While these databases are not integrated for analytical purposes, information that is common to two or more databases can easily be transmitted to save time and improve accuracy of records in each respective database.

The second method identified to link traffic records databases was to integrate them. Virginia's TREDS provides a good example of physically integrating multiple databases into one large database.

[2] Idaho Department of Transportation, *Idaho Traffic Record Systems Strategic Plan 2012-2017,* (June 2, 2015): 10.

Virginia Traffic Records Electronic Data System[3]



Traffic safety data in Virginia is maintained in independent databases run by multiple different government agencies. However, copies of records in each databases are regularly submitted to a central database maintained by the Virginia Highway Safety Office where a dedicated team works to integrate the data. This integrated data is used for a variety of analytical and research purposes.

Additionally, traffic records can be linked by integrating extracts from two or more databases for specific projects. While this type of linkage is not as immediate as physically integrating multiple databases, linking extracts avoids many of the costs, technical specifications and requirements, and other issues associated with physically linking databases.

Strategic Assessment Summary

The strategic assessment finds that based on a broad range of performance metrics, linked traffic records databases offer many advantages compared to non-linked traffic records databases. TTI conducted a Strengths, Weaknesses, Opportunities, Threats (SWOT) analysis to help summarize many of the pros and cons of linking traffic records databases.

[3] Virginia Highway Safety Office, *Traffic Records Electronic Data System (TREDS),* (2013): Retrieved from: http://www.atsip.org/program/Presentations2013/S5_TREDS.pdf.

	Helpful	Harmful
Internal Origin	**Strengths** •Time and cost savings •Improvement in accuracy, completeness, and uniformity of data •Better traffic safety data quality control •Avoidance of duplication in reporting •More efficient adjudication process	**Weaknesses** •Technology coordination barriers •Stakeholder engagement and agreement barriers •High Maintenance costs •Difficulty to connect systems •High need for training & skilled labor force
External Origen	**Opportunities** •Potential for allocation of more funding •Transparent data •Accurate cost-benefit analysis on traffic safety •Better measurement the cost of crashes to the state •More evidence on which countermeasures Work •More accessibility to stakeholders	**Threats** •Funding •Privacy and other legal issues to share data •Need for an external champion to promote integration and provide funding • Changes in systems that could threaten established linkages • Data management difficulties due to the multi-stakeholder complexity

Literature Review and Interviews with Stakeholders Main Findings

- Overall, there is a wide variety of traffic records database linkage statuses and efforts among the states. Some states have multiple data linkages including both interfaces and true integration, while other states are currently focused on getting their crash and citation records submitted electronically to their respective databases and plan on pursuing linkages in the future.
- The most commonly linked traffic records databases are the crash, citation, driver, and vehicle databases. These four databases are the easiest to link and, by being linked, offer the greatest benefits in terms of costs and time savings, and improved government efficiency and effectiveness.
- The EMS/Injury Surveillance database is the least likely to be integrated with the other traffic records databases. Privacy concerns and the lack of a ready to use unique identifier are the biggest reasons why it is difficult to link EMS/Injury Surveillance records.
- Every state interviewed used federal 405c and 408 funds to link their traffic records databases. No other funding sources were mentioned by the interviewees.
- The most commonly cited recommendation is for each of the six core traffic records databases to achieve electronic submission to each respective statewide repository before pursuing linkages. For example, states should have the majority of their crash records reported electronically to a statewide crash database before pursuing any linkages.

- Virginia was the only state to have a truly centralized integrated traffic records system. Virginia's main recommendation, which is echoed by several other states with advanced linkages, is to establish a team dedicated to building linkages. The team will eventually become experts over time in the traffic records data which will expedite and ease each additional linkage.

Current Status of Traffic Records Database Linkages in Texas and Potential Future Linkages

Below is a summary matrix of the current state of traffic records integration along with potential linkages with tangible benefits. OCA is currently pursuing the development of a centralized citation repository. The following matrix assumes the completion of this citation repository.

- Partially Realized Interface - An interface has already been developed fully or partially and information is being transmitted from one database to another by most users.

- Potential Interface Benefit - No interface currently exists, but there would be a benefit if an interface was developed to transmit information from one database to another.

- Potential Integration Benefit - Limited or no integration currently exists, but there would be a benefit if a potential integration were developed to link information from the referenced databases.

- Limited Integration Benefit - There would be limited-to-no-benefit if a potential integration were developed to link information from the referenced databases.

		Receives Information					
		Citation	Crash	Driver	Injury Surveillance	Roadway	Vehicle
Provides Information	Citation		Potential Integration Benefit	Partially Realized Interface	Limited Integration Benefit	Potential Integration Benefit	Potential Interface Benefit
	Crash	Potential Integration Benefit		Potential Interface Benefit	Potential Interface Benefit	Potential Integration Benefit	Limited Integration Benefit
	Driver	Partially Realized Interface	Partially Realized Interface		Potential Interface Benefit	Limited Integration Benefit	Potential Integration Benefit
	Injury Surveillance	Limited Integration Benefit	Potential Integration Benefit	Limited Integration Benefit		Potential Integration Benefit	Limited Integration Benefit
	Roadway	Potential Interface Benefit	Potential Interface Benefit	Limited Integration Benefit	Limited Integration Benefit		Limited Integration Benefit
	Vehicle	Partially Realized Interface	Partially Realized Interface	Potential Integration Benefit	Potential Integration Benefit	Limited Integration Benefit	

- Existing interfaces allow law enforcement personnel who use CRASH and some private e-citation software to import driver and vehicle data to auto-populate portions of the crash and citation reports.

- Class C misdemeanors are submitted electronically to the DPS' Driver's License Division, but the process is not used by all courts and is not completely automatic.

- There are some potential interfaces that could be beneficial, but more research is needed to determine the costs to develop these interfaces.

- All six core traffic records databases were built separately and continue to operate independently of one another which limits the potential to develop physical linkages.

- While interface linkages may not be appropriate for all databases, many traffic safety-related analyses would be improved by integrating several traffic records databases.

- Most of the benefits of integrating two or more databases can be achieved by linking extracts from each database and using statistical analysis software to analyze the data. Linking extracts avoids many of the costs, technical specifications and requirements, and other issues associated with physically linking databases.

- The process of linking data extracts would be aided by interfaces that were built to transmit a unique ID between databases. For example, if an interface were developed to send the crash ID to the related injury surveillance record(s), linking the data extracts later would be much easier and more accurate.

Recommendations on the Feasibility for Future Traffic Records Database Linkages in Texas

Like all states, Texas' traffic records databases were built independent of one another. However, there are multiple opportunities to pursue both interfaces and integration to link these databases.

Alabama, for example, has developed an interface that allows law enforcement to select the location of a crash or citation on a map which then auto-populates on the crash or citation report form. It also includes the road segment data from the roadway file. This is a time saver for law enforcement and helps researchers link and analyze crash and roadway data. While this was given a low priority by the Texas Crash User Group, as technology advances, it could become a very feasible and valuable interface in the near future.

Interfaces can also be used to update records. Currently, most Class C misdemeanors are submitted electronically to DPS' Driver's License Division through an interface that updates an individual's driver history. An interface that sent crash reports to DPS' Driver's License Division would be just as valuable.

Finally, interfaces can be used to transmit unique IDs to make integrating the databases later easier. For example, there are many states trying to develop a way to transmit the crash ID from a crash report to the corresponding record(s) in the injury surveillance system. None have been successful so far, but if an interface were developed, it would allow for the deterministic linking of crash and injury surveillance records which is much more accurate than the current method of probabilistic linking.

While interfaces are best to link some traffic records databases, pursuing integration is better for others. Integrating traffic records databases helps traffic safety stakeholders perform more in-depth analyses which allows for more informed decision-making.

Integration can be pursued through either physically linking the databases or integrating extracts from two or more databases.

As discussed above, Virginia provides a good model for physically integrating multiple databases. Virginia has found success getting other agencies to submit traffic safety-related data to a central repository by providing funding assistance to those reporting agencies with maintenance and improvement of their individual databases. While this is an ideal model, it takes a large amount of funding and technical expertise to perform.

An alternative to physical integration is to integrate extracts from two or more databases using statistical analysis software to analyze the data. Linking extracts avoids many of the costs, technical specifications and requirements, and other issues associated with physically linking databases. Linking extracts is currently being done in Texas. For example, TxDOT makes crash data available to groups such as law enforcement or researchers at TTI who link the crash data with other data sources for a variety of analytical and research purposes.

Section 2: Background Research and Evaluation

Part 1: Literature Review and Interviews with Stakeholders Outside of Texas

In an effort to identify key trends and provide guidance to Texas' efforts to integrate its six core traffic records databases, TTI researchers conducted background research on each state in the US. The research involved an online literature review of the other 49 US states and the District of Columbia in order to obtain a strong foundational knowledge of traffic records linkages in each state and to identify trends followed by interviews of representatives from twelve selected states in order to gain a more in-depth understanding of their state's efforts to integrate their traffic records systems.

Executive Summary

- Overall, there is a wide variety of traffic records database linkage statuses and efforts among the states. Some states have multiple data linkages including both interfaces and true integration, while other states are currently focused on getting their crash and citation records submitted electronically to their respective databases and plan on pursue linkages in the future.

- TTI interviewed the following twelve states: Alabama, California, Idaho, Indiana, Kansas, Maryland, New Jersey, North Carolina, Pennsylvania, Virginia, Washington, and West Virginia.

- The most commonly linked traffic records databases are the crash, citation, driver, and vehicle databases. These four databases are the easiest to link and, by being linked, offer the greatest benefits in terms of costs and time savings, and improved government efficiency and effectiveness.

- The EMS/Injury Surveillance database is the least likely to be integrated with the other traffic records databases. Privacy concerns and the lack of a ready to use unique identifier are the biggest reasons why it is difficult to link EMS/Injury Surveillance records.

- The majority of the interviewed agencies used point-to-point models. Point-to-point models usually use interfaces that for example allow crash and citation records to be pre-populated with information from the driver and vehicle file. The driver, vehicle, crash, and citation databases remain distinct, but interfaces allow pertinent information to flow easily from one database to the other. Point-to-point models are used by the states interviewed because they fill the pressing needs of the agencies involved. Agencies are usually most concerned with reducing time and costs associated with filling or updating records and with increasing accuracy than other goals such as integrating data for better analysis.

- Every state interviewed used federal 405c and 408 funds to link their traffic records databases. No other funding sources were mentioned by the interviewees.

- The most common recommendation was to first get each of the six core traffic records electronically reported to their own statewide repository. For example, states should have the majority of their crash records reported electronically to a statewide crash database, before pursuing any linkages.

- Virginia was the only state to have a truly centralized integrated traffic records system. Their main recommendation, which was echoed by several other states with advanced linkages, was to have a dedicated team to build linkages because that team would become experts over time in the traffic records data they were linking making each additional linkage easier.

Methodology

TTI began the background research analysis by conducting a literature review of the other 49 US states and the District of Columbia in order to obtain a strong foundational knowledge of traffic records linkages in each state. TTI focused its search on looking for documents such as the state's most recent traffic records assessment, traffic records plan, highway safety plan, strategic highway safety plan, documents published by each state's Traffic Records Coordinating Committee (TRCC), and related documents. The information obtained from each state is summarized below.

Based off of research conducted in the literature review, TTI followed up by reaching out to 19 states that seemed to have made the most progress in integrating their traffic records databases in order to gain additional insights and information and was able to schedule and conduct interviews with 12 of the states.

TTI began the interview process by contacting Traffic Records Coordinating Committee (TRCC) Coordinators in each state. Some TRCC coordinators were able to answer interview questions while others referred us to other stakeholders from their state.

The interviews provided clarity into the actual status and progression of each state's traffic records linkage efforts. Most of the interviews revealed that states that had literature suggesting some traffic records linkage had in fact progressed toward linking their traffic records. However, there were a few cases in which states had not progressed as far as the literature suggested due to delays and changing priorities since those documents were published.

Overview of Each State

Alabama

The Center for Advanced Public Safety (CAPS) in Alabama maintains the Critical Analysis Reporting Environment (CARE) data warehouse, which is the primary search engine for traffic crash and safety analyses performed in Alabama. According to the *2015 State of Alabama Highway Safety Plan,* the CARE database integrates "crash data, spatial and location reference data, limited roadway features data and traffic citation data to allow advanced statistical analyses."[4]

The State also has an integration mechanism between the crash, citation, driver and vehicle files. The eCrash and eCitation that provide linkage during the data collection process to law enforcement officers.[5] The State is planning to create in a web portal (Safe Home Alabama) with information from roadway safety agencies. The goal of this portal is to be the "go-to resource for everything concerning traffic safety for the state of Alabama."[6]

The State has also set a five-year plan to have citation, crash, EMS, and other records "submitted electronically on consistent and integrated data entry systems, and the data will be automatically uploaded to the central databases, saving considerable data entry costs and resulting in totally complete and consistent records that are readily available for analysis and case management." Alabama also wants to use case number cross references to merge crash and injury surveillance data. In addition, to having a "centralized index of all available databases".[7]

Interview of Representatives from Alabama

Beau Elliott: Deputy Director - Center for Advanced Public Safety
Rhonda Stricklin: Associate Director - Center for Advanced Public Safety
Jeremy Pate: Assistant Research Engineer - Center for Advanced Public Safety

Alabama is one of the states furthest along in terms of traffic records linkage. Their vehicle and driver databases interface to eCite and eCrash to populate relevant fields. eCite and eCrash then link back to vehicle and driver files to update. The vehicle file includes owner's driver's license number which aids in the linkage. Additionally, roadway data and eCrash are linked. eCrash uses Open Street Map, which can be used offline, allowing the officer to zoom in and select the crash location. When connected back to the internet, Open Street Map can be linked with the state linear referencing system to link the crash

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[4] Alabama Department of Transportation, *State of Alabama Highway Safety Plan, 2nd Edition*, (2015): 51, retrieved from: http://www.caps.ua.edu/files/2015/05/SHSP-2015.pdf.

[5] National Highway Safety Administration Technical Assessment Team, *State of Alabama Traffic Records Assessment*, (Jan-Feb 2011): 25, retrieved from: http://www.safehomealabama.gov/Portals/0/Images/TRCC/2011%20Alabama%20NHTSA%20Traffic%20Records%20Assessment.pdf.

[6] Alabama Department of Transportation, *State of Alabama Highway Safety Plan, 2nd Edition*, (2015): 51, retrieved from: http://www.caps.ua.edu/files/2015/05/SHSP-2015.pdf.

[7] State of Alabama, *State of Alabama Fiscal Year 2017 Highway Safety Plan,* (Jun 22, 2016): 58, retrieved from: https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/al_fy17hsp.pdf.

and roadway data. Currently Alabama's EMS data is not linked to any other core traffic records database. Alabama officials have discussed various ways to create a unique event identifier but have not come up with a practical solution of how the identifier would be transferred from the law enforcement agency, to EMS, to hospital, etc.

The University of Alabama's Center for Advanced Public Safety (CAPS) has built and maintained all linkages and interfaces. CAPS began by building the infrastructure for electronic submission of crash and citation records. Over the last 10 – 12 years, CAPS has progressed into linking the databases.

Both 405c and 408 funds were used to fund the effort. None of the interviewees were aware of the exact cost to link the databases since the scope evolved to include other interrelated efforts such as allowing electronic submission of crash and citation records, and the length of the project has spanned over a decade. However, the interviewees felt that the linkages have been very cost beneficial due to decreased time to complete crash and citation records and increased accuracy.

Alaska

Alaska's Division of Motor Vehicles hosts the vehicle and driver information through the License Vehicle Information Network (ALVIN). The Office of Administrative Director of the Alaska Court System hosts the citation and adjudication information through the CourtView system.[8] The 2010 *Traffic Resource Guide* for the State lists that the court system implemented a web service that electronically provides disposition information to DPS and DMV. This web service allows the State to have up-to-date conviction information in the DMV's ALVIN system. These dispositions are matched with the original citation because of the common identifier between the two databases: the citation number.[9] In addition, the Department of Transportation and Public Facilities hosts the Highway Analysis System (HAS), which contains crash, roadway and traffic information.[10] The State also has a Multi-Agency Justice Integration Consortium (MAJIC) encompassed of twenty member agencies and other organizations that work together to enhance the criminal justice system as a whole.[11]

Arizona

This literature review was unable to find any traffic records assessment for the State of Arizona. The *2017 State of Arizona Highway Safety Plan* does not refer to projects linking core traffic records.[12] The Traffic Records Coordinator, John Riemer, in a presentation titled "An Overview of Traffic Records" cited that the State collect crash data elements and enter it into the Accident Location Identification Surveillance System (ALISS) database. He also referred that before 2011 crash reports in the State were

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[8] Alaska Highway Safety Office, *Alaska Highway Safety Plan FFY 2017*, (July 1, 2016): 10, retrieved from: https://one.nhtsa.gov/links/StateDocs/pages/SafetyPlans.htm.

[9] State of Alaska Department of Transportation, *Traffic Records Resource Guide*, (Dec 2010): 16, retrieved from: http://www.dot.state.ak.us/highwaysafety/internal/AKDOT_Traffic_Records_Resource_Guide.pdf.

[10] Alaska Traffic Records Coordinating Committee, *2015 Alaska Traffic Records Strategic Plan*, (2015): Retrieved from: http://www.dot.state.ak.us/highwaysafety/assets/pdf/2014/ATRCC_FFY15_TR_Strategic_Plan_FINAL_012414.pdf

[11] Ibid., 9.

[12] Arizona Governor's Office of Highway Safety, *State of Arizona Highway Safety Plan FFY 2017*, (July 1, 2016): Retrieved from: https://www.azgohs.gov/about-gohs/FFY2017HSP.pdf.

manually entered into ALISS.[13] The State also has LEADRS, a DUI Reporting and Database. This database allows law enforcement to upload DUI citations into the database, which is linked to the ALISS and FARS databases.[14]

Arkansas

The literature review did not find information about Arkansas' efforts to link its core traffic records. According to the *2017 Performance Plan and Highway Safety Plan*, the State is investing in improving its Traffic Analysis Reporting System (TARS), which stores crash data for the State. The State is also devoting funds to the development of an electronic citation system that would send citations automatically to the Administrative Office of the Courts.[15]

California

The central repository for crash data in the State of California is the Statewide Integrated Traffic Records System (SWITRS). The system contains roadway data 15,000 miles of highways. The State also directly connects driver data with almost all of the municipal courts within the State. This linkage allows for timely and accurate prosecution of traffic violations because traffic court judges have access to complete and current driver histories. The Department of Justice in the State also maintains traffic records on all arrests that occur as well as their dispositions. [16]

The Department of Motor Vehicles (DMV) also maintains a DUI Tracking System, which tracks DUI offenders from throughout the entire process in the judicial system. Adjudication data is linked to the driver system to accurately impose proper administrative sanctions. Courts have the ability to query DMV driver systems to obtain driver history to administer sanctions.[17]

The Emergency Medical Services Authority (EMSA) controls the statewide database for emergency medical response in the State. The information is stored in the CEMIS database, and it is NEMIS compliant. The California Department of Public Health (CDPH) collects Emergency medical response data, trauma center, emergency department, hospital discharge, and vital records data.[18] The State also "implemented crash medical outcomes data project to develop a system to link multiple data sources, i.e., CEMSIS, SWITRS, and medical records."[19][20]

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[13] John Riemer, *An Overview of Traffic Records*, (April 15, 1016): 3, retrieved from: http://www.aztribaltransportation.org/nnp/pdf/072116-NNP-SC-Traffic-Records-Presentation.pdf.

[14] Traffic Records Coordinating Committee. *TRCC Projects*. (n.d.), retrieved from: https://azdot.gov/dataimprovement/trcc/projects.asp.

[15] Arkansas Highway Safety Office, *FY 2017 Performance Plan and Highway Safety Plan*, (2017): Retrieved from: https://one.nhtsa.gov/links/StateDocs/pages/SafetyPlans.htm.

[16] Office of Traffic Safety, *2017 California Highway Safety Plan*, (2017): 144, retrieved from: https://one.nhtsa.gov/links/StateDocs/pages/SafetyPlans.htm.

[17] Ibid., 145.

[18] Ibid., 145.

[19] Office of Traffic Safety, *2016 California Highway Safety Plan*, (2016): 139, retrieved from: https://one.nhtsa.gov/links/StateDocs/pages/SafetyPlans.htm.

[20]California Department of Transportation, *2015-2019 California Highway Strategic Highway Safety Plan*, (Sep 2015): 27, retrieved from: http://www.dot.ca.gov/trafficops/shsp/docs/SHSP15_Update.pdf.

Interview of Representative from California

Bill Ehart: CA TRCC Coordinator, Southern California Law Enforcement Liaison – California Office of Traffic Safety

California does not have any linked core traffic records databases. Caltrans, the University of Berkeley, and other research institutes currently use extracts from the individual traffic records databases and link subsamples of the data for various projects, but there are no physical linkages between the databases.

California does not have a statewide electronic crash database. As a result, all focus is currently being directed toward development of a statewide electronic crash database. Law enforcement submit fatal and serious injury crashes by paper to the state police where the data is recorded manually into a database. All other crashes are stored by local law enforcement. Additionally, California does not have a uniform crash form. While there are 43 required fields on the crash form, each agency is free to add additional fields.

California would like to pursue linking traffic records databases as a long-term goal, but data linkage is not a priority in the short and immediate-term.

Colorado

Colorado has minimal data linkages per the 2015 Traffic Records Assessment. Crash and roadway data are linked only to geocode the crash location.[21] Injury surveillance and crash data had previously been linked, but are no longer linked.[22] There are plans to begin integrating the data more in the future once a full time traffic records coordinator is hired.[23]

However, over the next few years, Colorado has established several goals to increase traffic records linkages. Colorado wants to conduct a pilot study by Dec. 31, 2018 to explore both deterministic and probabilistic linkages of crash and injury surveillance systems with an established linkage procedure in place to routinely link crash and injury surveillance data by Dec. 31, 2019.[24] Additionally, Colorado aims to have "100% of the electronic Crash data system to be integrated with Driver and Vehicle data systems,"[25] by Dec. 31, 2019. Finally, Colorado will document by Dec. 31, 2017 a plan to link citation data with other traffic records data.[26]

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[21] National Highway Traffic Safety Administration, *State of Colorado – Traffic Records Assessment,* (April 27, 2015): 205. Retrieved from: https://www.codot.gov/about/committees/strac/2015-traffic-records-assessment/view.

[22] Ibid., 206.

[23] Ibid., 202-208.

[24] Colorado State Traffic Records Advisory Committee, *Colorado State Traffic Records Advisory Committee Strategic Plan 2016-2019,* (April 2016): 23. Retrieved from: https://www.codot.gov/about/committees/strac/strac-strategic-plan-2012/strac-strategic-plan-2012/view.

[25] Ibid., 15.

[26] Ibid., 21.

Connecticut

The Traffic Records Committee in Connecticut developed a multiyear data linkage plan for the state, involving nine tangible steps to reach the goal of connecting its core traffic records systems.[27] The state has many examples of data sharing. The Department of Transportation (ConnDOT) and the Injury Prevention Program (IPP) at Department of Public Health (DPH) being one example. ConnDOT provides crash report data to DPH, for inclusion in the CODES project, which in turn adds the information to the Statewide Injury Surveillance System (SWISS). The State is also working on connecting citation information to the Crash Data Repository (CDR).[28] In addition, ConnDOT is developing its CDR in partnership with the University of Connecticut Transportation Institute (CTI) with plans to add roadway data to the existing crash data. The State also has the Collision Analysis System (CAS), which automatically submits crash data electronically to DMV's SafetyNet database.[29]

Delaware

Delaware was the first State to implement an integrated criminal justice information system known as CJIS.[30] The Delaware Criminal Justice Information System (DELJIS) was created by the State Legislature in 1982 and is responsible for maintaining and overseeing the day-to-day operations of CJIS. One component of CJIS is the Law Enforcement Support Suite (LEISS) which hosts the crash reporting system for the State.[31] In addition, CJIS maintains a data interface with driver license, vehicle registration, and citation/adjudication data.[32]

While CJIS has been in existence since 1990, the system has continuously changed to meet the needs of system participants and address compatibility issues as new hardware and software requirements emerge. In the past five years, updates to CJIS have included the re-write and release of the updated LEISS, development and release of Impaired Driving Reports, and development and release of eTow.[33]

The DELJIS Board of Managers meets monthly to discuss hearings, network management, strategic issues, and committee reports. A review of May 2017 meeting notes indicates that the Board is working

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[27] Traffic Records Coordinating Committee, *State of Connecticut Strategic Plan for Traffic Records*, (2017-2018): Retrieved from: http://www.ct.gov/dot/lib/dot/documents/dtransportation_safety/traffic_records/trcc_traffic_records_strategic_plan.pdf.

[28] National Highway Safety Administration technical Assessment Team, State of Connecticut Traffic Records Assessment, (April 22-27, 2017): 25, Retrieved from: http://www.ct.gov/dot/lib/dot/documents/dtransportation_safety/traffic_records/traffic_records_assessment_2012.pdf.

[29] Traffic Records Coordinating Committee, *State of Connecticut Strategic Plan for Traffic Records*, (2017-2018): Retrieved from: http://www.ct.gov/dot/lib/dot/documents/dtransportation_safety/traffic_records/trcc_traffic_records_strategic_plan.pdf.

[30] Holmes, Amir, *Delaware Criminal Justice Information System – The Evolution of Integration,* SEARCH – The National Consortium for Justice Information and Statistics, Fall 1999/Winter 2000: 1-12. Retrieved from: http://deljis.delaware.gov/pdfs/CaseStudy.pdf.

[31] National Highway Traffic Safety Administration, *Delaware – About Crash Data System*, 2015. Retrieved from: https://one.nhtsa.gov/nhtsa/stateCatalog/states/de/delaware.html.

[32] Delaware Criminal Justice Information System, *DELIS Systems.* Retrieved from: http://deljis.delaware.gov/whatwedo.shtml.

[33] Bell, Peggy, and Dave Elwood, "Law Enforcement Investigation Support Suite – LEISS" (presentation made at the National Association for Justice Information Systems, Tucson, Arizona, November 1 – 4, 2016). Retrieved From: https://najis.org/presentations/2016-presentations.

on a DELJIS Modernization Plan, including how to modernize its mainframe. One cited challenge to the modernization plan is that there was very limited requirement of documentation when the mainframe was built, and many of the individuals who have knowledge of the lines of coding have since retired.[34]

The DELJIS Board of Managers meetings are supplemented by the DELJIS Criminal Justice Users Group which meets every other month. The User Group is comprised of various representatives from DELJIS and system users, including local and state law enforcement, State Bureau of Identification, Family Court, Justice of the Peace Courts, etc. The User Group reviews DELJIS project status and reports on various user components, including requested features to be added to LEISS and E-Ticket/E-Crash portals, or any problems users may have encountered while navigating the system.[35]

Florida

Florida is working on an FY17 project to allow Law Enforcement to import contact info from the Electronic License and Vehicle Information System (ELVIS) into Traffic and Criminal Software (TraCS).[36]The State has successfully created a web portal that contains crash and citation data for traffic safety professionals to perform ad hoc reporting and any analytics reports. The portal also provides robust crash data including maps that include classified crashes by the type of occurrence.[37]

The State has also integrated citation/adjudication, driver, and vehicle data, as well as Florida Highway Patrol activity data into a singular data warehouse house under the Department of Highway Safety and Motor Vehicles (DHSMV). This data allows for "ad-hoc analysis is performed for legislative needs, grant purposes, and research through the DHSMV performance management office. Analyses were provided that link driver demographics, vehicle type, and citation data. Crash data is integrated with vehicle data for purposes of analysis and has been used to determine the crash involvement of vehicles with the title brand "rebuilt" in crashes. Reports were provided covering analyses of crash incidences involving newer versus older vehicles and involving rebuilt vehicles." In addition, Florida is exploring the possibility of linking roadway and crash as well as crash and injury surveillance data. [38]

Georgia

Georgia is assessing the possibility of linking DUI, crash and citation data to the driver system based on the *2014 NHTSA Traffic Records Assessment* recommendation. The State is currently expanding the use of electronic citation programs as well as improving it crash-reporting methods. The electronic crash reporting percentage was 92% in 2016. The State has also set goals to support the Traffic Records Coordinator position, improve crash location, and continue to fund CODES.[39]

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[34] DELJIS Board of Managers, *May 25, 2017 Meeting Minutes.* Retrieved from: https://publicmeetings.delaware.gov/Meeting/39345.

[35] DELJIS Criminal Justice Users Group, *April 10, 2017 Meeting Minutes.* Retrieved from https://publicmeetings.delaware.gov/Meeting/39324.

[36] Florida Department of Transportation, *2017 Florida Highway Safety Plan*, (2017): 87, retrieved from: https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/fl_fy17hsp_0.pdf.

[37] National Highway Traffic Safety Administration, *State of Florida traffic Records Assessment*, (Jan 4, 2016): 215, retrieved from email exchange.

[38] Ibid.

[39] Georgia Governor's Office of Highway Safety, *2017 Georgia Highway Safety Plan*, (Sep 13, 2016): 54, Retrieved from: https://one.nhtsa.gov/links/StateDocs/pages/SafetyPlans.htm.

Georgia has ranked its core traffic records based on a prioritization scale of improving Crash/Consequence Reporting (3 points), Crash Prevention/Mitigation (2 points), Support Database (1 point). Based on these levels, the State is prioritizing the use of Traffic Records Improvement Funds in the following order: improving crash and injury surveillance reports, citation/adjudication, driver records, vehicle records, and roadway file. The State has further assigned priority points with each of the levels discussed above to complete its assessment. Focus areas such as system re-engineering, data collection, repository and processing systems, and user tools are examples of the priority points assigned to the different levels.[40]

Hawaii

Hawaii is investing in improving the integration of citation systems with the Judiciary Information Management System (JIMS) by increasing number of citations that het sent electronically from law enforcement to the judiciary. The State also funded an FY17 project to link 90% of EMS patients involved in crashes to the crash report.[41]

Idaho

Idaho details there current state (as of 2015) of traffic records linkage and long term plans to link their traffic records in their *2012-2017 Idaho Traffic Record Systems Strategic Plan.* These plans appear extensive and involved the linking of all core traffic records systems in a web model that appears to use interfaces to link the databases. However, there are limited details on specific efforts. Instead graphics depicting the current state of linkage and the proposed future state of linkage are the primary sources of information and there is limited text detailing how or when these linkages would occur.[42]

Interview of Representative Idaho

Margaret Goertz: ID TRCC Coordinator, Idaho Transportation Department

Idaho has published detailed plans for integrating their traffic records systems in their Traffic Record Systems Strategic Plan[43]. However, Idaho has had two new directors take over agencies involved in traffic records linkage, and the new leadership has shifted their agencies away from data linkage towards other priorities.

Presently, Idaho is working towards creating a data warehouse that will link crash data with driver and vehicle data. Driver and vehicle databases were previously linked, but the Department of Motor

[40] Georgia Traffic Records Coordinating Committee, *2016-2017 Georgia Traffic Safety Information System Improvement Grant Documentation and Strategic Plan*, (2016-2017): 5, Retrieved from: http://www.gahighwaysafety.org/fullpanel/uploads/files/mike-tsi-info.pdf.

[41] Hawaii Department of Transportation, *Hawaii 2017 Highway Safety Plan*, (n.d.): 48, retrieved from: https://one.nhtsa.gov/links/StateDocs/pages/SafetyPlans.htm.

[42] Idaho Department of Transportation, *2012-2017 Idaho Traffic Record Systems Strategic Plan*, (Jun 2, 2015): Retrieved from: http://apps.itd.idaho.gov/apps/ohs/Plan/FFY16-FFY20_SHSP.pdf.

[43] Idaho Department of Transportation, Ibid.

Vehicles which maintains the driver and vehicle records has undergone a modernization of their computer and software systems which requires efforts to relink crash data with vehicle and driver data. The driver's license number and VIN number will be used to link the databases.

Additionally, the Idaho Supreme Court has recently centralized their system and changed their software. Ms. Goertz said this will be good in the long run for promoting e-citation and linking citation data with other traffic records.

EMS was onboard with trying to link EMS records, but the Idaho Bureau of Vital Records and Health Statistics is not due to privacy concerns which has delayed any efforts to link EMS data. Idaho officials have had discussions on what unique identifier to use to link EMS data, but they have not been able to reach a decision. As a smaller population state, one concern Ms. Goertz raised is the ability to identify people from high profile crashes because of the relatively small number of crashes they have compared to large population states such as Texas.

All prior efforts to link Idaho's traffic records databases used 405c funds.

Illinois

According to the *2011 State of Illinois Traffic Records Assessment*, Illinois did not have a traffic records system inventory.[44] In 2016, the Illinois Department of Transportation (IDOT) estimated that it processes approximately 450,000 crash reports per year using the Crash Information System (CIS) database. Electronic crash report submission represents about 61 percent of crash reports, seven third-party vendors submit a portion crash data to the Reporting System (MCR), and the rest of crash reports are done by paper.[45]"As of December 12, 2016, the Date Entry (DE) process was 69 days from the date of the crash, while Location Entry was at 96 days from the date of the crash. The Statistics Coding Unit has processed 286,537 crash reports, for CY 2016. An additional 156,963 crash reports are currently queued at DE. Based on annual crash report submission averages and the rate of receipt for crash reports this year, we estimate an additional 18,135 crash reports could be received yet this year for CY 2016." [46]

Crash records link with roadway, driver and vehicle data in the State. For example, MCR users can scan bar codes on driver's license and/or license plates to auto-populate the crash report with driver's license and vehicle information as well as add location codes. This process increases the changes for data validation and analysis. For instance, "Crash and roadway inventory data are linked based on location code and/or latitude/longitude coordinates through the IHIS Illinois Highway Information

[44] National Highway Safety Administration, *State of Illinois Traffic Records Assessment,* (April 04-08, 2011): Retrieved from: http://www.idot.illinois.gov/assets/uploads/files/transportation-system/reports/safety/itrcc/itrcc%202011%20traffic%20records%20assessment.pdf.

[45] Illinois Department of Transportation, *2016 Highway Safety Program Annual Evaluation Report,* (2016): 23, Retrieved from: http://www.idot.illinois.gov/Assets/uploads/files/Transportation-System/Reports/Safety/HSP/AER16-singles_010317.pdf.

[46] Ibid., 23.

System and stored in the IRIS database."[47] The State also links crash and citation data. Through the Law Enforcement Agency Data System (LEADS), law enforcement is able to auto-populate citation information that then is sent it to the Driver Services Department (DSD). "Two times per year, adjudication agencies can request a data file from the DSD office for DL records that have a county code for their county and surrounding counties to obtain the name and address of those drivers to populate their database. Currently, 105 of the 107 adjudication agencies have online direct access to the driving records through the direct inquiry system. They are able to print the DL history records. The systems connect through the driver's license bar code used in e-crash and e-citation applications as they are implemented. With the appropriate bar code reader technology the appropriate fields on electronic forms can be populated."[48] Lastly, "crash data are also linked to data files in the injury surveillance system, including EMS, emergency department, and hospital discharge data." [49]

Indiana

The State of Indiana has a central repository that integrates crash data (hosted by the State Police) to EMS (hosted by the DPH), Hospital (hosted by the DPH), driver (hosted by the Indiana Bureau of Motor Vehicles (BMV)) and road/traffic data (hosted by the Indiana's Department of Transportation). This repository provides timely crash, driver, road, and traffic data to the State. According to the State's *2016 Highway Safety Plan*, Indiana is working towards adding toxicology and coroner's, trauma registry, and e-citations data in the near future to the repository. [50]

The plan also points to the State's Safety Needs and Intervention Programs (SNIP), which is a promising software that has the "potential to unify infrastructure (engineering) and enforcement (behavioral) solutions under the same methodologies, and facilitate the allocation of resources to obtain an integrated estimated effect on traffic safety." [51]

In addition, Indiana's Automated Reporting information Exchange System (ARIES) stores nearly 100 percent of Indiana's crash reports. The State also use an Odyssey Casey Management System that gives traffic safety professional access to traffic citations. Along with citations, information on DUI (OVWI) cases go to the BMV. The State also has the Operation Pull Over (OPO) Database, which is a repository and reporting tool that contains all programmatic activities related to the Indiana Criminal Justice System.[52]

Interview of Representative from Indiana

John Bodeker: IN TRCC Coordinator, Indiana Criminal Justice Institute

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[47] National Highway Safety Administration, *State of Illinois Traffic Records Assessment,* (April 04-08, 2011): Retrieved from: http://www.idot.illinois.gov/assets/uploads/files/transportation-system/reports/safety/itrcc/itrcc%202011%20traffic%20records%20assessment.pdf.

[48] Ibid., 55-56.

[49] Ibid., 39.

[50] National Highway Safety Administration, *State of Indiana FY 2016 Highway Safety Plan,* (Jan 1, 2015): Retrieved from: https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/in_fy16hsp.pdf.

[51] Ibid., 87.

[52] Ibid.

Mr. Bodeker emphasized several times that the first step to traffic records data linkage is to "get everything electronic" before moving on to linking the databases. Indiana had begun building systems for electronic crash and citation submission 10 years ago. Once the systems were fully electronic Indiana began looking towards data linkage.

The Indiana State Supreme Court built Odyssey which is a court management system that links citations (which are collected through the Electronic Citation and Warning System [ECWS]) with the driver history and vehicle files. Additionally, the Indiana Department of Transportation is looking into linking crash and roadway data. The Indiana Department of Homeland Security oversees EMS and has been focused on getting EMS up to NEMSIS 3 standards.

Indiana used 405c funds to support the above efforts. Indiana has not conducted a cost benefit analysis of linking their traffic records databases, but Mr. Bodeker believes getting their databases electronic has been very beneficial in terms of cost and time saved.

Iowa

The Iowa Department of Transportation is the custodial agency for the State's crash, roadway, driver, and vehicle data. It also holds statutory authority to oversight citation/adjudication data. Law enforcement agencies electronically transmit crash and citation information to the DOT through the Traffic and Criminal Software (TraCS). According to Iowa's 2017 Highway Safety Plan, about ninety-eight percent of all crash submissions occur through TraCS, while the remainder occurs by paper. While, The Department of Public Health in Iowa has an injury surveillance system with EMS, Hospital, and trauma registry data. [53]

In the *2011 Traffic Records Assessment*, NHTSA assessors identified that the State of Iowa needed a portal for all traffic safety data. The Statewide Traffic Records Coordinating Committee (STRCC) then guided Iowa into the creation of this data hub - Traffic Safety Data Analysis (TSDA), which launched in 2014. This website provides information on all core traffic records.[54]

The *2017 Highway Safety Plan* pointed that the Iowa DOT has invested funding in collaborating with the University of Iowa, the Injury Prevention Research to integrate crash data with medical data. In addition to funding the Criminal and Juvenile Justice Planning (CJJP) division to begin the process of integrating DOT's BAC information into the Justice Data Warehouse (JDW) for enhanced data analysis.[55]

Kansas

The Kansas Department of Transportation (KDOT) hosts the Kansas Crash and Analysis Records System (KCARS), which is the crash repository for the State. Moreover, the State has a data warehouse that

[53] Iowa Department of Public Safety, *FFY 2017 Highway Safety Plan*, (2017): retrieved from: https://one.nhtsa.gov/links/StateDocs/pages/SafetyPlans.htm.
[54] Ibid., 77.
[55] Ibid., 86.

holds both crash and roadway data, although he two are not linked. As on its *2010 Traffic Records Assessment*, Kansas did not have crash data linked to other core traffic records, but it had plans to do so and store such data in the existing data warehouse infrastructure.[56]

The State is also investing in developing its electronic citation (eCitation) reporting system. The Kansas Bureau of Investigation (KBI) is the agency responsible for the management of the eCitation project. Kansas is also funding the Report and Police Impaired Drivers (RAPID) system, which intends to help DUI prosecutorial process in the State. [57]

Interview of Representative from Kansas
Chris Bortz: Kansas Department of Transportation – Traffic Safety Program Manager

Kansas has developed a search engine called Report and Police Impaired Drivers (RAPID) that allows law enforcement and prosecutors to search multiple databases at the same time. This system operates as their DUI tracking databases and was initiated after a repeat DUI driver killed a mother and child. His driving record showed only two prior DUIs but in reality, after deep searching, it was found he had 11 DUIs. The system was built to help law enforcement and prosecutors have an accurate understanding of a person's driving and criminal record, especially as it relates to DUI.

An officer or prosecutor can search by name, data of birth, incident date, incident type, and several other fields. The search results give a short summary of each record found and which database the record is stored in. If the individual clicks on a search result, they are re-directed to the database housing that record where they can then view the full record. Users can also enable alerts on records so they are notified if a particular court case or driving record is updated.

Currently, Kansas is working on a separate citation database. Only citations related to alcohol are searched by RAPID. Additionally they are working on linking their crash and roadway data.

RAPID cost $3.5 million. It was started in 2011 and took 3-3.5 years to complete. $1 million of funding came from the state and $2.5 million from 405c and 408 grants.

The legislature tasked several state agencies to work together and build RAPID which helped push the development. Throughout the process, developers kept prosecutors engaged since they would be the primary beneficiaries and users though stakeholders from all involved agencies were included in all phases of development.

[56] National Highway Traffic Safety Administration, *State of Kansas traffic Records Assessment*, (Feb 22-26, 2010): 23, Retrieved from: https://www.ksdot.org/bureaus/burTrafficSaf/reports/TRAssess2010.pdf.
[57] Kansas Department of Transportation, *FFY 2017 Highway Safety Plan*, (2017): 68, Retrieved from: https://one.nhtsa.gov/links/StateDocs/pages/SafetyPlans.htm.

As of the assessment, driver licensing database was not linked to Collision Reporting and Analysis (CRASH), however, the Kentucky State Police (KSP) is able to access the driver licensing database to confirm the status of a driver's license. KSP can also confirm whether a vehicle is registered.[58]

In 2016 data integration roundtable discussion, Kentucky discussed its continuing efforts to make crash and injury linkages by using crash and inpatient records, and crash and emergency department records. Kentucky also identified attempting to add new linkages including FARS, State death certificate files, Crash and trauma registry, Crash to EMS, and Crash to vehicle registration. Several barriers to traffic records integration were also identified during the presentation, including missing key TRCC players such as vehicle registration, driver licensing, and Administrative Office of the Courts.[59]

The TRCC has been tasked with producing a strategic traffic records plan that will be completed in FY 17. The plan will establish performance measures that will support goals and objectives aligned with other State traffic safety documents.[60]

Kentucky

The Kentucky Transportation Center (KTC) conducted an assessment for Kentucky's Traffic Records Program in 2015. As of 2015, the KTC links crash to roadway data using a crash extract and the Highway Performance Monitoring System database each year.[61]

The assessment report indicated that in 2012 a project was proposed to integrate crash with vehicle databases, and, secondarily, identify new capabilities that the linked databases would offer. Shortly after the project was awarded, problems arose in attempting to create a memorandum of understanding between the Kentucky Transportation Cabinet (KYTC) and the Kentucky Injury Prevention Research Center. The project was re-awarded between KTC and KYTC, but according to the 2015 assessment report, the data were never received to complete the linkage.[62]

Louisiana

The literature was unable to find information on integration efforts made by the State to link the various core traffic records. The *2017 Highway Safety Plan* pointed that Louisiana currently focuses on increasing the completeness of its injury surveillance/EMS system, improving the timeliness and accuracy of its citation/adjudication system. The State is investing most of its Traffic Records Funding towards traffic records initiatives that focus on improving data accessibility, implementing electronic citations and court management, as well as crash report revision.[63]

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[58] Ibid, 11.

[59] "Data Integration Roundtable" (presentation made at the Association of Transportation Safety Information Professionals [ATSIP] Traffic Records Forum, Baltimore, Maryland, August 7 – 10, 2016). Retrieved from: http://www.atsip.org/forum2016/program/sessions/session_6_1.html.

[60] Transportation Cabinet - Kentucky Office of Highway Safety, *Commonwealth of Kentucky Highway Safety Performance Plan Fiscal Year 2017,* 2017: 1 – 78. Retrieved from http://transportation.ky.gov/Highway-Safety/Documents/KY_FY2017_HSP.pdf.

[61] O'Connell, Lenahan, Green, Eric, and Reginald Souleyrette, *Assessment Program for Kentucky Traffic Records,* February 2015: 1 – 60. Retrieved from: http://dx.doi.org/10.13023/KTC.RR.2015.02.

[62] Ibid, 10.

[63] Louisiana Highway Safety Commission, *FFY 2017 Louisiana Highway Safety Plan*, (Jul 1, 2016): 76-81, Retrieved from: https://one.nhtsa.gov/links/StateDocs/pages/SafetyPlans.htm.

Maine

Maine is developing a Traffic Records Data Warehouse led by the Bureau of Highway Safety. Although developing the warehouse was listed in the budget year for 2017, the budget did not allocate any funding to the project. The literature review did not find much information on current traffic records data linkages. The *2017 Traffic records Strategic Plan* pointed that the State is investing in projects such as developing a Trauma Registry, updating its Crash Reporting System, connecting e-citation data with the court system, providing electronic access to the public on traffic records, and creating CODES EMS Linkage for the State.[64]

Maryland

None of the core traffic records databases are integrated in Maryland. The Maryland TRCC completed a five-year Traffic Records Strategic Plan in early 2016. As part of the strategic planning process, the TRCC conducted a SWOT analysis of Maryland's Traffic Records System. The number one weakness cited was that there were no interfaces between the core databases.[65] The Maryland TRCC identified developing and maintaining interfaces between the various core databases as prioritized strategies for each of the six data systems.[66]

Interview of Representative from Maryland

Douglas Mowbray: MD TRCC Chair, Maryland Department of Transportation – Traffic Records Program Manager

In Maryland, the state traffic records data owners have not integrated any of the six core databases. There are some limited interfaces, for example between the Maryland State Police and the Motor Vehicle Administration where officers can pull up a driver's record from their outfits.

There has been some discussion about integrating datasets, such as the roadway inventory and the crash file, but these have not gone past the stage of a scope review.

Maryland has had a successful Crash Outcomes Data Evaluation System (CODES) program for a number of years, and researchers at the University of Maryland have experience with integrating datasets, which could be beneficial for future efforts.

Massachusetts

The Department of Transportation (MassDOT) records management system hosts crash, driver history, and vehicle registration systems while MassDOT Office of Transportation Planning covers the road inventory file in the Common Wealth of Massachusetts. These systems, which compose the Massachusetts Traffic Records Analysis Center (MassTRAC), allows for analytical observations on crashes

[64] Maine Department of Public Safety, *Traffic Records Strategic Plan for FFY 2017*, (June 15, 2016): Retrieved from: https://one.nhtsa.gov/links/StateDocs/pages/SafetyPlans.htm.

[65] Maryland Traffic Records Coordinating Committee, *Traffic Records Strategic Plan FFU 2016 – 2020,* January 2016: 1 – 25. Retrieved from: http://www.mva.maryland.gov/safety/_docs/MDTRSP20162020FINAL.pdf.

[66] Ibid, 18 – 20, 22.

as it relates to driver, roadway, and vehicle data.[67] In 2014, "crash data and citation data were linked in MassTRAC using driver's license number and date and location of the incident. These records were uploaded biannually by MassTRAC."[68] In 2016, Massachusetts is also working on a Motor Vehicle Automated Citation and Crash System (MACCS), which would reconcile electronic citation to crash reporting, alcohol test-refusal data, and traffic-stop data collection. The Commonwealth is also investigating the possibility of developing a central crash analysis database, which would include data from all of the core traffic records systems.[69]

The current integration capabilities of Massachusetts allowed it to set integration targets and system performance measures for the near future. One target involves increasing the linkage of crash reports to hospital records by 10% by September of 2017. A second objective aims to increase the accessibility of MassTRAC database by 5% to agencies by June of 2017. A third goal is to improve the average days of crash reporting to fewer than 50 days. In addition, Massachusetts also aims to improve the completeness EMS, Criminal Justice Information Services (CJIS) network (MATRIS) to 85% by March of 2017. Lastly, it seeks to improve the completeness of the roadway inventory database by increasing the amount of data elements to 5,400 in the FY of 2017.[70]

Michigan

Michigan has no readily available documentation about the connection between the State's core-traffic records systems. Although, the literature review found that the Traffic Records Committee (TRCC) is currently implementing a data linkage project to determine the possibility of connecting these databases. [71] The State is also working towards creating procedure templates and process flow diagrams for its Traffic Crash Unit (TCRU) and investigating the possibility of improving it roadway data elements. [72]

Minnesota

This literature review was unable to find information about the State's efforts to integrate its core traffic records, but in its *2017 Highway Safety Plan,* it listed that in 2016, Minnesota implemented a new Crash Records System (MNCrash) as well as introduced a new crash report. On that same year, all agencies had to report crash data on-line. Therefore, this new system did not accept paper reports any longer. [73]

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[67]Commonwealth of Massachusetts Executive Office of Public Safety and Security, *Massachusetts traffic Records Analysis Center (MassTRAC),* (Aug 1, 2011): Retrieved from: http://pastforums.atsip.org/forum2011/Pages/Sessions/4c_Ziering_MassTRAC_Demo.pdf.

[68] National Highway Traffic Safety Administration Technical Assessment Team, *Commonwealth of Massachusetts Traffic Records Assessment*, (April 14, 2014): 202, Retrieved from: http://archives.lib.state.ma.us/handle/2452/238372.

[69] Highway Safety Administration, *Commonwealth of Massachusetts Highway Safety Plan*, (July 1, 2016): Retrieved from: https://one.nhtsa.gov/links/StateDocs/pages/SafetyPlans.htm.

[70] Ibid., 55-56.

[71] National Highway Traffic Safety Administration, *HSP 2016 Michigan Highway Safety Plan*, (2016): Retrieved from: https://one.nhtsa.gov/links/StateDocs/pages/SafetyPlans.htm.

[72] Traffic Records Coordinating Committee, *Strategic Plan FY 2016- FY 2020,* (May 3, 2016): Retrieved from: https://www.michigan.gov/documents/msp/TRCC_Stragetic_Plan_2010_405886_7.pdf,

[73] Minnesota Department of Public Safety, *2017 Highway Safety Plan*, (July 1, 2016): Retrieved from: https://one.nhtsa.gov/links/StateDocs/pages/SafetyPlans.htm.

Mississippi

Mississippi set performance targets for the FFY 2017 to continue the process of integrating crash data to data from the EMS Transport system and the Hospital Trauma Registry. A second performance target aims to carry on the process of mapping citation, crash, and EMS data. Otherwise, the State is investing in increasing crash, citation/adjudication, driver accessibility, and timeliness by posting the data sooner to traffic safety stakeholders. It also aims to provide timely citation data to courts and increase the percentage of citations electronically sent to DPS.[74]

Missouri

The Missouri State Highway Patrol (MSHP) is the custodian agency for the Statewide Traffic Accident Records System (STARS), which stores crash data in the State. STARS is also a component of Missouri's DOT, Transportation Management System (TMS). As of 2016, crash data interfaces with driver and vehicle data through the Department of Revenue (DOR), but it does not link to them. The opposite is true for crash data and roadway data. Crash and roadway files do not directly interface, but they link together with the two systems that currently compose Missouri's TMS.[75]

Missouri currently does not link its citation data with the driver file. This lack of linkage occurs because the DOR performs most of its administrative tasks manually. Therefore, administrative actions such as license suspension, revocation, for example, do not occur in a timely way nor it integrates with the other core traffic records.[76] Missouri also does not have an injury surveillance system. The Missouri Department of Health and Senior Services store the various elements such as trauma, EMS, hospital data.

Montana

The State of Montana's crash system has "no direct links for populating data elements such as the vehicle, roadway and driver records files to the Montana Highway Patrol (MHP) office.[77] The crash system also did not interface with the driver, vehicle, citation/adjudication, and the injury surveillance systems by the time that the State conducted the *Traffic Records Assessment* in 2014. Moreover, during the FFY 2017, the State did not invest current funding towards the integration of systems.[78]

Nebraska

The Nebraska Department of Roads (NDOR) collects crash data and roadway data. Crash data does not integrate with other core traffic records as of 2016. The State is working towards producing metrics for

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[74] Mississippi Office of Highway Safety, *State of Mississippi Highway Safety Plan FFY 2017*, (Aug 24, 2016): Retrieved from: https://one.nhtsa.gov/links/StateDocs/pages/SafetyPlans.htm.

[75] National Highway Traffic Safety Administration, *State of Missouri traffic Records Assessment*, (Jan 19, 2016): 381, Retrieved from: https://one.nhtsa.gov/links/StateDocs/pages/SafetyPlans.htm.

[76] Ibid., 381.

[77] National Highway Technical Assessment Team, *2014 State of Montana Traffic Records Assessment*, (June 17, 2014): 34, retrieved from: https://www.mdt.mt.gov/publications/docs/brochures/safety/trafrecords.pdf.

[78] Montana Department of Transportation, *Montana Highway Safety Plan FFY2017*, (Jun 27, 2016): 61-63, Retrieved from: https://one.nhtsa.gov/links/StateDocs/pages/SafetyPlans.htm.

data integration. Driver data, for example, does not connect with the crash because it lacks a personal identifier between the two systems. On the other hand, the vehicle file integrates with the driver file.[79]

The Nebraska Criminal Justice Information System (NCJIS) hosts citation data in the State. Nebraska is exploring options to interface citation information to jail/prosecutor data. Today, citation data links to the driver and vehicle files as well as law enforcement systems. The Department of Health and Human Services (DHHS) integrated DOR's crash data with the Hospital, EMS, and vital records. This is not a statewide linkage because there is still EMS data missing from certain areas of the State.[80]

Nevada

The literature review was unable to find any information on current traffic records data linkages in Nevada. However, several efforts related to traffic records data are underway. First, Nevada has developed the Nevada Citation and Accident Tracking System (NCATS). Las Vegas Metropolitan PD, Henderson PD, and Reno PD all submit crash data to NCATS. Additionally, Nevada is implementing the "remaining large law enforcement agencies reporting traffic citations through (NCATS) and evaluat(ing) smaller size agencies for suitability based on cost vs. number of citations by Dec. 31, 2017."[81] Which agencies were already submitting citations and what constitutes a large vs small agencies was not specified in the report.

The Nevada TRCC has prioritized in 2016 the integration of crash and EMS data.[82] Additionally, Nevada has a Safety Data Analysis Team that uses crash and citation data submitted to NCATS along with roadway, traffic control, traffic volume, and trauma data received from other sources to conduct analyses for traffic safety stakeholders in Nevada.[83]

New Hampshire

The literature found no information about New Hampshire's efforts to link its core traffic records, but as its *2017 Highway Safety Plan* pointed out, the State is investing in various traffic records projects. For example, the Department of Safety is developing a Crash Records Management System (CRMS) designed to comply with the fourth edition of the MMUCC. The Department is also receiving funding for VPN installation assistance to facilitate "electronic communication of criminal justice data between the various government al entities that have needed the data." The Department of Health and Human

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[79] Nebraska's Traffic Records Coordination Committee, *FY 2015-2019 Nebraska Traffic Safety Information System Strategic Plan*, (Jun 15, 2016), Retrieved from: http://www.roads.nebraska.gov/media/7516/nebraska-traffic-safety-info-sys-strategic-plan-2016.pdf.

[80] Ibid., 20-26

[81] Nevada Department of Public Safety Office of Traffic Safety, *2017 Nevada Highway Safety Performance Plan,* (2016): 57. Retrieved from: http://ots.nv.gov/uploadedFiles/otsnvgov/content/Resources/2017_Highway_Safety_Performance_Plan_FINAL.pdf.

[82] Ibid., 58.

[83] Nevada Executive Committee on Traffic Safety, *2016-2020 Nevada Strategic Highway Safety Plan,* (2015): 25. Retrieved from: http://www.zerofatalitiesnv.com/wp-content/uploads/2015/03/SHSP_Report_Final_SignaturesPending.pdf.

Services is developing CODES. In addition, the Department of Transportation is in charge developing geolocation tools to be added to crash data. [84]

New Jersey

The state of New Jersey Office of Information Technology (OIT) is the lead agency in the project of integrating crash, EMS, and driver data. OIT hosts a data warehouse that stores information collected by law enforcement, EMS units, and the Motor Vehicle Commission. In 2017, the State funded OIT's data warehouse for $ 500,000. The State is also investing in improving the electronic patient reporting system, it geocoding capabilities and crash record processing times.[85]

Interview of Representative from New Jersey

Patricia Ott: NJ TRCC Coordinator, MBO Engineering, LLC

In New Jersey, the crash, vehicle, and EMS databases are linked. The New Jersey Department of Transportation funded a new patient care reporting system for EMS which included linking to the crash and vehicle database. The data is linked a deterministic method.

While New Jersey has had success in linking EMS data, it has not been able to include citation data in their traffic records linkage because the State's Administrative Office the Courts has not been willing to link their data with other databases.

New Jersey used 405c funds to support the project, but the interviewee did not know the exact cost of all the linkages.

New Mexico

New Mexico has fostered data sharing agreements between law enforcement agencies and the University of New Mexico for data analytical purposes. The State now sends crash reports via Secure File Transfer Control (SFTP), and it plans to build an interface that will connect TraCS crash reports directly to the University. New Mexico does not have a statewide-automated citation transfer to the Administrative Office of Courts (AOC), but some Counties do so though the Odyssey records management system (RMS). In fiscal years of 2015 and 2016, the State heavily invested in implementing the use of TraCS systems by law enforcement agencies.[8687] Now, in the following fiscal year, the State has only allocated money to improving crash statistical and analytical reporting.[88]

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[84] State of New Hampshire Office of Highway Safety, *Highway Safety Plan 2017*, (2017): 91, Retrieved from: https://one.nhtsa.gov/links/StateDocs/pages/SafetyPlans.htm.

[85] New Jersey Division of Highway Safety, *2017 State of New Jersey Highway Safety Plan*, (2017): 127-130, Retrieved from: https://one.nhtsa.gov/links/StateDocs/pages/SafetyPlans.htm.

[86] New Mexico Department of Transportation, *2016 Highway Safety Plan*, (Jun, 2016), Retrieved from: https://one.nhtsa.gov/links/StateDocs/pages/SafetyPlans.htm.

[87] Ibid.

[88] Ibid.

According to the *2017-2019 Strategic Highway Safety Plan*, the State implemented the All Road Network of Linear Referenced Data (ARNOLD) system, which replaces the former Transportation Information Management System (TIMS). This system provides agencies with geospatially enabled public roadway network, which allows highway agencies to locate crashes that are not in the State Highway System. The State invested in the full implementation of the Tapestry system, which driver and vehicle system data. The State has set the goal to "transfer citation data electronically from the law enforcement agencies TraCS program to the Court's Odyssey data system."[89]

New York

The State of New York is slowing integrating its core traffic records systems. *The 2017 Strategic Highway Safety Plan* points that there is some level of integration between crash data and the DMV registration file, but the current linkage mechanism is imperfect, and it lacks precision.[90] The coupling occurs because of data elements such as a unique identifier on the crash report that links to DMV's license file, as well as the use driver's social security numbers to link crash records with CODES records.[91]

The Strategic Plan also points that the Citation and adjudication systems lack compatibility, but there is potential for integration, although both of them currently integrate to DMV files.[92] In addition, the driver data is readily available to courts through the Judicial Online Information System (JOIN).[93] Moreover, the Injury Surveillance systems integrate with other databases from the Department of Health. The CODES database links crash data to injury data, although it is unable to link all "individuals involved in crashes since DMV collects relatively limited data on vehicle passengers".[94] The New York State Department of Transportation (NYSDOT) contains the Roadway Inventory System (RIS). NYSDOT currently links crash data to roadway data through a manual process.[95]

North Carolina

North Carolina appears to have vehicle and driver databases interface to citation and crash databases. Other than these linkages, it appears that additional linkages between the other traffic records datasets have not occurred on a statewide level.[96] According to the 2016 Strategic Plan, the TRCC has identified and was in the process of achieving a number of objectives that would lay the foundation for future

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[89] New Mexico Department of Transportation, *Statewide traffic Records System Strategic Plan FFY 2017-2019*, (Jun, 2016): 13, retrieved from: http://nmtrafficrecords.com/wp-content/uploads/NM-TRCC-Strategic-Plan-2017_2019-final.pdf

[90] New York State Governor's traffic Safety Office, New York State FFY 2017 *Highway Safety Strategic Plan*, (July 1, 2016): 86, Retrieved from: https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/ny_fy17hsp.pdf.

[91] New York State Governor's traffic Safety Committee, *New York State traffic Safety Information Systems Strategic Plan: FFY 2016*, (June 2015): 10, Retrieved from: https://www.itsmr.org/wp-content/uploads/2015/09/FFY-2016-Strategic-Plan-for-updated-website.pdf.

[92] Ibid., 87.

[93] New York State Governor's traffic Safety Committee, *New York State traffic Safety Information Systems Strategic Plan: FFY 2016*, (June 2015): 2, Retrieved from: https://www.itsmr.org/wp-content/uploads/2015/09/FFY-2016-Strategic-Plan-for-updated-website.pdf.

[94] Ibid., 89.

[95] Ibid., 90.

[96] The UNC Safety Research Center in collaboration with the North Carolina Traffic Records Coordinating Committee, *North Carolina Traffic Safety Information Systems Strategic Plan,* June 2016: 1 – 92. Retrieved from: https://connect.ncdot.gov/groups/NCTRCC/Documents/2016%20TRCC%20Strategic%20Plan.pdf.

linkages, including (1) "expanding the linear referencing system to cover all public roads, state- and locally-owned," and (2) "improving the interoperability and linkage between the linear referencing system, road characteristics data, and the crash system."[97]

A review of 2016 TRCC meeting minutes revealed that there are also several smaller data linkage projects that are ongoing, including expanding EMS and DMV crash data linkage from Wake County to other communities.[98] According to the Strategic Plan, the TRCC was awaiting results from a pilot study conducted in Wake County in 2013 before launching an EMS statewide linkage project.[99]

Interview of Representative from North Carolina
Eric Rodgman: NC TRCC Co-Chair, NC Highway Safety Research Center

North Carolina's linkage of traffic records database is very similar to Alabama. North Carolina's vehicle and driver databases interface to their citation and crash databases to populate relevant fields. The crash and citation databases then link back to vehicle and driver files to update. The vehicle file includes owner's driver's license number, allowing all of these linkages to be done using the driver's license number as the unique identifier.

North Carolina's EMS data is not currently linked. The NC TRCC wants to explore linking it because additional funding sources, such as through the Centers for Disease Control and Prevention, becomes accessible once EMS data is linked to the other core traffic records databases. The NC TRCC did a feasibility study in one county where the crash, EMS, hospital records, emergency dept., etc. were all electronic. The study proved it was feasible to do probabilistic linkage, but execution was difficult even under ideal conditions with all records being electronic. Standardization is a major obstacle in linking EMS data since each EMS, hospital, emergency department, etc. all use different records management systems.

North Carolina used 405c funding to build the linkages, but the total cost is unknown since the project has evolved over the years to include additional linkages to the databases.

North Dakota
The literature was unable find any information about integration efforts in the State. The *2015 Highway Safety Plan* pointed that the State aims to provide accurate, timely, complete, and accessible traffic safety data to stakeholders, which indicates that North Dakota does not focus in the integration of

[97] Ibid, 33.
[98] North Carolina Traffic Records Coordinating Committee, *May 17, 2016 Meeting Minutes.* Retrieved from: https://connect.ncdot.gov/groups/NCTRCC/Documents/May%2017,%202016%20NC%20TRCC%20Meeting%20Minutes.pdf.
[99] The UNC Safety Research Center in collaboration with the North Carolina Traffic Records Coordinating Committee, *North Carolina Traffic Safety Information Systems Strategic Plan, 33.*

systems now.[100] One of the funded projects for FFY 2017 invested on the improvement of the crash data system to transmit data effectively through TraCS to the Crash Reporting System (CRS).[101]

Ohio

The literature review was unable to find any information on current traffic records data linkages in Ohio. For the past four years, Ohio's Highway Safety Plans have revealed that the State has mainly focused on two initiatives: improving its crash reporting and implementing a pilot to expand electronic submission of citations to the courts. Although there were some investments towards building an EMS Rehabilitation Registry/ Incident Reporting System and a road intersection inventory assessment.[102]

Oklahoma

Oklahoma, according to its *2017 Highway Safety Plan*, is investing money into integrating crash data to criminal data systems following the principles of data driven approaches to crime and traffic safety (DDACTS). It is also building a statewide impaired driver database using PARIS.web, a portal in which law enforcement agencies submit impaired driving arrest information to the database.[103]

The Tax Commission houses registration records in the State. These records are electronically provided to OHSO for analysis. Once they have better GPS information capabilities emerge, the department hopes to create a statewide DDACTS systems after linkage of criminal data from the Oklahoma State Bureau of Investigation.[104]

Oregon

According to the *2016 Traffic Records Assessment*, Oregon connects crash data with roadway data. Such information is available from a web page and used to access maps and data. Oregon also tried to integrate EMS to crash, but the study the integration study only lasted for one month in the State. For the FFY 2017, the State funded a project to link pre and post hospital admission data.[105] The 2016 assessment also pointed that the State is working towards connecting crash data to citation and adjudication data.[106]

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[100] North Dakota Department of Transportation, *Safety Division Annual report FFY 2015*, (n.d.): 21, Retrieved from: https://www.dot.nd.gov/divisions/safety/docs/fy2015-annual-report.pdf.

[101] North Dakota Department of Transportation, *North Dakota Highway Safety Plan FFY 2017*, (Jun, 2016): 65, Retrieved from: https://one.nhtsa.gov/links/StateDocs/pages/SafetyPlans.htm.

[102] State of Ohio Highway Safety Office, *State of Ohio FFY 2017 Highway Safety Plan*, (2017): Retrieved from: https://one.nhtsa.gov/links/StateDocs/pages/SafetyPlans.htm.

[103] Oklahoma Highway Safety Office, *2017 Oklahoma Highway Safety Plan,* (2017): 54, Retrieved from: https://one.nhtsa.gov/links/StateDocs/pages/SafetyPlans.htm.

[104] Oklahoma highway Safety Office, *Oklahoma Strategic Highway Safety Plan 2013-2014*, (n.d.): 117, Retrieved from: https://www.ok.gov/health/Protective_Health/Injury_Prevention_Service/Oklahoma_Traffic_Data_Linkage_Project/TDLP_Board_of_Directors/.

[105] Oregon Department of Transportation, *Oregon traffic Safety Performance Plan FFY 2017,* (May, 2016): 145, Retrieved form: https://one.nhtsa.gov/links/StateDocs/pages/SafetyPlans.htm.

[106] National Highway Safety Administration Technical Assessment Team, *State of Oregon Traffic Records Assessment*, (Jan 11, 2016): 213-218, Retrieved from: https://www.oregon.gov/ODOT/TS/docs/TRCC/Oregon%20TRA%20Final%20Report.pdf.

Pennsylvania

This literature review did not find much information about the State's efforts to integrate core traffic records, except for the *2017 Strategic Highway Safety Plan* mention that a Data Integration Plan is under development.[107] For the 2017 fiscal year, the projects funded under the Traffic Safety Information Systems related to the improvement of crash reporting. [108]

Interview of Representative from Pennsylvania

Robert Ranieri: PA TRCC Coordinator, Pennsylvania Department of Transportation

Pennsylvania does not have any linked traffic records, however, the PA TRCC is interested in pursuing linkage efforts and has provided funding for the creation of a Traffic Records Integration Plan that is scheduled to be completed this year. This plan will address the technical/physical aspects of linkage, housing, political/legal hurdles, privacy risks, data owner concerns, management, and suggested priority in deciding what to integrate first.

It is anticipated that most of the funding for integration will come from the TRCC. The PA TRCC expects there will be some legal or legislative issues surrounding the integration of EMS and other health records. Consequently, the TRCC anticipates linking EMS records will be prioritized last.

Rhode Island

The literature review did not find information about Rhode Island's existent core-traffic records linkage efforts, but it collected that the State has invested money into creating a Traffic Records Data Warehouse. The *2017 Rhode Island Highway Safety Plan* showed that the existing core traffic records projects in the State aim to develop linkages between the various traffic records databases to increase reporting capabilities. [109] The plan also points that the State is investing money on the continued implementation of a "Statewide Records Management and Computer Aided Dispatch System (RMS/CAD)"[110]

South Carolina

The South Carolina Department of Public Safety (SCDPS) has developed the South Carolina Collision and Ticket Tracking System (SCCATTS) which allows for the electronic completion and submission of crash reports. As of 2013, SCDPS and 20 local agencies were using SCCATTS and 60% of all crash reports in

[107] Pennsylvania Department of Transportation, Pennsylvania 2017 Strategic Highway Safety Plan, (2017): 41, Retrieved from: https://one.nhtsa.gov/links/StateDocs/pages/SafetyPlans.htm.

[108] Pennsylvania Department of Transportation, Pennsylvania FFY 2017 Highway Safety Plan, (July, 2016): 122-123, Retrieved from: https://one.nhtsa.gov/links/StateDocs/pages/SafetyPlans.htm.

[109] Rhode Island Office of Highway Safety, *2017 Rhode Island Highway Safety Plan*, (2017): Retrieved from: https://one.nhtsa.gov/links/StateDocs/pages/SafetyPlans.htm.

[110] Ibid., 127.

South Carolina were being submitted electronically using SCCATTS.[111] SCCATS use had expanded to SCDPS and 60 local law enforcement agencies in 2016.[112]

Additionally, South Carolina had participated in the Crash Outcome Data Evaluation System (CODES) program in the mid 2000's. Through CODES, South Carolina linked its crash records with impatient hospitalization and emergency department visit records. Analysis through CODES led to the state legislature passing a law increasing the fine for unrestrained minors. It is not clear if the CODES program or linkage of crash records and impatient hospitalization and emergency department visit records has continued.[113]

Looking towards the future, South Carolina's FFY17 Highway Safety Performance Plan describes South Carolinas goal of creating a linked eCitation system. Their first step is to begin electronic citation submission pilot testing from July to December 2016. Second, South Carolina will "interconnect the citation database among law enforcement, SCDPS, South Carolina Judicial Department (SCJD), and the South Carolina Department of Motor Vehicles (SCDMV) for information sharing in order to decrease the number of days required to receive adjudication records from 30-45 days to 10 days by January 2018."[114] This will be done by law enforcement submitting citations to a central database that will link with the SCJD's case management system which will then submit posted citation/adjudication data to the SCDMV.[115]

South Dakota

South Dakota's *2015 Highway Safety Plan* lists that the crash database links to driver license, vehicle registration, SafetyNet, dRoad, Social Services, CarFax, and PONTIS (bridge), but the document does not offer information on how the linkage occurs. The only description involves, the process in which Law enforcement locates the crash, and the staff at the Office of Highway Safety (OHS) uses the Incident Location Tool (ILS) to make the crash location more efficient and accurate.[116]

The Motor Vehicle Division (MVD) maintains the vehicle registration and title data for the State. Every vehicle registration document contains a 2-D bar code that is easily scanned by law enforcement. The "vehicle file is linked with the driver file, the crash database query system, the Equipment Management System, and the Commercial Vehicle Information Systems and Networks (CVISN)."[117]

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[111] South Carolina Department of Transportation, *South Carolina Multimodal Transportation Plan – Technical Memorandum: Safety and Security,* (June 2013): 15. Retrieved from: http://www.dot.state.sc.us/multimodal/pdf/tech_memo_safety&security.pdf.

[112] South Carolina Department of Public Safety – Office of Highway Safety and Justice Programs, *South Carolina's Highway Safety and Performance Plan FFY 2017,* (Aug. 19, 2016): 206.

[113] National Highway Traffic Safety Administration, *The Crash Outcome Data Evaluation System (CODES) and Applications to Improve Traffic Safety Decision-Making (DOT HS 811 181),* (April 2010): 51-52.

[114] South Carolina Department of Public Safety – Office of Highway Safety and Justice Programs, *South Carolina's Highway Safety and Performance Plan FFY 2017,* (Aug. 19, 2016): 205-206.

[115] Ibid.

[116] South Dakota Department of Public Safety, *South Dakota 2015 Highway safety Plan*, (n.d.): 197, retrieved from https://one.nhtsa.gov/links/StateDocs/pages/SafetyPlans.htm

[117] Ibid., 21

Tennessee

The Tennessee Department of Safety and Homeland Security (DPOSHS) has built the Tennessee Integrated Traffic Analysis Network (TITAN). Through TITAN, 100% of crashes are reported electronically in Tennessee.[118]

TITAN also supports an eCitation component for the Tennessee Highway Patrol (THP) that electronically submits citation data from TITAN to the courts using the Tennessee Administrative Office of the Courts' (TNAOC) Tennessee Court Information System (TNCIS). Additionally, TNAOC is developing a component to TNCIS called the Court Disposition Reporting (eCDR) that when developed will electronically send dispositions from the courts to the A-List Driver History System. This is expected to be completed during FFY16.[119] Tennessee intends to expand TITAN's eCitation component to local law enforcement once THP has been fully trained.[120]

In addition, TTIAN uses latitude and longitude to link crash and roadway data and also collects crime data from THP. This allows TITAN to provide crash, citation, crime, and roadway data that can be analyzed through the C.R.A.S.H. Predictive Analysis Program.[121]

Utah

Utah's *2017 Highway Safety Plan* points that its systems are not integrated across other traffic records.[122] For example, although roadway data may contain crash elements, it does fully integrate with the crash system to provide complete information. The same is true of its injury surveillance systems. Emergency Room data integrates with Hospital data, but it does do it in a prompt manner. The State has implemented electronic crash reporting in 2013, but it still struggles with the accuracy of reporting. Some of the funded projects for FFY 2017 involved improving the crash information management system and EMS Prehospital data reporting.[123]

Vermont

Vermont is investing funding on developing a Statewide Incident Reporting Network (SIREN), which collects patient care and injury data to match with the crash data, providing the State robust data points to the Vermont Department of Health Emergency Medical Services. The State is also funding the development of an e-citation system that automatically sends citations to the court's case management system through DPS. [124]

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[118] Tennessee Governor's Highway Safety Office, *Tennessee Governor's Highway Safety Office 2015 Annual Report,* (2015): 23. Retrieved from: http://tntrafficsafety.org/sites/default/files/AR15_Final.pdf.

[119] Ibid.

[120] Tennessee Highway Safety Office, *Tennessee Highway Safety Office FY 2017 Highway Safety Plan,* (2016): 312.

[121] Ibid., 308.

[122] Utah Traffic Records Advisory Committee, Utah Traffic Records Information Systems Strategic Plan, (August 31, 2015): 10, Retrieved from: https://highwaysafety.utah.gov/wp-content/uploads/sites/22/2015/09/UT-traffic-records-information-systems-strategic-plan-8-2015.pdf.

[123] Utah Department of Public Safety, *2017 Utah Highway Safety Plan*, (2017): 115-118, Retrieved from: https://highwaysafety.utah.gov/wp-content/uploads/sites/22/2016/01/2017-HSP-402-Final-february-2017.pdf.

[124] Vermont Governor's of Highway Safety Program, *2017 Highway Safety Plan*, (2017): Retrieved from: https://one.nhtsa.gov/links/StateDocs/pages/SafetyPlans.htm.

Per interview with the Agency of Transportation (AOT) Technician, this literature found that "Vermont currently uses a message switch to connect to the driver records from the crash program. It will auto-fill name, address, license number & state, date of birth, vehicle registration, vehicle year, vehicle make & model and VIN."[125]

Virginia

Virginia has developed a state-of-the-art highway safety information system known as the Traffic Records Electronic Data System (TREDS). TREDS centralizes statewide crash information and integrates with a number of other data systems for extensive reporting and analytics. As of 2015, TREDS had 15 interfaces with other data systems, and over 9,000 role-based users. Interfaces include crash data, SafetyNet, medical review, motorcycle student training data, roadway location, VMEDS Toxicology (forensic science), driver history, CODES, conviction, e-citation, DUI tracking system, EMS (VPHIB), and FARS.[126]

TREDS was developed after a 2005 Traffic Records Assessment in which NHTSA provided a less than favorable assessment of Virginia's system. DMV – through the Virginia Highway Safety Office – spearheaded the 30-month effort, with final migration completed July 6, 2009. As of a 2010 report, TREDS cost $5.4 million to develop and implement, and was yielding $1.4 million annually for Virginia. At the time, Virginia anticipated the cost of the project would be recovered in less than four years.[127]

Interview of Representative from Virginia

Angelisa Jennings: VA TRCC Chair, Virginia DMV – Deputy Director

Virginia has the Traffic Records Electronic Data System (TREDS) which is a central repository for all crash data and other traffic safety related data. They currently link roadway, driver, and vehicle data to crash data.

Additionally, EMS data is linked using a deterministic model. If the system is unable to get a 100% match to link EMS and crash records, and analyst reviews the information to manually link the records. They have not had any legal or privacy issues linking crash and EMS records. The linkages are covered using memorandums of understanding (MOUs) and non-disclosure agreements (NDA's).

There is no statewide e-citation system, but conviction data is available and stored in TREDS. Currently they are working on developing a DUI tracking database.

TREDS has been built over the last 10 years using 405c and 408 funds. The driver and crash databases were the first to be linked. The other linkages occurred one by one as TREDS expanded. The linkages

[125] Interview with Mandy White, AOT Technician VI & VT FARS Analyst.

[126] Jennings, Angelisa, and Linda Ebel, "Traffic Records Electronic Data System" (presentation made at the Virginia Association of Chiefs of Police Small Law Enforcement Agency Symposium, September 24 – 25, 2015). Retrieved from: http://www.vachiefs.org/images/uploads/docs/SAS-TREDS_VaHSO_Update.pdf.

[127] Nixon, Samuel, A., Jr., *Virginia Traffic Records Electronic Data System,* June 2, 2010: 1-7. Retrieved from: https://www.nascio.org/portals/0/awards/nominations2010/2010/2010VA1-2010%20XBC%20TREDS%20NASCIO%20Submission.pdf.

were done by a small team of dedicated contractors. Having a dedicated team has helped mitigate costs because the team has developed a strong understanding of the various traffic records and how best to link them with each successive linkage. Additionally, by keeping the same team on board, Virginia avoids having to bring in new contractors for each task.

Ms. Jennings stated that the first step is to get records submitted electronically before working on linking them. She repeatedly emphasized the importance of strong relationships across the various traffic records stakeholders and the importance the TRCC had played in Virginia. Finally she recommended having a dedicated team to build and manage the linkages.

Washington DC

The official crash database for the District of Columbia is managed by the Metropolitan Police Department (MPD), and it is called the Traffic Crash Management System. As of 2014, e-Crash reporting accounted for over 95% of all crash reports as compared to a completely paper-based submission system in 2007.[128] A secondary crash database is maintained by the District Department of Transportation (DDOT), and it is known as the Traffic Accident Reporting and Analysis System (TARAS). TARAS is updated nightly with crash records from MPD.[129] According to the DDOT's 2014 Traffic Records Strategic Plan, MPD will have the capability to merge all law enforcement data sources (Centralized Computer Aided Dispatch [CAD] which is run by the Office of Unified Communications, citation, crime, and crash) as a result of adoption of the Intergraph records management and field data collection software.[130]

The DDOT uses a number of GIS and table-based data systems which host the roadway inventory system. In terms of data integration, GIS and SSD integrate numerous files across departments and support multiple location reference systems.[131]

Driver and vehicle files are combined in a program referred to as DESTINY. The two files are linked by the driver license number, which is required from all applicants for vehicle registrations or titles. DESTINY is not currently linked with other traffic records system components. As of 2014, no electronic interface existed between the District and other jurisdictions for reporting out-of-state convictions. Convictions from other jurisdictions were mailed to the District and subsequently manually entered into the DESTINY system. Therefore, the District set a goal of establishing a web application to allow States to report low-volume convictions via the Internet and an FTP application to allow neighboring States to report high-volume convictions electronically.[132] As of 2014, the District was also seeking to migrate the legacy vehicle system to a more robust platform capable of increased functionality, including the ability

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[128] *District of Columbia Traffic Records Strategic Plan*. Retrieved from: http://www.ddot-hso.com/ddot/hso/documents/Publications/SHSP/2014/DDOT%20TRSP%20-%20November%202014.pdf.

[129] *District of Columbia Traffic Records Assessment*. Retrieved from: http://www.ddot-hso.com/ddot/hso/documents/Safety_Program_Documents/DC%20Traffic%20Records%20Assessment_11June2012.pdf.

[130] *District of Columbia Traffic Records Strategic Plan*, 26.

[131] Ibid, 36.

[132] Ibid, 49.

to integrate with other databases like the crash database.[133] At the time, neither of these projects had an estimated completion date.

As of 2014, the District was holding discussions exploring the potential linkages between citations/arrest and driver/vehicles files.[134]

As of 2014, the District did not have an electronic trauma data repository, a hospital discharge data repository, or an ER data repository. The District of Columbia does have access to pre-hospital data collection system managed by Fire and Emergency medical services (FEMS) and vital records data managed by the Vital Records Division (VRD) within the Department of Health (DOH). The new FEMS repository has the capability to link to other agency databases for validation and enhancement of reporting functions. The DOH trauma repository will have similar capability and be able to validate initial injury reporting.[135]

Washington State

This literature was unable to find much information about Washington's integration efforts, but it appears that the State has invested money in hiring a coordinator as well as develop a software to link crash and health information in the FFY 2017 and it plans to complete the project in a three-year frame. One of the goals of the State of providing quality data to customers includes the development of a statewide DUI database. In 2017, the Traffic Records Committee funded an electronic DUI processing project that aimed to "allow users to complete the current DUI process and associated administrative tasks electronically."

Interview of Representatives from Washington State

Debi Besser: WA TRCC Chair, Washington Traffic Safety Commission – Program Manager
Dr. Staci Hoff: Washington Traffic Safety Commission – Research Director

Washington State has focused most of its traffic records integration records on linking its trauma registry, inpatient hospital discharge, and crash records in order to more accurately assess crash injuries. Additionally, they have linked crash and driver records, FARS and crash records, and FARS and death records. By the end of 2017 they hope to have linked toxicology and crash records and further in the future want to link crash and vehicle records.

In 2009, Washington State pursued two feasibility studies. The first sought to link crash data with the trauma registry. The second sought to link inpatient hospital discharge records with crash records. Both studies were successful and in 2010 Washington State moved forward with implementing both linkages.

Both linkages have gone through several iterations of improvements as their analysts refine their algorithms and use new software. Originally they used Link King software but currently use the Data

[133] Ibid, 50.
[134] Ibid, 65.
[135] Ibid, 75.

Quality Suite from SAS. Both software tools require manual review. While they like the outcomes of the data linkage, they do not like the manual review because it is time consuming and subject to subjectivity. Currently the Washington State Financial Department is using Informatica software to link education data which does not require manual review. WTSC staff is looking into using Informatica to integrate crash and medical records in the future.

The linking of crash and medical records has raised privacy concerns. The original projects were all done through an IRB research protocol. They are looking to develop and IAC between the agencies involved in the linkage and get an IRB exemption since the linkage is no longer for research but part of everyday business practice.

These linkages were funded with 405c funds.

They recommended having at least one full time employee working on the data linkages along with dedicated employees from partner agencies involved with the data linkage. This involves promoting strong working relationships across agency lines. Additionally, linkages should be developed in a manner that is flexible enough to allow more linkages later. Finally, they recommended implementing good data governance from the beginning so you have an understanding of what you can do with the data once it is linked.

In 2018 they plan on beginning to look at methods for analysis of the linked data.

West Virginia

West Virginia set out to modernize and integrate all of the State's computer systems in an extensive project formerly known as WV OASIS. The WV OASIS system was intended to be rolled out in five phases and would include integration of the State's financial systems, procurement systems, human resources, payroll, and transportation management systems. Among other data analysis features, the fifth phase – known as the Safety Module – was to integrate data from the State's crash records database, citation tracking system, driver records, vehicle registration (Licenses and Convictions), EMS run data, and trauma registry. [136] [137]

The first phase of the Safety Module went live in January 2014, and among other features, it included an interface of crash records data into the Safety Module. Additional work took place that involved developing interfaces with the other datasets, however, the Safety Module experienced continual delays and scope changes which prevented the Safety Module from ever going live. As of 2016, a completion date for WV OASIS had not been resolved.[138]

Interview of Representative from West Virginia

[136] West Virginia Highway Safety Office, *West Virginia Highway Safety Improvement Program 2016 Annual Report*, 2016: 1-52. Retrieved from: https://safety.fhwa.dot.gov/hsip/reports/pdf/2016/wv.pdf.

[137] Mays, Marsha K., and Chris Kinsey, "wvOASIS Safety Management System" (presentation made at the Planning Conference, Parkersburg, West Virginia, October 7 – 9, 2014).

[138] West Virginia Highway Safety Office, 8.

Austin Macri: WV Traffic Records Coordinator, West Virginia Governor's Highway Safety Program

West Virginia is pursuing a massive overhaul of all state records for all government agencies called WV OASIS that would, among other things, facilitate better data linkages. WV OASIS was developed through multiple phases and tasks. Overhauling traffic records was under "Task E" and was one of the last tasks to be completed. The project has not yet reached Task E but is already 50% over budget. As a result, "Task E" which would have integrated West Virginia's traffic records databases is currently paused and may never get off the ground.

Wisconsin

The literature found that the State of Wisconsin currently funds a project to investigate the possibility of linking licensing, registration, roadway, citation, warnings, adjudication, EMS, coroner, and health records. The initial goal of this Law Enforcement Traffic Records Data Warehouse project is to determine the necessary data elements for linkage of these systems to crash data. Another funded project is the CODES Traffic Crash Record Linkage, which aims to match crash data to hospital and EMS data as well as ambulance records to hospital data. [139]Another example of linkage in the State emerges from the State's Department of Transportation, which collects interstate carrier's data by the SAFETYNET database. WisDOT's SAFETYNET database stores information on drivers, crashes, as well as vehicle data. [140]

Wyoming

Wyoming is working to improve the integration of crash data to roadway systems. The State is increasing the number of Roadway feature data sets that link to crash records using LRS Route and Milepost locations. The State is also planning to link the crash database to the driver and vehicle database. In addition, Wyoming has a project underway to connect The Wyoming Electronic Crash Records Systems (WECRS) with the Injury Surveillance system that will provide EMS professionals with insurance information collected by law enforcement as well as improve crash data regarding EMS runs and injury severity.[141]

[139]Wisconsin Department of Transportation, *State of Wisconsin FFY 2017 Highway Safety Plan*, (2017): 33-34, Retrieved from: https://one.nhtsa.gov/links/StateDocs/pages/SafetyPlans.htm.

[140] Ibid., 148.

[141] Wyoming's Highway Safety Behavioral Program, FFY 2017 Highway Safety Plan, (July 1, 2016): 198-201, Retrieved from: https://one.nhtsa.gov/links/StateDocs/pages/SafetyPlans.htm.

Findings

Status of Traffic Records Database Linkages

Overall, there is a wide variety of traffic records database linkage statuses and efforts among the states. Some states, such as Alabama, Virginia, and Washington have multiple data linkages including both interfaces and true integrations. On the other hand, other states, such as California, are currently focused on getting their crash and citation records submitted electronically to their respective databases and plan on pursue linkages in the future.

The reasons for the level of linkage discrepancy will be discussed in detail in the rest of the findings, but include funding, technical capability, and prioritization from leadership.

Databases Connected

The most commonly linked traffic records databases are the crash, citation, driver, and vehicle databases. These four databases are both the easiest to link and offer the greatest benefits in terms of cost and time savings, and improved government efficiency and effectiveness by being linked.

Based on the interviews, states used the driver's license number and/or the VIN number to link crash, citation, driver, and vehicle databases. The driver's license number will appear on the crash record and the driver history file which allows those databases to be linked. Additionally, most states collect a person's driver's license on the citation. Some states such as Alabama and North Carolina collect the owner's driver' license number on the vehicle registration. This allows the vehicle and citation files to be linked with the crash and driver files.

Linking the vehicle and driver files with the crash and citation records can be very valuable for multiple reasons. First, driver and vehicle information can be automatically populated through an interface when a law enforcement officer is filling out a crash or citation form. This saves time and increases accuracy.

Second, once the crash report has been finalized or the citation adjudicated, the driver and vehicle files can be updated with the crash and/or citation information. For example, North Carolina's linked databases allow the state to identify crash-prone drivers and even update the vehicle file if the vehicle is seized by the state as a result of a crime.

The second most common linkage is the crash and roadway files. In Alabama, for example, the state has created a linkage that allows the law enforcement officer investigating a crash to click on the location of a crash on an offline map. When back online, the location the officer selected is then linked to the appropriate road segment.

In contrast, the EMS/Injury Surveillance database is the least likely to be integrated with the other traffic records databases. Privacy concerns are the biggest reason why it is difficult to link EMS/Injury Surveillance records. It is difficult to find or establish a unique identifier that allows records to be linked anonymously. The other traffic records are typically linked using the driver's license number, but linking by the driver's license number allows an individual's identity to easily be traced. A person's name can also be used to link records, however, that is obviously not an anonymous way to link the records. Furthermore, a person's name is not a good unique identifier because individuals may go by different names such as "Bob" and "Robert" names may be spelled differently such as Sara or Sarah, and people may have the same name as someone else.

There are some linkages between EMS and crash records through programs such as the CODES, but these often rely on probabilistic linkages which have the potential for error since they use a variety of fields such as a person's name, date of birth, location, and date of incident to try and link crash and medical records that most likely involve the same person and the same incident since a deterministic link is not possible without an unique identifier. Some states have begun to look for a unique identifier that can link EMS and crash records. The Indiana TRCC discussed the idea of using a law enforcement agency's Originating Agency Identifier (ORI) number plus a randomly generated number from the agency's Computer Aided Dispatch (CAD) system. Law Enforcement representatives on the Indiana TRCC agreed this was technically feasible and EMS and other health care providers on the TRCC thought this would alleviate privacy concerns, but the effort has not moved forward due to other priorities and issues surrounding how the unique identifier would be transferred from law enforcement to EMS.

Linkage Model

Every state TTI spoke to, except Virginia, uses a point-to-point linkage model. Point-to-point models have no centralized database, and each database is connected through individual links with other databases. The alternative would be a hub-and-spoke model where each individual traffic records database connects to a centralized database. This is what Virginia uses. Records are collected and stored by the individual agency, but then also sent to a central database to be integrated with multiple other traffic records.

Point-to-point models are used because they fill the more pressing needs of the agencies involved than hub-and-spoke models. Agencies are usually most concerned with reducing time and costs to fill or update records and with increasing accuracy. Point-to-point models usually feature interfaces that, for example, allow crash and citation records to be pre-populated with information from the driver and vehicle file. The driver, vehicle, crash, and citation databases remain distinct, but interfaces allow pertinent information to flow easily from one database to the other.

A hub-and-spoke model could be used to fulfil the same function, but they are more difficult and complex to implement. A central database would raise questions such as who would build, pay, and control the central database, and who would own and control the data once it was sent to the central database. Questions about ownership and maintenance of the central database and data make point-to-point models more attractive to implement since those kinds of decisions to not have to be resolved.

Additionally, point-to-point models are less complicated than hub-and-spoke models because they only require two agencies to agree to share information. For instance, in order to connect the crash and driver databases, only the two respective agencies overseeing those databases must work together as opposed to all traffic records database owners having to coordinate to link their databases to a central database.

Funding Sources

Every state interviewed used federal 405c and 408 funds to link their traffic records databases. Kansas was the only state to mention the use of state funds. No other funding sources were mentioned by any of the interviewees.

Lead Agency

In the majority of states, the state department of transportation was the lead agency for linking the traffic records databases. In a few states it was the state police, and in Alabama, a university is the lead agency.

Recommendations and Challenges from the Interviews

The most common challenges and recommendations was getting data into a single database (i.e., establishing a single repository for crash data, a single repository for citation data, etc.), and getting data reported to each traffic records databases electronically. Without records being kept in a single database and without electronic submission that facilitates timely and accurate reporting, meaningful data linkages cannot be established. Indiana and Alabama both discussed the necessity of getting their records electronically submitted to a single database, and how this step was key pursuing linking their traffic records databases. California stated that its current efforts are focused on creating a single statewide repository for crash data, and after that is completed, the California may begin pursuing data linkages.

The next most common challenge mentioned was funding. States and individual agencies have many funding demands that cannot always all be met. As a result, the many interviewees recommended identifying leadership that would prioritize linking traffic records databases. West Virginia and Idaho both discussed the impact of funding and leadership. West Virginia is pursuing a massive overhaul of all state records for all government agencies called WV OASIS that would among other things facilitate better data linkages of traffic records. WV Oasis was being developed in phases, and the task of overhauling traffic records fell under a later task, "Task E." The project has not yet reached Task E but is already 50% over budget. As a result Task E has been paused indefinitely and may never get off the ground. Similarly, Idaho stated that there were plans to move rapidly towards integrating their databases, but due to a change in leadership at the director level with two of the involved agencies, linkage of traffic records has been deprioritized. Both examples underscore the importance of securing funding and having strong leadership to champion projects.

The final recommendation mentioned by states with advanced data linkages was to have a dedicated team to build linkages because that team would become experts over time in the traffic records data they were linking making each additional linkage easier.

Limitations

There are several limitations with the literature review. First, not all of the documents are recent. This is an issue because technology and organizational priorities change rapidly. TTI found during the interviews that some states such as Idaho and West Virginia had laid out ambitious plans to link their traffic records in documents published online, but those plans had changed since publication due to changes in leadership and funding.

Additionally, there was lack of availability of some documents from state to state. Some states published their most recent traffic records assessment and their traffic records plan or similar documents. Other states did not make this information readily available from our searching. Consequently, some of the states TTI could not find information may in fact have linkages among their traffic records databases.

Part 2: Strategic Assessment

This assessment depicts how TxDOT's goal of integrating core traffic records tracks with national recommendations. To further the assessment, TTI identified seven performance measures to evaluate the dissimilarities between integrated and non-integrated traffic records systems. The seven performance measures are:

- Single Repository for each traffic records system
- Electronic reporting for each traffic records system
- Linked vs. non-linked citation data with court data
- Linked vs. non-linked crash data with roadway data
- Linked vs. non-linked crash data with EMS/Injury Surveillance data
- Linked vs. non-linked vehicle and driver data with crash and citation data
- Linked vs. non-linked citation and crash data

From those seven performance metrics, TTI conducted a Strengths, Weaknesses, Opportunities, Threats (SWOT) Analysis of linking core traffic records. Overall, there are many strengths and opportunities associated with linking core traffic records data. Interfaces offer many immediate benefits such as increased accuracy, uniformity, and timeliness that improve business processes. Integration of two or more core traffic records databases allows for more in-depth analyses to be performed.

However, the weaknesses and threats must also be considered. The most prominent weakness and threat are the need for communication among all stakeholders to coordinate and maintain the integration and the need for funding to pay for the initial integration and on-going operations.

Strategic Context

In the 2017 Texas Highway Safety Plan, TxDOT emphasized its goal of linking traffic records systems in Texas, stating:

"The State of Texas also has long term plans to fully integrate the individual crash records systems, databases, and data across the program into a linked system. Integration of the crash records, trauma registry, citation database, DUI tracking system, and other systems is the ultimate goal for TRF-TS." [142]

Some of the benefits identified by TxDOT for linking traffic records systems include:

- reduce crashes and social harms
- support a data-driven approach to traffic safety
- Linked data can be a rich resource for developing and measuring progress of a State's Highway Safety Plan, as well as for research use by safety agencies and stakeholders

[142] Texas Department of Transportation, *Highway Safety Plan FY 2017,* (July 1, 2016): 144. Retrieved from: https://www.txdot.gov/apps/eGrants/eGrantsHelp/Reports/HSP_FY17.pdf.

- implement data driven performance measurement such as linked citation and crash data will allow targeted enforcement, which should reduce the number of crashes the data targeted and the percentage of reduction in speed-related crashes following targeted enforcement [143]

Performance Measures

The following analysis shows that linked traffic records systems outperform non-linked traffic records systems.

PERFORMANCE MEASURES: INDIVIDUAL SYSTEMS INTEGRATION

Performance Measure 1: Single repository for each traffic records system

Single repository for traffic records system	Lack of a single repository for each traffic records system
- Storing each of the core traffic records into its respective central repository increases accessibility of data that later can lead to the linking and sharing of data between agencies. This can lead to increased efficiency in government processes and increased capability for analytical findings from the statewide data.	- Without a single repository for each of the core traffic records, it is difficult to keep track of the records or even know if records exist. For example, without a single database for citations and adjudications, court personnel and law enforcement must individually request the records from a specific court. Lack of being able to access records is both time-consuming and tedious for involved parties. While law enforcement and court personnel may be able to access person's citation and adjudication history via driver and criminal history, the databases through which that history are accessed do not always give law enforcement and court personnel access to the individual cases.

[143] Ibid.

Performance Measure 2: Electronic reporting for each traffic records system

Electronic reporting for each traffic record system	Non-electronic reporting for each traffic record system
- Electronic reporting is not required in order to link databases, as it is possible to link databases containing data that has been manually entered. However, data that has been manually entered has many drawbacks (detailed to the right). Having data that is entered electronically into a single repository is preferable before trying to link the data with other databases. - Electronic reporting for each core traffic record system leads to fewer input errors, reduces redundant data entry, saves time, and increases accuracy, completeness, and uniformity of the information to agencies.	- Paper reporting leads to higher rates of illegibility, inaccuracies, and incomplete reporting than electronic records. These seemingly minor problems can lead to bigger issues, such as cases being dismissed in court due to the paper report not being accurately completed. Additionally, there are increased time costs in order to fill out the paper record and to identify and fix errors. There is also time spent duplicating entry of the information. For example, law enforcement must enter in the citation information, and then court personnel would enter in the same citation information later. All of these issues account for a higher cost to identify and fix errors and input the same data into multiple systems. Additionally, paper-based systems will never be able to provide timely data because of the lag time it takes to input the information into the system.

PERFORMANCE MEASURES: INTEGRATION AND INTERFACE ACROSS SYSTEMS

Performance Measure 3: Linked vs. non-linked citation data with court data

Linked citation data with court data	Non-linked citation with court data
- Electronic citations that are automatically sent to the courts via an interface have fewer errors and do not require duplicative entry by court staff. - Citations linked with court disposition data can be analyzed to provide information about percentage of citations that lead to convictions, plea bargains, and dismissals. It also can inform how long it takes for dispositions to occur and what courts are getting most of the workload.	- Courts systems that do not connect automatically with citation systems take longer to adjudicate cases because of backlogs. Non-linked data also leads to difficulty collecting statewide data about issues such as the percentage of arrests that are not filled by district attorneys, arrests resulting in conviction for lesser charge, calculation of the effectiveness of court sanctions by county and offender status, measurement of the effectiveness of probation sentences in comparison to jail time, and many other analytical capabilities.

Performance Measure 4: Linked vs. non-linked crash data with roadway data

Linked crash data with roadway data	Non-linked crash data to roadway data
- Linking crash data with roadway data through an interface allows officers to select the roadway segment on the crash report leading to more accurate reporting of crash locations, and saving law enforcement time. - This capability also provides better data for engineers and researchers to analyze trends of which highway segments are more prone to certain types of crashes and other traffic violations.	- The lack of an interface between crash and roadway systems can lead to inaccuracies on reporting crash locations by road segment. In Texas, the Crash Records Information System (CRIS) uses geographic coordinates to identify location while the Roadway Highway Network (RHiNo) uses distance from origin. These different spatial methods make it hard for the State to aggregate the data and run statistical analysis later to identify trends.

Performance Measure 5: Linked vs. non-linked crash data with EMS/injury surveillance data

Linked crash data with EMS/injury surveillance data	Non - linked crash data with EMS/Injury Surveillance data
- Law enforcement officers receive robust and continual training to improve the diverse skillset required to perform their jobs. Law enforcement, however, are not trained medical officials and, therefore, may not accurately assess injury severity sustained by individuals in motor vehicle crashes. The injury severity assessment process is further complicated by the fact that two individuals may both be accurately assessed as sustaining an incapacitating injury, such as a broken arm or major head trauma, but the nature of those injuries, including cost and long-term impact on the individual, could be very different. Linking crash and EMS data gives the State the ability to better identify the number and severity of crash injuries, gauge the total cost of traffic crashes, and determine which types of injuries are occurring in which types of crashes.	- Non-integrated systems do not allow for a detailed assessment or analysis on the severity and type of injuries that occur in crashes.

Performance Measure 6: Linked vs. non-linked vehicle and driver data with crash and citation data

Linked driver and vehicle data with crash and citation data	Non-linked driver and vehicle data with crash and citation data
- An interface between driver and vehicle data and crash and citation data allows law enforcement officers to quickly add driver and vehicle information to crash and citation forms increasing accuracy and time savings. - Additionally, an interface between the crash and citation databases with driver and vehicle records allows for the driver and vehicle records to be updated once the crash investigation has been completed and the citation adjudicated. This would save time updating the driver and vehicle files and increase completeness. - From analytical standpoint, having these systems connected can allow for many different analyses such as identifying crash prone drivers.	- Non-integration of driver and vehicle data to crash and citation data increases the time that law enforcement spends populating crash reports. - Without an interface between crash and citation databases with vehicle and driver databases, vehicle and driver databases may not display up-to-date or accurate information due to time delays uploading the information.

Performance Measure 7: Linked vs. non-linked citation and crash data

Linked citation and crash data	Non-linked crash and citation data
- Linked citation and crash data allows for better identification of areas for traffic enforcement. This will assist programs such as Data Driven Approaches to Crime and Traffic Safety (DDACTS) that use data to direct high visibility enforcement.	- Law enforcement and analysts will have an incomplete picture of the traffic safety challenges in their jurisdiction if crash and citation data are not linked. Layering crash and citation data helps law enforcement and analysts to better identify areas of traffic safety concern better than relying on only crash or citation data.

Conclusion

The ultimate goal of linking traffic records system is having seamless support of traffic records business processes as well as data that informs the State on various analytic fronts. The linkage of these systems, through interfaces or integration, leads to time and cost savings to the State, an increased effectiveness of traffic operations, and provides a holistic picture of traffic operations and safety in the State. This

comprehensive system informs traffic safety stakeholders, allowing them to make decisions with more comprehensive information.

SWOT Analysis for Linked Traffic Records Systems

Strengths

Broadly speaking, the strengths of linking traffic records databases can summed up in terms of time and cost savings.

Linked traffic records data provides multiple ways to increase time and cost savings. Many of the immediate benefits of linking traffic records data can be reaped through establishing interfaces. Interfaces offer a seamless, on-demand connectivity and a high degree of interoperability between systems that supports critical business processes and enhances data quality.[144] Interfaces can transfer information already stored in one database to populate information in another database. This saves time from having to manually enter the same information a second or even third time. A specific example of this would be linking the vehicle and driver databases with crash and citation reporting software to fill out and complete vehicle and driver information on crash and citation forms.

Additionally, linked data systems avoid duplication in reporting and allow records to be updated more quickly. For example, automatically linking completed or adjudicated crash and citation records with the driver and vehicle files can save time manually submitting or entering the data. This can lead to a more efficient adjudication process.

Furthermore, inaccuracies and illegibility are reduced by automatically filling out information via a data linkage instead of manually entering the information, which saves time correcting or properly completing documents such as crash and citation forms. This increase in accuracy, completeness, and uniformity also saves time and money. The increase in accuracy, completeness, and uniformity also helps improve the quality of the data which makes analyses more accurate and impactful.

Many of these strengths can be achieved through interfaces, which, while easier to establish than integrating separate databases, provide immediate benefit through time and cost savings. This is why more states have linked their traffic records databases through interfaces than through integration.

Weaknesses

The biggest potential weakness for a linked traffic records system is the high level of communication needed to coordinate linking the different databases. Communication is important to overcome many concerns such as stakeholder management and technology coordination.

Stakeholder management and communication involves making sure all stakeholders involved in the data linkage are able to express and solve their concerns, many of which will be discussed further down under weaknesses and the threats analysis. Additionally, stakeholder management is vital when there is a change in leadership at an involved agency which could affect the data linkage agreements if the new leadership does not prioritize maintaining the data linkage.

[144] National Highway Traffic Safety Administration. (2012). *Traffic Records Program Assessment Advisory*. Page iii. https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/811644

Technology coordination involves making sure each of the systems involved in the linkage are able to communicate with one another. This is especially important because technology changes rapidly. For example, if one agency involved in the data linkage upgrades its systems, it will be important to coordinate this change in technology to make sure it does not negatively impact the established data linkage.

Additionally, there is a need to identify skilled people who can create and maintain these data linkages. There could be a loss of institutional knowledge which can hinder the data linkage If there is turnover in personnel, either from the technical team or management.

Finally, there are on-going maintenance and upgrades that must be continually coordinated and funded.

Opportunities

While there are many strengths associated with establishing interfaces between databases, the State and other involved stakeholders can reap more opportunities when it moves beyond establishing interfaces and advances into integrating separate databases. Integration is the discrete linking of databases for analytic purposes.[145]

Interfaces help improve the timeliness, accuracy, and uniformity of the traffic records data which can lead to improved analyses. But in addition, linking, especially through integrating, two or more traffic records databases provides more analytical insights than looking at individual traffic records databases.

There are two different ways to link separate datasets. Researchers can link separate datasets that have been pulled as extracts from two or more databases, for example driver and crash datasets, and then link those datasets for a specific project or analysis. However, if the datasets existed in an integrated database, the data would be linked already, and would eliminate the need of having to link separate datasets for each individual project.

There are many examples of how linked data can improve analysis. For example, linking crash records with roadway data can allow researchers to more easily analyze the roadway characteristics that have the most impact on crashes. Another example is linking crash and EMS data to better understand the injuries sustained in crashes. These types of analyses can be used to justify more traffic safety funding and to gain a more accurate assessment of the cost and benefits of traffic safety countermeasures.

Integrated traffic records databases can also increase the accessibility of the data to stakeholders outside of the agency that generates the data. It can also lead to improved standardization of data reporting and analysis.

Threats

The biggest threat to a linked traffic records data system is funding. Linking traffic records requires funding for both start-up and on-going operations. This funding most often comes from the federal government but can also come from the state. However, funding sources may diminish or cease over time due to changing priorities or leadership threatening the linked data.

[145] Ibid.

Next, linked data systems benefit from champions, both in the involved agencies and from agencies involved in funding such as from the federal government or state legislature. The lack of a champion can limit the long term potential and success of being able to maintain data linkages across multiple traffic safety agencies.

Furthermore, linked traffic records can be threatened from changes in legal and privacy laws and regulations. Traffic safety data contains both personal and medical information that needs to be protected. Changes in the laws and regulations regarding the use and protection of this data could threaten the linked data systems.

Related to legal and privacy laws and rules is the need for strong data governance to regulate how data is shared, who has access to shared data, and how shared data is stored and kept secure. A clear set of data governance procedures can prevent many potentially damaging situations from occurring, such as the mishandling of shared data, which could threaten a data linkage.

Finally, changes in data requirements can threaten a linked traffic records system. For example, if the federal government requires certain updates to crash records, this could affect already established linkages, especially linkages completed via integration, to other datasets such as driver and vehicle files.

Conclusion

Overall, there are many strengths and opportunities associated with linking core traffic records data. Interfaces offer many immediate benefits such as increased accuracy, uniformity, and timeliness that improve business processes. Integration of two or more core traffic records databases allows for more in-depth analyses to be performed.

However, the weaknesses and threats must also be considered. The most prominent weakness and threat are the need for communication among all stakeholders to coordinate and maintain the integration and the need for funding to pay for the initial integration and on-going operations.

SWOT Table

	Helpful	Harmful
Internal Origin	**Strengths** •Time and cost savings •Improvement in accuracy, completeness, and uniformity of data •Better traffic safety data quality control •Avoidance of duplication in reporting •More efficient adjudication process	**Weaknesses** •Technology coordination barriers •Stakeholder engagement and agreement barriers •High Maintenance costs •Difficulty to connect systems •High need for training & skilled labor force
External Origen	**Opportunities** •Potential for allocation of more funding •Transparent data •Accurate cost-benefit analysis on traffic safety •Better measurement the cost of crashes to the state •More evidence on which countermeasures Work •More accessibility to stakeholders	**Threats** •Funding •Privacy and other legal issues to share data •Need for an external champion to promote integration and provide funding • Changes in systems that could threaten established linkages • Data management difficulties due to the multi-stakeholder complexity

Part 3: Cost Benefit Analysis

This analysis examines each of the theoretical 30 possible linkages among the six core traffic records databases to look at the potential cost and benefit of each linkage. The cost to benefit comparison varies greatly depending on which databases are being linked, the type of linkage that is needed, and the benefit to stakeholders of that linkage. This report will examine those issue in more depth finding some databases would benefit from an interface linkage, others from integration, and some that would not be beneficial to link.

Key Terms

The following terms are used to describe current and potential linkages of the Texas core traffic records databases:

- Partially Realized Interface - An interface has already been developed fully or partially and information is being transmitted from one database to another by most users.

- Potential Interface Benefit - No interface currently exists, but there would be a benefit if an interface was developed to transmit information from one database to another.

- Potential Integration Benefit - Limited or no integration currently exists, but there would be a benefit if a potential integration were developed to link information from the referenced databases.

- Limited Integration Benefit - There would be limited-to-no-benefit if a potential integration were developed to link information from the referenced databases.

Executive Summary

- Below is a summary matrix of the current state of traffic records integration along with potential linkages with tangible benefits.

		Receives Information					
		Citation	Crash	Driver	Injury Surveillance	Roadway	Vehicle
Provides Information	Citation		Potential Integration Benefit	Partially Realized Interface	Limited Integration Benefit	Potential Integration Benefit	Potential Interface Benefit
	Crash	Potential Integration Benefit		Potential Interface Benefit	Potential Interface Benefit	Potential Integration Benefit	Limited Integration Benefit
	Driver	Partially Realized Interface	Partially Realized Interface		Potential Interface Benefit	Limited Integration Benefit	Potential Integration Benefit
	Injury Surveillance	Limited Integration Benefit	Potential Integration Benefit	Limited Integration Benefit		Potential Integration Benefit	Limited Integration Benefit
	Roadway	Potential Interface Benefit	Potential Interface Benefit	Limited Integration Benefit	Limited Integration Benefit		Limited Integration Benefit
	Vehicle	Partially Realized Interface	Partially Realized Interface	Potential Integration Benefit	Potential Integration Benefit	Limited Integration Benefit	

- Existing interfaces allow law enforcement personnel who use CRASH and some private e-citation software to import driver and vehicle data to auto-populate portions of the crash and citation reports.

- Class C misdemeanors are submitted electronically to the driver's license division, but the process is not used by all courts and is not completely automatic.

- There are some potential interfaces that could be beneficial, but more research is needed to determine the costs to develop these interfaces.

- All six core traffic records databases were built separately and continue to operate independently of one another which limits the potential to develop physical linkages.

- Theoretically, interfaces could be developed to transmit citation and injury surveillance information to auto-populate those respective fields on a crash report. However, it would be difficult to develop this interface because all three databases are independent of one another, and the information that would flow between each database would come from records being created and updated at the same time.

- While interface linkages may not be appropriate for all databases, many traffic safety related analyses would be improved by integrating several traffic records databases.

- Most of the benefits of integrating two or more databases can be achieved by linking extracts from each database and using statistical analysis software to analyze the data. Linking extracts avoids many of the costs, technical specifications and requirements, and other issues associated with physically linking databases.

- The process of linking data extracts would be aided by interfaces that were built to transmit a unique ID between databases. For example, if an interface were developed to send the crash ID to the related injury surveillance record(s), linking the data extracts later would be much easier and more accurate.

Limitations

The biggest limitation of this study is the lack of cost information. The literature review of all 50 states was unable to identify detailed cost summaries of the linkages developed in other states. Additionally, while representatives from 12 states were interviewed, none knew what their linkages cost to create. This is because most linkages were funded through federal grants. In many instances one grant would support several projects or ongoing operations instead of one grant funding a linkage project solely. Also many projects took several years which required several grants. This made estimating the cost for interviewees difficult. Finally, none of the interviewees had a performed a cost-benefit analysis to estimate the benefits as well.

Calculation Assumptions

Where possible, the time savings benefit was calculated using the following assumptions:

- $95,945 equals one full-time law enforcement officer (LEO). According to the Bureau of Labor Statistics, the mean police officer salary in Texas is $60,350.[146] Additionally, the Bureau of Labor Statistics reports that the average state and local government employee receives 37.1% of their compensation through benefits, including paid leave, supplemental pay, insurance, retirement benefits, and other legally required benefits.[147] Multiplied together, the full-time employee (FTE) of the average Texas police officer is $95,945.

- $57,027 equals one full-time emergency medical technician (EMT)/paramedic. According to the Bureau of Labor Statistics, the mean EMT/paramedic salary in Texas is $35,870.[148] Additionally,

[146] Bureau of Labor Statistics. (2016). Occupational Employment and Wages, May 2016 – 33-3051 Police and Sheriff's Patrol Officers. Retrieved September 13, 2017, from https://www.bls.gov/oes/current/oes333051.htm.

[147] Bureau of Labor Statistics. (2017). Economic News Release: Employer Costs for Employee Compensation. Retrieved September 13, 2017, from http://www.bls.gov/news.release/ecec.nr0.htm

[148] Bureau of Labor Statistics. (2016). Occupational Employment and Wages, May 2016 – 29-2041 Emergency Medical Technicians and Paramedics. Retrieved September 13, 2017, from https://www.bls.gov/oes/current/oes292041.htm#st.

the Bureau of Labor Statistics reports that the average state and local government employee receives 37.1% of their compensation through benefits, including paid leave, supplemental pay, insurance, retirement benefits, and other legally required benefits.[149] Multiplied together, the FTE of the average Texas EMT/paramedic is $57,027.

- A FTE works 1,792 hours (52 weeks x 40 hours per week – 96 hours [12 days of vacation] – 96 hours [12 holidays] – 96 hours [12 days of sick leave]).

- 5,650,521 traffic related misdemeanor citations are issued annually in Texas. According to the Texas Office of Court Administration (OCA), there were 3,985,701[150] new cases filed in Texas Municipal Courts, and 1,664,820[151] new cases filed in Texas Justice Courts related to traffic misdemeanors in fiscal year 2016.

- There were 551,971 reportable crashes in Texas in 2016.[152]

- There were 3,773 fatalities, 17,582 incapacitating injuries, and 81,704 non-incapacitating injuries from crashes in Texas in 2016.[153]

Description of Each Traffic Records Linkage

Below is a description of each of the theoretical 30 possible linkages among the six core traffic records databases. There is a determination of the type of linkage that is current or possible between those two databases followed by a description of the linkage and possible benefits of the linkage. When possible, a breakdown of potential monetary benefits is performed.

[149] Bureau of Labor Statistics. (2017). Economic News Release: Employer Costs for Employee Compensation. Retrieved September 13, 2017, from http://www.bls.gov/news.release/ecec.nr0.htm

[150] Texas Office of Court Administration. (2017). Annual Statistical Report for the Texas Judiciary FY 2016. Retrieved September 13, 2017, from http://www.txcourts.gov/media/1436989/annual-statistical-report-for-the-texas-judiciary-fy-2016.pdf#page=141.

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[152] Texas Department of Transportation. (2017) Rural and Urban Crashes and Injuries by Severity. Retrieved September 13, 2017, from http://ftp.dot.state.tx.us/pub/txdot-info/trf/crash_statistics/2016/10.pdf.

[153] Texas Department of Transportation. (2017) Crash and Injuries by County. Retrieved September 13, 2017, from http://ftp.dot.state.tx.us/pub/txdot-info/trf/crash_statistics/2016/12.pdf.

Citations

OCA is currently working to establish a centralized citation repository in Texas. The following analysis for linking citation records to the other core traffic records assumes the central citation repository has been created.

Linking citation records to crash records

Linkage: Potential Integration Benefit

Presently, citation numbers associated with a crash are captured on the crash report form. However, the crash ID is not captured on the citation form because the crash ID is not generated until a crash report has been submitted to TxDOT which is usually after the citation is issued. It is difficult to create an interface between two records that are being created/updated simultaneously.

Also, a theoretical interface between the two databases would have a small time savings that is difficult to measure. An interface would work by having an officer type in the citation number which would auto-populate the charge field. If an officer is using TxDOT's CRASH system, then the unit number and person number associated with the citation are already auto-filled for the officer. The average time needed to fill in the charge field is so small that it is difficult to measure the cost savings of such an interface.

However, layering extracted citation and crash datasets is a critical component of data driven approaches to crime and traffic safety (DDACTS). The linking of these two extracted datasets would allow law enforcement to identify locations where high visibility enforcement would be most effective. This benefit is already partially realized through analytical efforts from some law enforcement agencies and TTI. A statewide citation database would dramatically improve the potential for analysis though.

Linking citation records to driver records

Linkage: Partially Realized Interface

Courts submit adjudicated Class C misdemeanors to the Driver License Division through a secure File Transfer Protocol (FTP). The Driver License Division converts the file from text format to HTML and uploads to the Driver License System (DLS). All Class C misdemeanors are required to be sent to DPS electronically. The vast majority of courts submit their Class misdemeanors to DPS, but it is known that a few do not. However, the exact number of non-participating courts is unknown.

Class B misdemeanors and above, such as DWI convictions, are submitted to the Driver License Division via paper or electronically through the Criminal Justice Information System (CJIS). If the conviction is sent through CJIS, the driver's license will automatically be suspended if applicable.

This partially automated system has many costs savings. However, there are more benefits that could be realized if an interface were developed that allowed Class C misdemeanors to be automatically appended to the driver file and if all Class B misdemeanor and above adjudications were submitted electronically to DPS.

Linking citation records to injury surveillance records

Linkage: Limited Integration Benefit

There is no citation information that is currently also captured on injury surveillance records.

Since not all citations are result in a crash and an injury, it is unclear how much benefit would be had if citation and injury surveillance records were linked.

Linking citation records to roadway records.

Linkage: Potential Integration Benefit

There is no citation information that is currently also captured on roadway records.

Linking extracted citation to roadway datasets would help identify the locations and types of roads with the highest number of citations. This analysis, for example, could be compared with crash locations to determine if enforcement areas correlate with crash areas. This benefit is already partially realized through analytical efforts from some law enforcement agencies and TTI. A statewide citation database would dramatically improve the potential for analysis though.

Linking citation records to vehicle records.

Linkage: Potential Interface Benefit

There is no citation information that is currently also captured on vehicle records.

Through the literature review, TTI found that a couple of states have linked their citation and vehicle databases through an interface to allow the vehicle database to be updated if the state seizes an individual's vehicle as a result of a crime.

Crash Records

Crash records play a central role in traffic records linkage. Crash records are often the recipient of data from other data sources, but there are opportunities to link crash data with the other traffic records databases.

Linking crash records to citation records

Linkage: Potential Integration Benefit

It would be difficult to create an interface to link crash data to citation data because citations are often completed simultaneously as the crash report is completed. However, as previously discussed, linking extracted crash and citation datasets is a critical component of DDACTS and would have analytical benefits.

Linking crash records to driver records

Linkage: Potential Interface Benefit

Currently TxDOT submits an extract of all reportable crashes quarterly to DPS to be appended to the driver file. TTI was unable to identify how much it costs for DPS to then upload the crash reports to each driver file. An interface that performed this task would allow for the driver record to be updated in a timelier manner and could provide a cost savings over the current process.

Linking crash records to injury surveillance records

Linkage: Potential Interface Benefit

Currently there are projects in Texas to link extracts of both datasets in order to better understand the types and severity of injuries sustained in crashes. This is done through probabilistic linkages which could be improved if a unique identifier, such as the crash ID, were somehow transferred to the injury surveillance record. Other states have looked into this, but have thus far not been able to find a reliable way to automatically link records in these two databases through a unique identifier.

Linking crash records to roadway records

Linkage: Potential Integration Benefit

There is no crash information that is currently also captured on roadway records. However, linking extracts of these two datasets allows for the identification of crash hot spots and the roadway characteristics of those hot spots.

Linking crash records to vehicle records

Linkage: Limited Integration Benefit

There is no crash information that is currently also captured on vehicle records.

Driver Records

Interfaces already exist to allow driver information to be auto-populated in crash and citation reports. There are other opportunities for linkages with injury surveillance records.

Linking driver records to citation records

Linkage: Partially Realized Interface

Through Texas Crime Information Center (TCIC), law enforcement can pull vehicle records to auto-populate citation forms using e-citation software and hardware purchased from private vendors. It is not known how many law enforcement agencies use e-citation software that have this interface.

Linking driver records to crash records

Linkage: Partially Realized Interface

There is currently an interface for the CRASH reporting system that allows law enforcement officers to auto-populate driver information on a crash report. This option is only available to law enforcement officers who have a Texas Law Enforcement Telecommunications System (TLETS) ID and submit crash reports to TxDOT via CRASH.

Linking driver records to injury surveillance records

Linkage: Potential Interface Benefit

EMS personnel record injured driver and passenger name and address information using an individual's driver's license. An interface similar to what law enforcement uses could assist in reducing how long it takes for EMS personnel to record the information as well as improve the accuracy by avoiding translation errors.

Benefit Calculation

103,058 injuries likely to result in an EMS response x 30 seconds to fill out the name and address information of the patient = 51,529 man hours.

51,529 hours ÷ 1,792 hours (FTE) = 29 FTE EMT

29 FTE EMT x $57,027 = $1,653,783 in annual savings

Linking driver records to roadway records

Linkage: Limited Integration Benefit

There is no driver information that is currently also captured on roadway records.

Linking driver records to vehicle records

Linkage: Potential Integration Benefit

The driver name and address are recorded on the vehicle registration but the driver's license number is not. Without a unique identifier such as a driver's license, it would be difficult to link the two datasets. However, there could be some time savings if the vehicle registration included a driver's license number

that linked back to the driver record to auto-populate the owner name and address information on the vehicle registration.

Additionally, it was mentioned in the interview with the Texas Department of Motor Vehicles that some personnel involved in the registration process have stated that having access to driver's license photos would assist in the vehicle registration process. While this would help properly identify vehicle registrants, it is difficult to measure in monetary terms the benefit this would have.

Injury Surveillance Records

Crash records are the only other core traffic records database that contain information stored under injury surveillance records, but linking the two is difficult.

Linking injury surveillance records to citation records

Linkage: Limited Integration Benefit

There is no injury surveillance information that is currently also captured on citation records.

Linking injury surveillance records to crash records

Linkage: Potential Integration Benefit

Injury severity, taken to (such as hospital or doctor's office), taken by (such as EMS or self), data of death, and time of death are fields on the crash report that could be filled using information from injury surveillance data. However, it is difficult to link two databases using records that are being created/updated simultaneously.

Extracted injury surveillance and crash datasets are being connected using probabilistic linking methods. These linkages would be improved if there was a unique identifier that could be transferred through an interface from the injury surveillance system to the crash report. This would allow crash and injury surveillance records to be linked using a deterministic method which is much more robust than probabilistic linkages.

Linking injury surveillance records to driver records

Linkage: Limited Integration Benefit

There is no injury surveillance information that is currently also captured on driver records.

Linking injury surveillance records to roadway records

Linkage: Potential Integration Benefit

There is no injury surveillance information that is currently also captured on roadway records. However, linking extracted injury surveillance, crash, and roadway datasets would allow researchers to study how crash and roadway characteristics impact the type and severity of injuries.

Linking injury surveillance records to vehicle records

Linkage: Limited Integration Benefit

There is no injury surveillance information that is currently also captured on vehicle records.

Roadway Records

Roadway records are not currently linked to any of the other core traffic records. TxDOT's Roadway Records Division is currently focused on ensuring all public roadways are inventoried followed by ensuring all inventoried roads have their attributes in the data listed correctly which is an on-going process since there is always road construction. There are no immediate plans to link roadway data with any of the other core traffic records.

Linking roadway records to citation records

Linkage: Potential Interface Benefit

Officers must enter the location of the citation on to the citation form. Alabama, for example, has developed a tool that allows officers to select the location of a crash or traffic violation on a map which then auto-fills the location information on the citation and crash forms.

Benefit Calculation

5,650,521 annual citations x 30 seconds to fill out the location information on a citation = 47,088 man hours.

47,088 hours ÷ 1,792 hours (FTE) = 26 FTE LEO

26 FTE LEO x $95,945 = $2,494,570 in annual savings

Linking roadway records to crash records

Linkage: Potential Interface Benefit

Officers must enter the location of the citation on to the citation form. Alabama, for example, has developed a tool that allows officers to select the location of a crash or traffic violation on a map which then auto-fills the location information on the citation and crash forms. TxDOT, through the CRASH user group, has looked at developing a linkage with the roadway data to help auto-populate crash location fields, but this was given a low priority by the CRASH user group and has not been pursued by TxDOT.

Benefit Calculation

551,971 annual crash reports x 30 seconds to fill out the location information on a crash report = 4,600 man hours.

47,088 hours ÷ 1,792 hours (FTE) = 2.5 FTE LEO

2.5 FTE LEO x $95,945 = $239,862 in annual savings

Linking roadway records to driver records

Linkage: Limited Integration Benefit

There is no roadway information that is currently also captured on driver records.

Linking roadway records to injury surveillance records

Linkage: Limited Integration Benefit

There is no roadway information that is currently also captured on injury surveillance records.

Linking roadway records to vehicle records

Linkage: Limited Integration Benefit

There is no roadway information that is currently also captured on vehicle records.

Vehicle Records

Vehicle records currently interfaces directly with the CRASH reporting system and indirectly with some e-citation systems through information shared with the TCIC to allow crash and citation reports to be auto-populated with vehicle information.

Linking vehicle records to citation records

Linkage: Partially Realized Interface

Through TCIC, law enforcement can pull vehicle records to auto-populate citation forms using e-citation software and hardware purchased from private vendors. It is not known how many law enforcement agencies use e-citation software that have this interface.

Linking vehicle records to crash records

Linkage: Partially Realized Interface

There is currently an interface for the CRASH reporting system that allows law enforcement officers to auto-populate vehicle information on a crash report. This option is only available to law enforcement officers who have a Texas Law Enforcement Telecommunications System (TLETS) ID and submit crash reports to TxDOT via CRASH.

Linking vehicle records to driver records

Linkage: Potential Integration Benefit

There is no vehicle information that is currently also captured on driver records. However, there could be a benefit for law enforcement if an individual's driver record and history also showed which vehicles are registered to that driver.

Linking vehicle records to injury surveillance records

Linkage: Potential Integration Benefit

There is no vehicle information that is currently also captured on injury surveillance records.

Valuable information could be gathered on the nature of crash injuries in different types of vehicles if either vehicle or crash records were integrated with injury surveillance records.

Linking vehicle records to roadway records.

Linkage: Limited Integration Benefit

There is no vehicle information that is currently also captured on roadway records.

Section 3: Analysis of Interviews with Representatives of the Six Core Traffic Records Databases in Texas

TTI interviewed representatives of the six core traffic records in Texas in order to assess the current state of linkages between Texas' six core traffic records and to identify beneficial opportunities for linkages in the future.

Key Terms

TTI will use the following key terms and definitions throughout this report. These key terms and definitions are from the National Highway Traffic Safety Administration (NHTSA) Traffic Records Program Assessment Advisory which NHTSA uses to guide the evaluation of states' traffic records programs.[154]

- Data linkages: The links established by matching at least one data element in a record in one file with the corresponding element or elements in one or more records in another file or files. Linkages may be further described as interface or integration depending on the nature and desired outcome of the connection.

- Data interface: A seamless, on-demand connectivity and a high degree of interoperability between systems that supports critical business processes and enhances data quality.

- Data integration: The discrete linking of databases for analytic purposes.

Executive Summary

- TTI interviewed representatives from: Texas Office of Court Administration (citation records), Texas Department of Motor Vehicles (vehicle records), Texas Department of Transportation (crash and roadway records), Texas Department of Public Safety (driver records).

- There are currently interfaces that allow law enforcement officers with TLETS IDs to auto-populate driver and vehicle information when using TxDOT's CRASH program or some private e-citation companies. Additionally, Class C misdemeanors are submitted to the Texas Department of Public Safety electronically though there are some manual aspects to the submission process.

- None of the databases are integrated. Each database is administered separately by different agencies or divisions within the same agency.

- There are no current immediate plans by any of the six core traffic records databases to link with any of the other core traffic records databases. Long term, several agencies expressed an openness to pursuing more linkages.

[154] National Highway Traffic Safety Administration. (2012). *Traffic Records Program Assessment Advisory*. Page iii. https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/811644

Summary of Each Interview

TTI reached out to members of the Texas Traffic Records Coordinating Committee to identify representatives from each of the six core traffic records databases in Texas. The Department of State Health Services (DSHS) responded to the questions via email. The other representatives were interviewed over the phone and lasted approximately 30-45 minutes each. The interviews provided insights into how the data for each database is acquired, how the data is shared with other agencies, and plans and interest to link databases in the future.

Citation Records

Texas Office of Court Administration
Thomas Sullivan, Project Manager

Texas does not currently have a centralized statewide citation database. Currently, the Texas Office of Court Administration's (OCA) focus is developing a statewide eCitation database. The statewide eCitation database would only collect citation data from law enforcement agencies. The database will not be involved in the transfer of the citation from the law enforcement agency to the court. Law enforcement agencies will continue to issue citations using current methods. Many agencies are using private eCitation systems that interface with the State driver and vehicle record and allow for those fields to be auto-populated on the citation.

Additionally, there are no plans to immediately physically integrate the statewide eCitation database with any other traffic records. However, there are plans to share the data with multiple traffic safety partners including the Department of Public Safety Highway Safety Operations Center (DPS HSOC), TxDOT, and the Department of State Health Services (DSHS) for those agencies to link citation data with their data for analysis.

Finally, in addition to the statewide eCitation database project, OCA is looking at a long range (4-5 years) project that would collect adjudicated records from the courts. The Driver Records Division may be interested in linking to this database since it would contain adjudicated records, but since the projected start date is so far out, it is unclear what will be included in the database and the extent of Driver Records interest in linking to it.

Crash Records

Texas Department of Transportation
Lesley Trevino, CRIS Operations Supervisor
Larbi Hanni, Crash Data Analysis Branch Manager

Crash records have two interfaces with other core traffic records systems. Through the Texas Law Enforcement Telecommunications System (TLETS), law enforcement officers who use CRASH and have a TLETS ID can auto-populate fields related to the driver and vehicle.

TxDOT, through the CRASH user group, considered developing a linkage with the roadway data to help auto-populate crash location fields, but this was given a low priority by the CRASH user group and has not been further pursued by TxDOT.

There are no linkages with citations or injury surveillance databases. Those fields are completed manually by officers on the crash report. However, a linkage with injury surveillance was described as potentially very valuable from an analytical perspective since it would give more insights into the nature of injuries caused in crashes than is currently collected on a crash report.

TxDOT provides extracts of the crash data to multiple groups including quarterly extracts given to DPS so that the extracts may be linked and driver files updated. Additional extracts are made available to local law enforcement agencies such as Austin PD and DPS for CMV-related crashes.

Driver Records

Texas Department of Public Safety
Abed Nader, Assistant Manager, Enforcement & Compliance Services, Driver License Division

The driver's license and driver record are stored in the same database. The driver's license is not directly linked with any other databases unless the driver is a commercial driver, whose driver's licenses are connected across the states because commercial driver's license (CDL) interstate commerce is regulated by the federal government. The American Association of Motor Vehicle Administrators (AAMVA) processes transactions for CDLs using the Commercial Driver's License Information System (CDLIS). CDLIS maintains a ten year history. By maintaining a long-term driver history database, a commercial driver cannot leave Texas and go to Oklahoma to avoid DWI suspension, for example.

Courts submit adjudicated Class C misdemeanors to the Driver License Division through a secure File Transfer Protocol (FTP). The Driver License Division converts the file from text format to HTML and uploads it to the Driver License System (DLS). All Class C misdemeanors are required to be sent to DPS electronically. The vast majority of courts submit their Class misdemeanors to DPS, but it is known that a few do not. However, the exact number of non-participating courts is unknown.

Class B misdemeanors and above, such as DWI convictions, are submitted to the Driver License Division via paper or electronically through the Criminal Justice Information System (CJIS). If the conviction is sent through CJIS, the driver's license will automatically be suspended if applicable.

DLS is only linked through an interface with the Texas Law Enforcement Telecommunications System (TLETS). DLS is not connected or linked with any other databases though DLS does send information to other agencies, such as the Texas Secretary of State, who uses the information for voter registration purposes. DLS also shares information with vehicle registration if a vehicle registration or license plate needs to be suspended. DSHS shares information regarding deceased individuals with DLS.

The Driver License Division has been in communication with the OCA regarding the development of a statewide citation database. The Driver License Division has shown interest in linkages that would allow for more uniform reporting from all courts for Class B misdemeanors and above as well as for compliance issues such as ignition interlock sanctions on a license.

Injury Surveillance Records

Texas Department of State Health Services
Dan Dao, Injury Epidemiology & Surveillance Branch Manager

DSHS maintains Emergency Medical Services (EMS) and trauma databases which they currently integrate with crash records data. The integration is done for analytical purposes and allows DSHS to further describe the health outcomes of a crash. It also allows DSHS to check the uniformity and accuracy of data across databases. The linkage is done through probabilistic linkage methods which use demographic data such name, age, birthdate, date of incident, and location of incident to link records. The linkages are supported by funding from TxDOT but are time consuming and require new skills from their epidemiologist. Additional costs come from maintaining the registry and having access to the data.

In the future, DSHS has plans to link with other datasets, specifically administrative health ones like Hospital Discharge and Emergency Department data. DSHS' biggest current and future concerns center on privacy issues and include obtaining legal ability to do the linkages, determining who owns the linked data, and with whom the linked data can be shared. However, there are many benefits to linking injury surveillance data that include further validation of the data by using secondary sources and the ability to better describe health outcomes, which helps inform prevention efforts.

Roadway Records

Texas Department of Transportation
David Freidenfeld, Roadway Records Branch Supervisor

Roadway records primary focus is to have an up-to-date inventory of all public roadways in Texas. TxDOT has built the Geospatial Roadway Inventory Database (GRID), which is a relatively new application, to completely house its road inventory data system. It is a back-end database and an application to maintain all the roadway inventory data. All state DOTs need to maintain a roadway network system under the Highway Performance Monitoring System (HPMS). TxDOT released GRID two years ago, but it is not using it yet for HPMS submittal or annual reports, or the Crash Records Information System (CRIS). However, TxDOT plans to have that data come from GRID this year.

Roadway data currently comes from the Roadway Inventory File (RIF) which was preceded by the Road Highway Inventory Network (RHiNo). Additionally, TxDOT maintains the Geometric (Geo-HINI) database which inventories roadway curve data.

TxDOT's Roadway Records Division is currently focused on ensuring all public roadways are inventoried followed by ensuring all inventoried roads have their attributes in the data listed correctly which is an on-going process since there is always road construction.

There are no current live links with any other data systems. However, roadway data is shared through extracts with multiple other entities. These include CRIS, Pavement Management Information System (PMIS), Statewide Traffic Analysis and Reporting System (STARS), and Design Construction Information System (DCIS).

There are no future plans to link roadway data with any other data systems. Linking is not a priority to assist with maintaining the roadway inventory, but Roadway Records understand their data can be very valuable when shared with other groups to help improve safety analyses.

Vehicle Records

Texas Department of Motor Vehicles
Tim Thompson, Deputy Director Vehicle Titles and Registration Division

Presently, vehicle records are primarily reported to the Department of Motor Vehicles (DMV) through local tax assessors or car dealerships. The vehicle record does not link with the driver record, but it does interface directly with the CRASH reporting system and indirectly with some e-citation systems through information shared with the Texas Crime Information Center (TCIC) to allow crash and citation reports to be auto-populated with vehicle information.

The Department of Motor Vehicles is currently focused on an overhaul of its computer systems and does not have any current or future plans to link the vehicle database to any other core traffic records databases. One potential linkage that could be beneficial is linking vehicle records with driver records. Mr. Thompson relayed that some DMV personnel involved in the registration process stated that having access to driver's license photos would assist in the vehicle registration process.