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DENVER REGIONAL COUNCIL OF GOVERNMENTS

Regional Crash Data Consortium Final Report

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Cover photo courtesy of Colorado State Patrol.

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Introduction

The Denver Regional Council of Governments secured 405c traffic records improvement grants in federal fiscal years 2023 and 2024 to investigate and demonstrate the value of a regional crash data consortium and address traffic record improvement issues related to crash data in the Denver region. Staff of local governments, the State of Colorado, federal agencies and other stakeholders use crash data to work to improve traffic safety, allocate resources and plan transportation systems. DRCOG staff proposed the creation of a regional crash data consortium to leverage the interest and collective capacity of organizations in the Denver region, along with state and federal partners to work to solve common issues with crash data collection, processing and analysis. This Regional Crash Data Consortium Final Report details the grants' goals; provides an overview of consortium guiding principles; reports on performance measures tracking progress; and outlines specific outcomes, recommendations and next steps to improve crash data collection, processing and analysis in the Denver region.

Overview

Since October 2022 the Regional Crash Data Consortium project has been funded by 405c State Traffic Safety Information System Improvements grants. Through partnership with the National Highway Traffic Safety Administration, Colorado Department of Transportation, and the Statewide Traffic Records Advisory Committee, DRCOG was awarded National Highway Traffic Safety Administration 405c traffic records improvement grants for federal fiscal years 2023 and 2024.

When this report refers to crash data, it is the crash data collected by law enforcement agencies using a required standard form, the DR3447 crash report, which can flow along multiple pathways to become useful to downstream data users. DRCOG staff have created a crash crash data collection, processing and analysis model that represents some of the non-exhaustive interconnections and pathways of crash data as described by crash data consortium stakeholders. The crash report contains fields the State of Colorado associates with a driver's record and uses for traffic safety analysis. The Colorado Department of Revenue, the custodian of record for crash data in Colorado, maintains statewide crash data in a system called Colorado Driver License, Record, Identification and Vehicle Enterprise Solution, known by its acronym, DRIVES. It shares DRIVES data with the Colorado Department of Transportation through the Behavior and Engineering Safety Data for Transportation system, referred to by its acronym, BESDT. Colorado Department of Transportation coders work with the BESDT data to publish an annual crash dataset used by state and regional

stakeholders for engineering, education and enforcement purposes including traffic safety and transportation network analysis.

The Colorado Department of Transportation's annual crash dataset is the basis for data that DRCOG and several local governments use to create their datasets, but it often requires modification such as geolocating records. CDOT staff geolocate crashes on the state highway and interstate systems, as well as all fatal and serious injury crashes in the state, but the current process often leaves tens of thousands of crashes in the region that are not on the highway or interstate system without latitude and longitude. DRCOG receives annual data from CDOT, geolocates all crashes in the Denver region and hand-checks all crashes that DRCOG staff have determined to be high priority: fatal, serious injury, pedestrian, bicyclist and motorcyclist crashes.

Primary goal

The primary goal of the Regional Crash Data Consortium is to investigate and demonstrate the value of a regional crash data consortium to inventory the needs of the region and work to solve common issues with crash data collection, processing and analysis.

DRCOG staff want to improve the accuracy, use and coordination of crash data at the regional level to ultimately help achieve regional traffic safety goals.

Guiding principles

DRCOG staff developed a vision, mission and goals to guide consortium activities with stakeholder feedback. Participants of the May 11, 2023, crash data consortium meeting reviewed and endorsed the guiding principles.

Vision: The consortium is a sustainable and valuable resource to further local and regional roadway safety goals by facilitating collaboration and developing high-quality crash data for the Denver region.

Mission: To bring stakeholders in the Denver region together and improve crash data collection, processing and analysis to reduce traffic fatalities and serious injuries. Stakeholders will share expertise and resources to address commonly identified issues of crash data such as timeliness, accuracy, consistency and accessibility.

Goals:

- Improve completeness and accuracy of spatial locations.
- Encourage consistency of high-quality data collection.
- Coordinate a timely release of crash data.
- Provide education on crash data collection, organization and analysis.
- Develop an authoritative regional crash dataset.

Photo courtesy of Colorado State Patrol.

Regional Crash Data Inventory and Needs Assessment

DRCOG staff investigated and demonstrated the value of a regional crash data consortium to inventory the region's needs by soliciting input from stakeholders regionwide and statewide, hosting well-attended consortium meetings, and conducting interviews and conversations with dozens of local, state and federal stakeholders. Staff from more than half of DRCOG's member governments participated in consortium activities with representation from traffic engineers, transportation planners, geospatial information systems professionals, and members of law enforcement. At the state level, DRCOG staff conducted ongoing conversations with the Colorado Department of Revenue, Colorado Department of Transportation, Colorado Department of Public Health and Environment, and the Colorado State Patrol; and at the federal level with the Federal Highway Administration. In addition to government contacts, DRCOG staff met with planning and engineering contractors, crash data software vendors and safety advocates.

Beyond individual conversations, as of July 2024 DRCOG hosted five meetings of the Regional Crash Data Consortium, bringing together a diverse range of stakeholders and covering topics such as crash data collection and processing. Consortium meetings provided a space for stakeholders to present their work, make connections and share ideas. Participant enthusiasm for the project contributed to the development of the Regional Crash Data Inventory and Regional Crash Data Needs Assessment, demonstrating the consortium's value and successful inventorying of the needs of the region.

Regional Crash Data Inventory

DRCOG staff engaged with stakeholders across the region, state agencies, and federal partners to learn about the crash data sources they're using; analysis use cases and goals; their issues and problems with crash data collection, processing and analysis; and provide opportunities for stakeholders to share other information and perspectives on crash data. DRCOG staff completed the inventory in September 2023 and shared a draft document with stakeholders for feedback, then published the final Regional Crash Data Inventory in March 2024. Staff based the inventory on the results of online surveys, information learned in consortium meetings, and conversations with stakeholders. DRCOG staff have continued stakeholder engagement since September 2023 and may update the inventory later, however much of what DRCOG staff have heard since publishing the inventory confirms the general findings as published.

Key findings from the inventory include the data sources stakeholders report they used in their work, data sources they desire to incorporate, the types of analysis they perform and various challenges they experience while working with crash data. Stakeholders' main challenges include the quality and availability of geospatial data, the timeliness of data, the

completeness of data, inconsistencies and errors in crash reports, the accessibility of data, discrepancies among datasets, and the challenges of integrating different datasets and types of data. Despite the challenges, there are many opportunities for stakeholders (including, but not limited to, engineers and planners, law enforcement, geospatial information systems professionals, public health officials and crash data managers) to collaborate to improve the crash data to move the Denver region and state closer to their traffic safety goals.

Regional Crash Data Needs Assessment

DRCOG staff developed a Regional Crash Data Needs Assessment based on information gathered during development of the regional crash data inventory and shaped by the consortium's vision, mission and goals. DRCOG staff hosted an interactive workshop with stakeholders during the September 2023 crash data consortium meeting and received positive feedback on the draft needs assessment. DRCOG staff published the Regional Crash Data Needs Assessment in March 2024 and have been using it to guide consortium activities and shape the recommendations in this report.

Feasibility of the crash data consortium concept

DRCOG staff have engaged with stakeholders from across the region, state agencies and with several federal partners, demonstrating the feasibility and value of a regional crash data consortium. Stakeholders expressed a clear desire to improve the quality, timeliness and availability of crash data, and to work with DRCOG staff and one another to improve the crash data system. DRCOG staff's original goal was to identify 50 participants for crash data consortium activities and exceeded their goal during the first year of the project, with more than 135 individuals from 65 organizations contributing their knowledge and viewpoints to the Regional Crash Data Inventory in federal fiscal year 2023. As of July 2024, DRCOG staff have engaged with 185 individual traffic engineers, transportation planners, law enforcement chiefs and sergeants, public health officials, safety advocates, geospatial information systems professionals, fire district staff and crash data software vendors. The individuals represent 76 organizations and DRCOG staff have had success leveraging connections and the work being done in the region and state by stakeholders. DRCOG staff have held informal crash data conversations with 42 organizations and have been in regular contact with stakeholders for updates throughout the project. Stakeholders have been widely willing to share information about their practices and desires for changes in crash data and eager to make connections with others in their organizations and with other stakeholders.

DRCOG staff hosted five large group meetings of crash data consortium stakeholders between November 2022 and June 2024. On average, between 50 and 70 non-DRCOG participants attended the meetings, asked questions and provided comments. DRCOG staff hosted crash data consortium meetings every five to six months and have invited stakeholders to present and participate in discussions aligned with the consortium's goal of providing education on crash data collection, organization and analysis. Stakeholders shared that crash data consortium meetings have helped them understand data processes in the state and region and make connections with other professionals. Crash data consortium meetings have featured presentations or panelist participation from the following organizations:

- Colorado Department of Public Health and Environment.
- Colorado Department of Revenue.
- Colorado Department of Transportation.
- Denver Regional Council of Governments.
- Stolfus and Associates.
- Colorado State Patrol.
- Denver Police Department.
- Mead Police Department.
- Westminster Police Department.

Grant performance measures

The National Highway Traffic Safety Administration has established six data systems and six data quality attributes for state traffic records systems to help track and guide meaningful data quality improvement as described in its February 2011 Model Performance Measures for State Traffic Records Systems.

Data systems:

- Crash.
- Driver.
- Vehicle.
- Roadway.
- Citation and adjudication.
- Injury surveillance.

Data quality attributes:

- Timeliness.
- Accuracy.
- Completeness.
- Uniformity.
- Integration.
- Accessibility.

The intergovernmental agreement between DRCOG and CDOT includes three performance measures for which DRCOG is expected to achieve specific goals for the data quality attributes of completeness, accessibility and integration within the crash data system.

Completeness: The percentage of crash records with no missing critical data elements.

Goal: The project will help reduce the percentage of missing latitude and longitude data from 35-50% to 30% in five years.

Outcome: **Achieved.** The Colorado Department of Transportation shared 2022 crash data for the Denver region with DRCOG in March 2024. The data included 55,357 records, with 8,644 missing latitude and longitude (or 16% of all records). In contrast, 2021 crash data for the Denver region included 57,035 records with 20,962 missing latitude and longitude (or 37% of all records). This is an encouraging but recent trend and DRCOG staff hope that through the consortium, a sub-30% outcome can be maintained and brought closer to a condition where nearly all CDOT-provided records include latitude and longitude.

Through its partnership with CDOT, DRCOG receives crash data for the Denver region modeling area including all of Adams County, Arapahoe County, Boulder County, the City and County of Broomfield, the City and County of Denver, Clear Creek County, Douglas County, Gilpin County, and Jefferson County, as well as parts of Elbert and Weld counties. From 2017 to 2020, DRCOG received crash records from CDOT for which more than 50% of each year's records did not include latitude and longitude.

Table 1: Number of crash records in Denver region

Year	Total crash records in Denver region	Number of crash records missing latitude and longitude in Denver region	Percentage of crash records missing latitude and longitude in Denver region
2017	74,043	42,087	57%
2018	74,942	43,897	59%
2019	73,972	42,185	57%
2020	51,034	32,611	64%
2021	57,035	20,962	37%
2022	55,357	8,644	16%

Location information, especially latitude and longitude, is crucial for many traffic safety analyses. Stakeholders using crash data that is missing latitude and longitude data often must geocode the data from CDOT themselves if they do have the capacity in-house, hire a consultant to geocode the data, or use the yearly data geocoded by DRCOG staff. When multiple organizations geocode data, it results in multiple datasets and a significant duplication of effort. Among the crash data consortium's goals is to reduce the number of records that need to be geocoded in CDOT-provided data by DRCOG to 30% after five years of the consortium.

Integration: The percentage of appropriate records in the crash database that are linked to another system.

Goal: DRCOG does not currently link off-system crash records to a managed road network dataset (linear referencing system). The project will help increase the percentage of crash records from CDOT's crash data linking to a DRCOG or CDOT linear referencing system from 0% to 25% by October 2024.

Outcome: **Achieved.** DRCOG staff were able to match 59% of records to an intersection using a linear referencing process it developed in-house.

DRCOG staff received 2022 crash data from CDOT and a copy of CDOT's linear referencing system as a SQL Server file. DRCOG purchased a license for the ArcGIS Pro software extension Esri Roads and Highways as part of the federal fiscal year grant for 2024 to link crash data to the managed road network dataset. DRCOG staff learned how to update the linear referencing system with CDOT's annual changes. Staff developed a trial method to snap crash points to the linear referencing system and apply offsets to assign locations along the network based on attributes found in the crash report.

The snapping process included creating and refining a new intersection dataset for the Denver region. DRCOG staff used the linear referencing system's current road network of all roads and ran a tool to place intersection points where roads crossed and assigned route IDs from the roads and recorded measurement values along each route to each intersection point.

DRCOG staff matched each crash point to an intersection by comparing the point's location information with the names of the roads at the intersection. If staff discovered a clean match, the point was then moved to the intersection. If the crash record had data for an offset distance, for example 100 feet south of the intersection, staff moved the point along that road using the appropriate distance and direction from the intersection point. The result is an event table in the linear referencing system with crash points with measures along the routes designating their spatial locations.

Table 2: Results of matching 2022 crash data with DRCOG linear referencing system

Records	Number
Total	55,357
Matched with high confidence to an intersection	32,583
Not matched with high confidence to an intersection	22,774

Table 3: Reasons why some 2022 crash records were not matched with high confidence to an intersection

Records	Number
Misspellings, location errors and other miscellaneous reasons	14,738
Mile marker location method	4,949
Block or street address location method	3,087

Accessibility: Identify the users of the crash database and improve accessibility.

Goal: The project will help increase the users of the crash database by identifying current users and surveying potential users and stakeholders. Staff will improve data and target outreach to increase downloads from DRCOG's Regional Data Catalog from 133 to 166 in a one-year period (25% increase).

Outcome: **Undetermined at date of publication**. CDOT provided preliminary guidance to DRCOG to report on downloads from the Regional Data Catalog for the period of October 1, 2023, to September 30, 2024. The period includes dates that will fall after the publication of this report. DRCOG will report total downloads following the end of the 405c grant period.

During the creation of the regional crash data inventory and subsequent stakeholder engagement, DRCOG staff have asked stakeholders about the data sources they use, and publicized regional crash data products offered through the Regional Data Catalog. DRCOG staff provided an overview of the 2021 crash data and data download links during consortium meetings and to DRCOG's Transportation Advisory Committee in May 2024.

DRCOG staff published 2022 crash data in August 2024 and emailed instructions for downloading it to crash data consortium stakeholders, DRCOG's Regional Vision Zero Working Group and the Denver Regional Data Consortium.

Photo courtesy of Colorado State Patrol.

Improving crash data collection, processing, analysis and sustaining the consortium

DRCOG staff have developed outcomes, recommendations and next steps to solve common challenges with crash data collection, processing and analysis and strategies to sustain the crash data consortium. Before crash data collected by law enforcement is useful for analysts as a large dataset, it must go through several steps, some of which require time-consuming manual corrections by the Colorado Department of Revenue or the Colorado Department of Transportation. Many of the recommendations and strategies in this Regional Crash Data Consortium Final Report are intended to target aspects of the crash data process to improve and standardize collection, which in turn should produce data which will require less time-consuming processing by the state, resulting in more timely availability of data for analysts and a more complete dataset.

Outcomes

DRCOG staff have established outcomes to be achieved by implementation of this report's recommendations and strategies.

Increased data quality evidenced by the number of records:

- Submitted with accurate latitude and longitude.
- Submitted with no missing data for the following fields: harmful event sequence fields, location fields, latitude and longitude, vehicle movement, vehicle direction, road location and description.
- Submitted with a narrative that does not include any personal identifiable information.
- Submitted electronically.

Improved timeliness of data delivery from the Colorado Department of Transportation:

- With improvements to data collection and processing, CDOT should be able to produce its dataset within a calendar year, excluding any needed updates, as opposed to current year-and-a-half to two-year crash data deliveries.

Photo courtesy of Colorado Department of Transportation.

Improved access to crash data:

- Greater understanding of the available crash data and how to effectively use it to improve traffic safety outcomes.
- Greater analyst access to narratives free of personal identifiable information.
- Greater analyst access to diagrams of individual crashes when available.

Increased number and depth of partnerships:

- Increase number of law enforcement agencies in consortium activities.
- Invite medical examiners and coroner's offices into consortium activities.
- Continue to strengthen connections and partnerships among state agencies with distinct roles in processing and managing crash data and other consortium stakeholders.

Recommendations

DRCOG staff developed six recommendations to address the grants' primary goal to investigate and demonstrate the value of a regional crash data consortium to inventory the needs of the region and solve common issues with crash data collection, processing and analysis.

- Improve general statewide crash reporting practices.
- Improve collection of location information.
- Improve collection of critical data elements.
- Improve crash data processing practices.
- Increase crash data analyst access and competencies.
- Sustain and expand the crash data consortium.

To make significant progress, most recommendations will require ongoing strategic collaboration by multiple agencies and stakeholders. It is likely that some strategies may take longer to implement than others, and DRCOG staff have suggested a timeframe for each strategy, from short-term, to medium-term to long-term (refer to Table 4).

Table 4: Expected timeframe to implement strategies.

Timeframe	Years to implement
Short-term.	Zero to two years.
Medium-term.	Three to four years.
Long-term.	Five or more years.

Each recommendation includes a reference to specific needs that the recommendation aims to address that were identified in previous planning and listed in the Regional Crash Data Needs Assessment. Similarly, each need in the Needs Assessment includes a reference to where more information about each need can be found in the Regional Crash Data Inventory.

Improve general statewide crash reporting practices

Law enforcement agencies respond to and investigate roadway crashes and create crash reports, which become the records in the data published CDOT, which form the basis for DRCOG's regional data product and the products of crash data vendors and local governments. The quality of data at its initial collection point affects all subsequent uses, so it is crucial that it be complete enough to be accepted by the Colorado Department of Revenue and accurate to inform CDOT and stakeholders making traffic safety decisions.

Nearly 50 law enforcement agencies report crash data in the Denver region, including the Colorado State Patrol. Law enforcement agencies can report crashes electronically, often through a records management system, or through a paper form sent to the Colorado Department of Revenue. Law enforcement agencies have differing policies for completing reports, and there are several records management systems available and used by agencies which influence how law enforcement officers and troopers complete the DR3447 crash report. When submitted crash reports are missing key information, CDOT staff spend significant effort and time correcting the records so they can be used for analysis.

CDOT staff report that records are often missing location data, contain factual errors, spelling errors and inconsistencies requiring time and attention to correct. Aspects of records management systems and crash reporting interfaces can at times introduce errors and inconsistencies. Errors and inconsistencies also result from differing

approaches to training and expectations among law enforcement agencies for what fields need to be completed beyond minimum requirements.

Depending on their role, law enforcement officers may have little experience completing crash reports. Officers from dedicated traffic units respond to crashes daily and typically have a solid understanding of the crash report and experience with their jurisdiction's crash reporting software, while a patrol officer may only respond to several crashes a year and have less experience with the DR3447 crash report form and the software their agency uses to complete the crash report form. This section's strategies are intended not only to improve the quality of data provide to the state system, but to improve the experience of law enforcement officers responding to crashes by streamlining processes and eliminating time that must be potentially spent in harm's way if the input process can be made quicker, easier, and more intuitive.

Photo courtesy of Colorado State Patrol.

Table 5: Strategies to improve general statewide crash reporting practices

Strategies	Timeframe
Research and document crash reporting applications, including costs, software and vendor challenges and potential improvements.	Short-term.
Research consolidating statewide crash reporting into a single application incorporating features desired by law enforcement such as conditional formatting, drop-down menus, and auto filling repeated information such as occupants or nonoccupants to expedite the completion of crash reports.	Long-term.
Support the in-progress BESDT Phase 4 development of an external crash form which can be used by any Colorado law enforcement agency.	Short-term.
Encourage vendors to implement automatically filled fields when appropriate.	Short-term.
Continue education and additional training on filling out crash reports.	Short-term.
Coordinate and apply for 405c grant funding to help reporting agencies acquire technology and training resources to facilitate improved crash reporting.	Medium-term.
Encourage greater electronic data collection and transmission from law enforcement agencies to the Colorado Department of Revenue.	Short-term.
Encourage law enforcement to complete impairment suspected fields of the DR3447 crash report when impairment is truly suspected, without waiting for toxicology or other information to come through the legal system.	Short-term.

Table 6: Regional Crash Data Needs Assessment needs addressed by strategies to improve general statewide crash reporting practices

Item	Need
Quality-1.	Improve data quality of fields of submitted reports.
Quality-2.	Improve completeness of submitted reports.
Quality-4.	Explore opportunities for improving law enforcement technologies or systems.
Timeliness-1.	Improve the timeliness of crash data delivery to stakeholders from the Colorado Department of Transportation.
Integration-2.	Reconcile differences between law enforcement, CDOT and DRCOG datasets.

Improve collection of location information

Crash data analysts consider location information among the most important data captured through the DR3447 because analysts need to know where crashes are happening to make informed infrastructure decisions, however in many cases it is missing, incomplete or insufficient. Improving the collection of location information will increase timeliness of data availability and minimize the duplication of efforts by stakeholders currently geocoding CDOT-provided crash data.

Table 7: Strategies to improve collection of location information

Strategies	Timeframe
Continue education and training on the importance of precise latitude and longitude capture.	Short-term.
Require law enforcement agencies to include latitude and longitude along with one other location reporting method before a report is accepted by the Colorado Department of Revenue. Phase in this requirement and work with individual agencies to implement.	Medium-term.
For greater accuracy, encourage law enforcement agencies to collect latitude and longitude data on-scene or through an application to geospatially locate crashes instead of auto-assigning latitude and longitude through dispatch or to the nearest intersection with previously recorded coordinates.	Medium-term.
Encourage law enforcement officers to correctly complete location fields with the road, intersection, or mile marker and offset, instead of blocks or addresses which require significant effort to accurately geolocate	Short-term.

Table 8: Regional Crash Data Needs Assessment needs addressed by strategies to improve collection of location information

Item	Need
Geospatial-1.	Increase number of records with accurate latitude and longitude.
Geospatial-2.	Improve geospatial accuracy of records in CDOT and DRCOG datasets.
Quality-1.	Improve data quality of fields of submitted reports.
Timeliness-1.	Improve the timeliness of crash data delivery to stakeholders from the Colorado Department of Transportation.

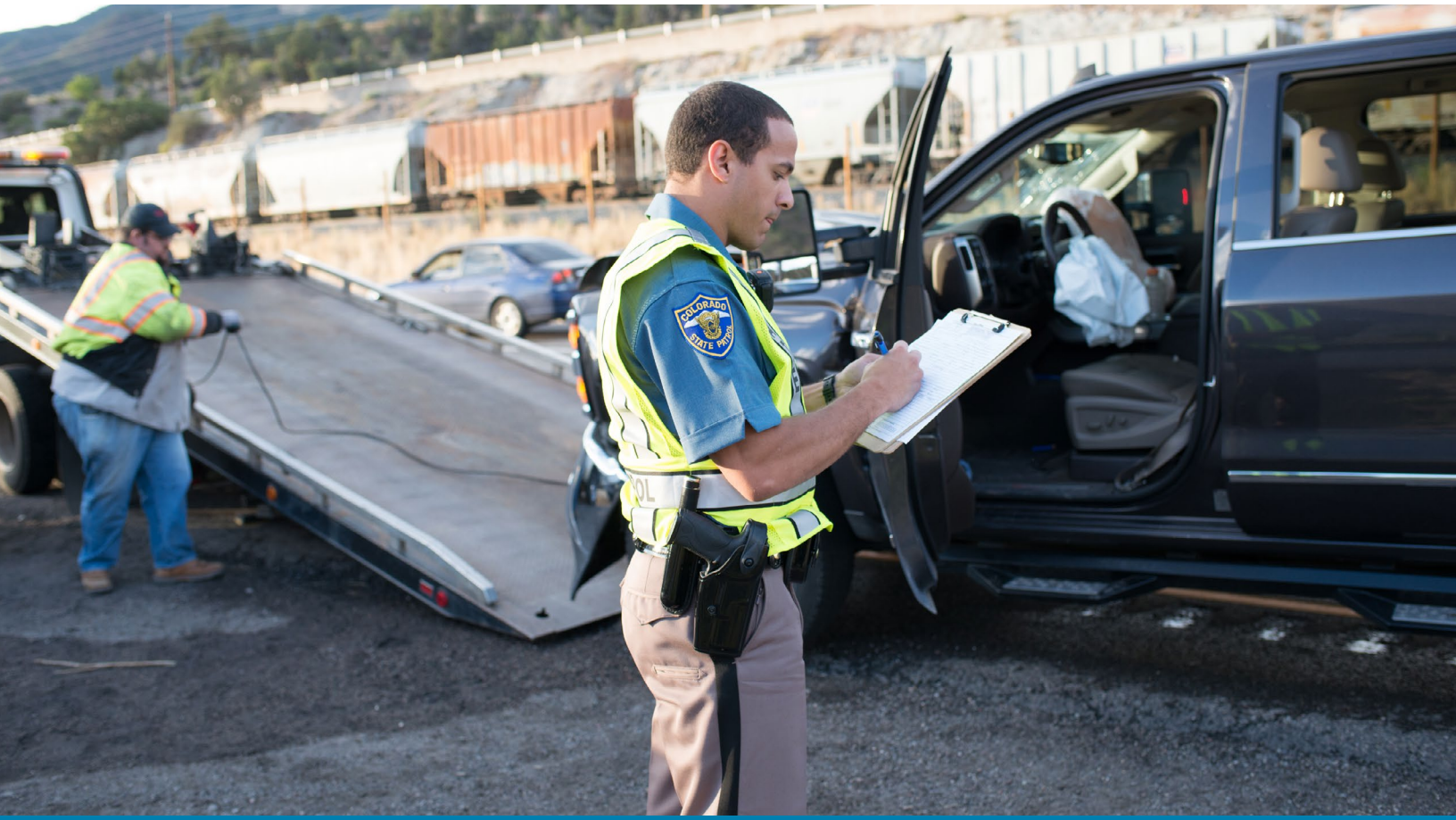


Photo courtesy of Colorado State Patrol.

Improve collection of critical data elements

Analysts use several fields of the crash report form to better understand the physics behind a crash. Crash coders at the Colorado Department of Transportation interpret the crash report and enter or correct data as necessary for roadway safety engineers and other data users. Relevant fields often need to be corrected based on the crash report narrative or diagram when available. Such fields include the harmful event sequence, location, latitude and longitude, vehicle movement, vehicle direction, road location and description. Improving the consistency and accuracy of data entered into such fields would improve the usefulness of resulting datasets and improve timeliness by requiring less manual processing by CDOT staff. In addition, the narrative field often contains personal identifiable information, which is time-consuming for CDOT staff to remove before they can provide the crash data to other stakeholders.

Table 9: Strategies to improve collection of critical data elements

Strategies	Timeframe
Require fields critical to CDOT and other analysts including harmful event sequence, location, latitude and longitude, vehicle movement, vehicle direction, road location and description.	Medium-term.
Identify the most common missing or incomplete data fields in crash reports and develop strategies to assist reporting agencies to improve data quality	Short-term.
Continue education and training on proper use and placement of personal identifiable information within the crash report.	Short-term.

Table 10: Regional Crash Data Needs Assessment needs addressed by strategies to improve collection of critical data elements

Item	Need
Quality-1.	Improve data quality of fields of submitted reports.
Quality-2.	Improve completeness of submitted reports.
Quality-3.	Address underreporting of data.
Timeliness-1.	Improve the timeliness of crash data delivery to stakeholders from the Colorado Department of Transportation.

Improve crash data processing practices

The Colorado Department of Revenue and CDOT must process the crash data received from law enforcement before the data is available to local government staff, unless local government staff have relationships with their respective law enforcement agencies and can access data internally. There are potential points of failure as data flows between agencies. The State of Colorado has reported not receiving data fields from law enforcement agencies even when collected properly by the agency due to data transmission issues between the agencies' records management system and the Colorado Department of Revenue's system.

Records management systems used by law enforcement agencies have various technical configurations and do not necessarily send data to the Colorado Department of Revenue in the same ways. To ensure accurate and efficient data-sharing, staff must properly set up validations. Validated record-sharing ensures that when agencies transmit data to the Colorado Department of Revenue, correlated field types match, in other words, the field values used by records management systems are the same as those expected and required by the Colorado Department of Revenue to accept a report.

Consortium participants identified opportunities to improve the quality of crash data after it's published by the state. DRCOG staff have developed a methodology using a linear referencing system to geospatially locate crash data using a combination of latitude and longitude and the location fields in a crash record. DRCOG staff will continue to improve the methodology and accuracy of the crash

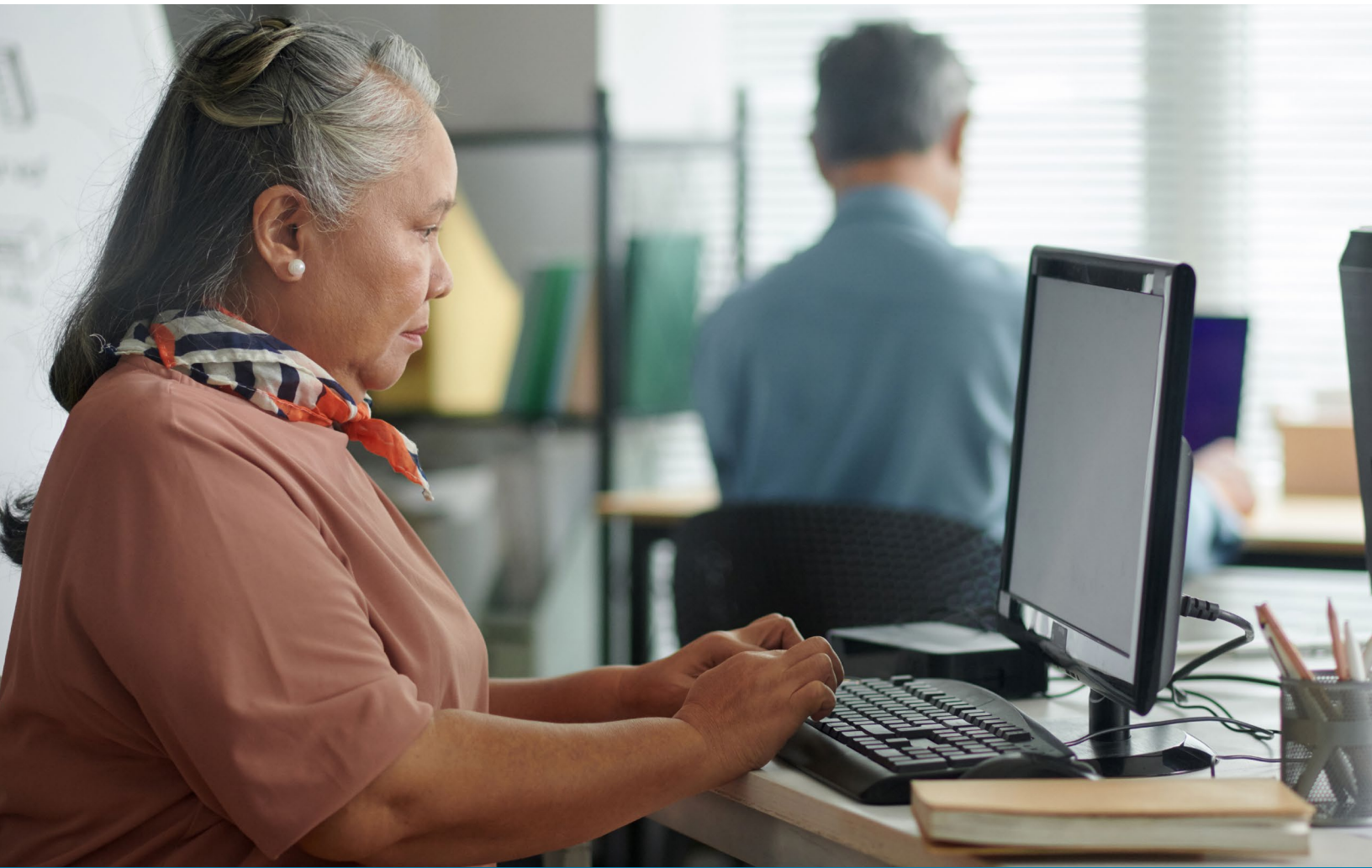
points located using it. Consortium members also identified opportunities to use new technologies to improve the quality of data and speed up processing, including using machine learning to remove personal identifiable information from crash record narratives instead of manually removing the information from records.

Table 11: Strategies to improve crash data processing practices

Strategies	Timeframe
Coordinate with the Colorado Department of Revenue to allow DRCOG staff access to state databases to allow data to be geospatially matched to latitude and longitude or linearly referenced points before the data goes through the entire process at the state to improve the timeliness of assigning accurate locations to crash data.	Short-term.
Engage in more collaborative data management among law enforcement agencies, records management system providers, the Colorado Department of Revenue and CDOT to ensure that crash data is flowing smoothly and catch failures in transmission and translation of crash records.	Short-term.
Encourage law enforcement agencies, records management system providers, the Colorado Department of Revenue, and CDOT to enhance required fields and logical validations to reduce the introduction of errors in the early stages of data processing.	Medium-term.
Continue to investigate and correct data transmission issues. Establish validations to check for submission issues such as missing field values and inadvertently truncated values.	Short-term.
Investigate machine learning techniques or applications to identify and remove personal identifiable information in narratives when personal identifiable information is present.	Medium-term.
Expand DRCOG linear referencing system crash point matching beyond the best matched intersections to include mile marker reported crashes.	Short-term.
Improve DRCOG linear referencing system crash point match rate and spatial accuracy of matched points based on data in crash reports.	Short-term.

Table 12: Regional Crash Data Needs Assessment needs addressed by strategies to improve crash data processing practices

Item	Need
Timeliness-1.	Improve the timeliness of crash data delivery to stakeholders from the Colorado Department of Transportation.
Accessibility-2.	Improve data sharing and agency collaboration.
Accessibility-3.	Improve transparency about data processing, stages of quality control, issues being addressed, procedures for accessing data and accompanying documentation.



Increase crash data analyst access and competencies

Stakeholders in the Denver region have a high level of knowledge and skills surrounding the use of crash data, but it is not equally distributed among local governments and other entities. DRCOG staff have used consortium meetings as opportunities to provide educational opportunities related to crash data collection and processing but have not covered analysis as thoroughly. Most consortium stakeholders conduct some sort of crash data analysis using various methods, but access to resources such as specialized software or training is also unequally distributed. DRCOG publishes regional crash data which can be downloaded for use in geospatial information systems software and has developed the DRCOG Crash Data Dashboard as a resource for stakeholders to access geospatial data without needing specialized software. Consortium leaders can facilitate other opportunities such as training, working to improve access to data, and exploring crash analysis vendor solutions for regional stakeholders.

Table 13: Strategies to improve crash data analyst access and competencies

Strategies	Timeframe
Encourage use of DRCOG's Crash Data Dashboard and downloadable data products to reduce duplication of effort.	Short-term.
Provide training on how to effectively use state and regional data.	Short-term.
Coordinate with consortium members to determine if a regional license to a software vendor for crash data is desired, and if so, evaluate embarking on competitive process to hire a vendor.	Medium-term.
Improve analyst access to narratives and diagrams by working with law enforcement agency partners and establishing connections among stakeholders who want to access narratives and diagrams.	Medium-term.
Compare and contrast different sources of crash data available for the same geographies.	Short-term.

Table 14: Regional Crash Data Needs Assessment needs addressed by strategies to improve crash data analyst access and competencies

Item	Need
Accessibility-1.	Develop a single, standardized and geolocated data source.
Accessibility-4.	Improve analyst access to crash diagrams and narratives.
Geospatial-3.	Improve regional geospatial crash analysis.

Photo courtesy of Colorado State Patrol.

Sustain and expand the crash data consortium

DRCOG will continue to maintain the crash data consortium and organize stakeholders and consortium activities beyond the 405c grant period.

Table 15: Strategies to sustain and expand the crash data consortium

Strategies	Timeframe
At least twice a year, continue meeting as a consortium led by DRCOG staff to encourage collaboration and information-sharing.	Short-term.
Continue engagement with law enforcement agencies in the region to identify what is working well, what challenges exist, how to make improvements, and how to implement other crash data improvement strategies.	Short-term.
Encourage law enforcement collaboration with engineers and planners based on successful models including those currently underway at the City of Boulder, City of Lakewood, City and County of Denver, and Douglas County.	Short-term.
Continue building connections with state and federal agencies that collect, process or analyze crash data.	Short-term.
Build connections with the Colorado Hospital Association, medical examiners and coroner's offices to explore and develop new ways of addressing underreporting of impairment-related crashes and non-motorist crashes.	Short-term.
Develop subgroups to explore specific issues such as underreporting of impairment-related crashes or specific data quality concerns.	Short-term.
Incorporate the crash data consortium into DRCOG's larger transportation safety planning.	Medium-term.
Research successful consortium structures.	Short-term.
Perform structured peer analysis and best practices study of other states and metropolitan planning organization traffic records systems.	Medium-term.
Develop a new method for assigning unique identifiers to crash records at the law enforcement agency level which can be applied state-wide to facilitate greater data integration by eliminating potentially overlapping case numbers for crashes among reporting agencies.	Medium-term.
Monitor Notice of Funding Opportunities from that National Highway Traffic Safety Administration and other federal or state agencies that could be used to fund crash data improvements.	Short-term.

Table 16: Regional Crash Data Needs Assessment needs addressed by strategies to sustain and expand the crash data consortium

Item	Need
Capacity-1.	Build consortium partnerships.
Capacity-2.	Research successful consortium structures.
Capacity-3.	Explore funding opportunities for continued management of consortium activities.
Accessibility-2.	Improve data sharing and agency collaboration.
Integration-1.	Integrate additional data sources with crash data.

Next steps

DRCOG staff are committed to specific steps to work toward implementing the strategies in support of the consortium recommendations.

Develop implementation framework.

DRCOG staff will collaborate with stakeholders to implement strategies. Many strategies that address the recommendations are short-term, estimated to take up to two years to implement. While many strategies can be pursued concurrently, the consortium needs to prioritize which strategies to implement. It would be difficult for the consortium to effectively pursue all strategies simultaneously. Some stakeholders are already implementing specific strategies and DRCOG staff believe these stakeholders should be supported and, if under-resourced, the consortium could help identify ways to provide additional resources to help them achieve the strategies.

Continue leading consortium activities.

DRCOG staff will continue to continue organizing and facilitating crash consortium meetings and leading consortium activities.

Build and maintain relationships.

DRCOG staff will continue stakeholder engagement to expand the consortium membership and strengthen existing relationships. Specifically, DRCOG staff will work with CDOT law enforcement liaisons to establish connections with more law enforcement agencies in the Denver region and connect with county coroner's and medical examiner's offices to explore opportunities related to impairment-related and non-motorist crash data. The Colorado State Patrol and 12 local law enforcement agencies have participated in consortium activities, each bringing distinct perspectives to the region's crash data needs and potential solutions. Stakeholders have suggested coroners and medical examiners as potential partners who may be able to help correct observed inconsistencies in reported numbers of impairment-related and non-motorist crashes between local government numbers and state numbers. Stronger connections with such offices may fill a crucial gap in consortium membership and help address observed inconsistencies.

Conclusion

DRCOG staff completed an innovative stakeholder engagement and data analysis process during federal fiscal years 2023 and 2024 with 405c State Traffic Safety Information System Improvements grant funding to investigate the feasibility of a Regional Crash Data Consortium for the DRCOG region. DRCOG staff brought together diverse stakeholders and demonstrated the feasibility and value of the consortium by inventorying crash data sources, uses and challenges, identifying needs and developing recommendations and strategies to improve traffic records data. Many of the challenges addressed by the recommendations and strategies in this report are of statewide concern and progress will require sustained partnership. DRCOG staff will continue to collaborate with its state, local government and other partners to improve the timeliness, completeness and accuracy of crash data used to improve safety outcomes in the greater Denver area.

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