



2018 ANNUAL REPORT ON ROADWAY TRAFFIC CONGESTION IN THE DENVER REGION

October 2019

1. Introduction

Quality of life in the Denver region depends on mobility, the ease with which people and goods move from place to place. The region's residents and visitors frequently cite the importance of reliable access to jobs, services, education and recreation via a variety of travel options.

Each year, the Denver Regional Council of Governments publishes a report on congestion in the Denver metro area. This year's report includes information on a range of mobility subjects beyond roadway traffic congestion. Federal law requires DRCOG to implement a congestion management process, but DRCOG's staff and member

governments are also concerned with other aspects of mobility that affect, or are affected by, car and truck traffic. Please consult previous congestion reports that address specific subjects related to traffic congestion.

Topics addressed in this report include:

- annual monitoring of vehicle miles traveled
- five-year trends in demographic, mobility and travel characteristics
- traffic congestion measures
- incident management and safety
- recent and ongoing transportation projects



2. Travel and vehicle miles traveled on a typical weekday

Rapid household and economic growth pose a challenge to providing adequate mobility.

Every year, DRCOG staff estimates the annual change in total vehicle miles traveled (VMT) per day. VMT demonstrates how much people are traveling on roadways across the region. VMT influences traffic congestion, pollutant emissions, petroleum fuel use and traffic safety, and informs transportation professionals about transportation needs. Staff consolidates data from Federal Highway Administration annual reports, automated traffic recorders, the Colorado Department of Transportation's Highway Performance Monitoring System and local agency and toll highway traffic counts.

"Figure 1: Average daily VMT in the Denver region (2000-2018)" on page 3 depicts average weekday VMT by all types of motor vehicles for the Denver region.

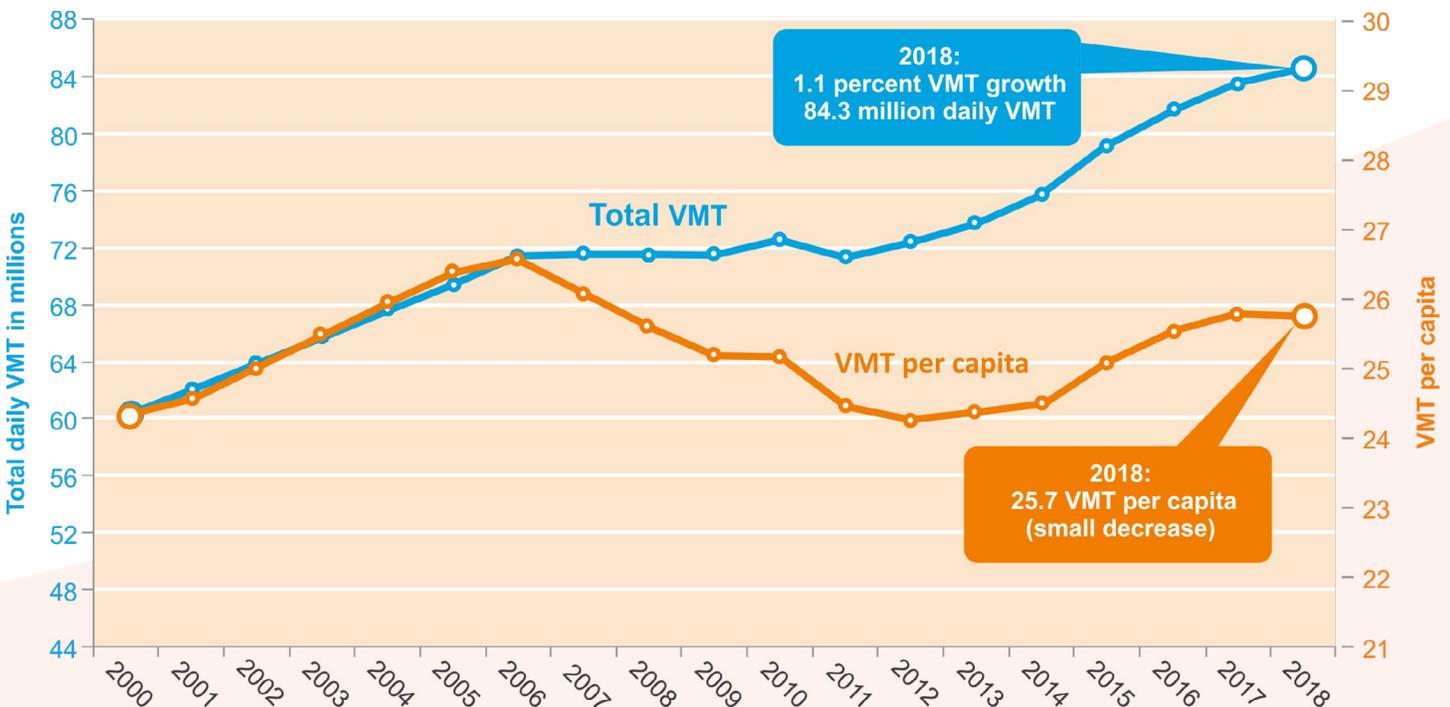
In 2018 the DRCOG region experienced a slowdown in VMT growth and a small decrease in VMT per capita. VMT increased by an estimated 1.1%, slower than

population growth of 1.4%. Before 2007, VMT and VMT per capita grew at a relatively stable and predictable rate. From 2007 through 2011 VMT was mostly flat, but with noticeable declines in the per capita value. A resurgence in VMT growth occurred through 2017. Is 2018's slower VMT growth the start of a new trend?

As the region looks toward its future, many unpredictable factors will influence transportation and mobility, such as fuel prices and availability, personal habits, alternative fuels, connected vehicle technologies and driverless (automated) vehicles. Technology is rapidly evolving and could have many unknown implications.

The Mobility Choice Blueprint (final report published in February 2019) initiative is a regional effort to plan and prepare for technological and service innovations affecting mobility. The blueprint suggests a set of 34 tactical actions led by an agency designated as the responsible initiator (champion) to help define the Denver region's mobility future. The first of the recommended tactical actions is to establish an Advanced Mobility Partnership committee to provide guidance on Mobility Choice Blueprint implementation activities.

Figure 1: Average daily VMT in the Denver region (2000-2018)



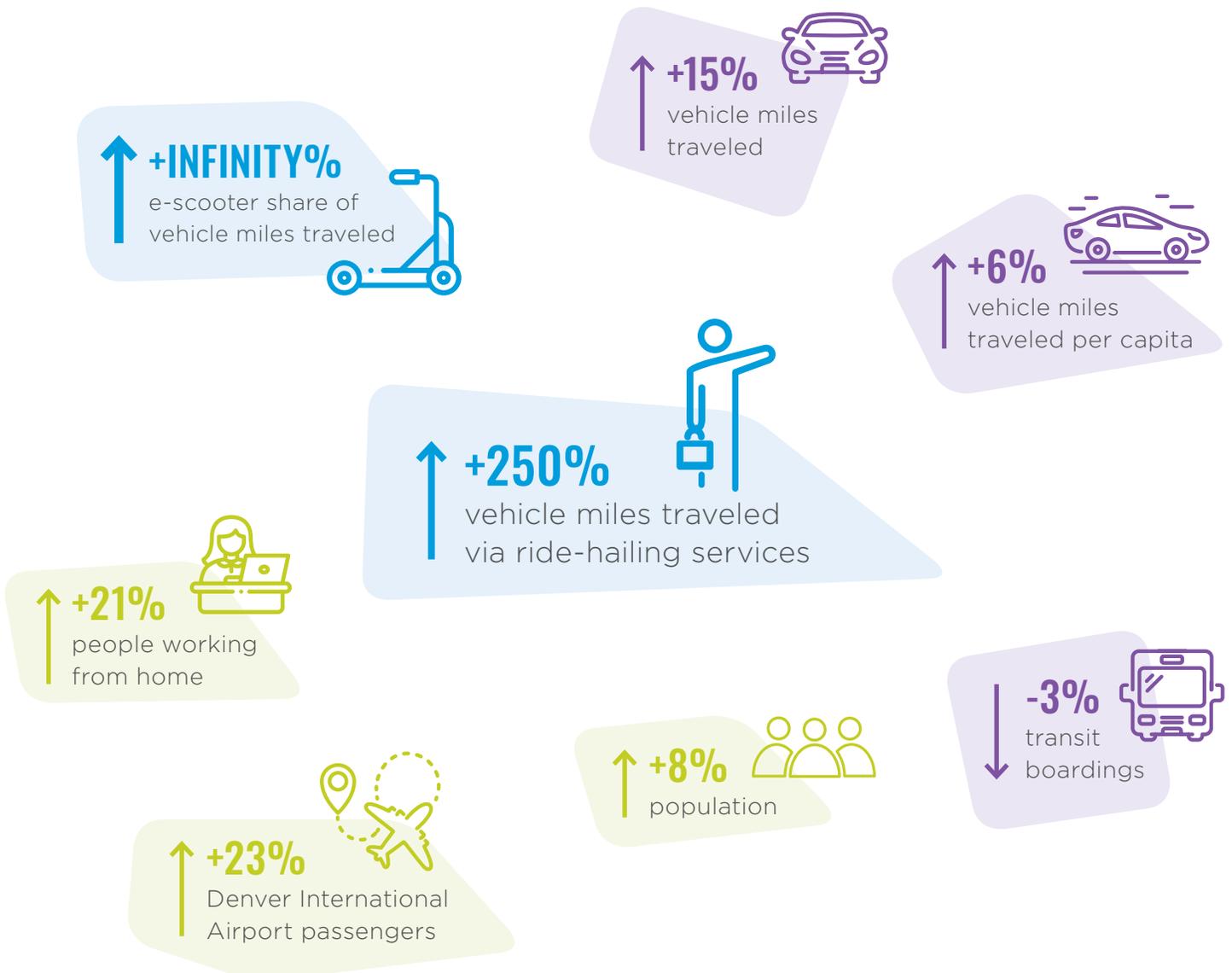
3. Mobility-related trends for the past five years and the foreseeable future

During the past five years, the Denver region has experienced significant growth in population and travel, new options and challenges from emerging transportation service technologies, and new transportation infrastructure. Since 2013, the Denver region has consistently ranked as one of the fastest-growing areas in the nation. Population and VMT have grown faster than the transportation system's capacity, resulting in more congestion and decreased travel time

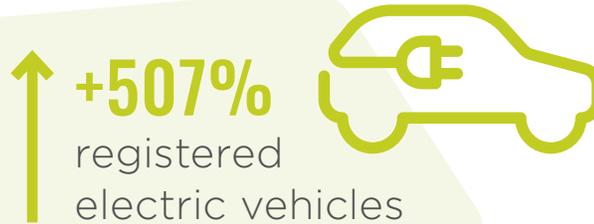
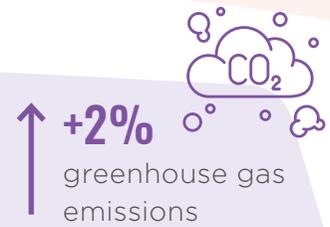
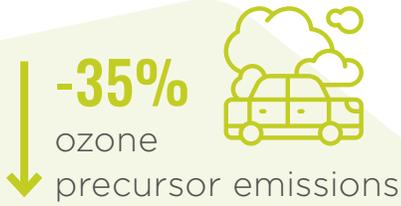
reliability. Meanwhile, technology and cultural forces have enabled large increases in teleworking, e-commerce, micromobility and on-demand ride-hailing.

Just five years ago Union Station wasn't open, our region had 40 fewer miles of passenger rail lines, and bus rapid transit was not yet serving the U.S. Route 36 and I-25 north corridors. I-225 was four lanes wide and construction had not yet begun on managed lane projects on Central I-70, South I-25 and C-470. The following infographic summarizes five-year trends influencing transportation.

FIVE-YEAR TRAVEL TRENDS



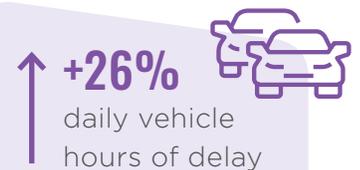
FIVE-YEAR MOTOR VEHICLE EMISSION TRENDS



FIVE-YEAR FREIGHT TRENDS



FIVE-YEAR CRASH AND CONGESTION TRENDS



4. Traffic congestion on major roadways

Per Federal Highway Administration rules, DRCOG maintains a database to monitor traffic congestion and performance measures for the 2,400-mile designated Regional Roadway System (“Figure 2: Key congested locations in 2018 and 2040” on page 8). The Regional Roadway System includes major streets, highways, freeways and tollways. It does not represent the entire roadway system. The congestion database identifies key attributes associated with roadway capacity, traffic volume and person volume (number of individuals) for each segment of the system.

“Table 1: Current and future congestion measures on Denver regional freeways and major roads” on page 7 displays several measures for the Regional Roadway System, with 2040 estimates based on forecasts from the DRCOG regional travel demand model. The model assumes an additional 1 million people will live in the Denver region by 2040. The model incorporates the population’s future demographic makeup and future transportation facilities, transit lines and employment concentrations. However, it does not include speculative factors for emerging technologies related to vehicles, roadways, fixed guideways and mobility services.



Photo courtesy of the Colorado Department of Transportation.

Table 1: Current and future congestion measures on Denver regional freeways and major roads

	2018		2040 (RTP)		Percent change between 2018 and 2040
	Average weekday	Annual total estimate (1)	Average weekday	Annual total estimate (1)	
Vehicle measures:					
Vehicle miles of travel	65,110,000	22,007,167,000	93,360,000	31,555,829,000	43%
Vehicle hours of travel	1,449,000	489,671,000	2,239,000	756,803,000	55%
Vehicle hours of delay	229,000	77,359,000	531,000	179,387,000	132%
Travel delay per driven registered vehicle (2)	7 minutes	40 hours	12 minutes	70 hours	74%
Travel delay per household	11 minutes	60 hours	17 minutes	97 hours	63%
Person measures:					
Person miles of travel	89,450,000	30,234,071,000	130,817,000	44,216,212,000	46%
Person hours of travel	2,029,000	685,901,000	3,165,000	1,069,898,000	56%
Person hours of delay	316,000	106,741,000	729,000	246,295,000	131%
Travel delay per resident	5.8 minutes	33 hours	10 minutes	56 hours	72%
Other:					
Percent of travel time in delayed conditions	16%	N/A	23%	N/A	48%
Travel time variation (peak vs. off peak)	1.22	N/A	1.37	N/A	13%
Lane miles of roads congested for three-plus hours	1,489	N/A	2,819	N/A	89%
(percent of total lane miles)	21%	N/A	36%	N/A	N/A
Economic travel delay costs:					
Commercial vehicles (3)	\$1,600,000	\$527,600,000	\$3,100,000	\$1,031,100,000	95%
Passenger vehicle persons (3)	\$3,200,000	\$1,067,900,000	\$5,800,000	\$1,945,600,000	82%
Total cost of delay	\$4,700,000	\$1,595,500,000	\$8,800,000	\$2,976,600,000	87%
Transit and other regionwide measures:					
Total RTD transit boardings	325,000	N/A	641,000	N/A	97%
Rail transit boardings	110,300	N/A	250,000	N/A	126%
"RTD Park-n-Ride parking space use (out of 31,225 spaces)"	65%	N/A	N/A	N/A	N/A
Modeled bicycle and pedestrian trips	1,088,000	N/A	1,532,000	N/A	41%
Population	3,278,000	N/A	4,373,000	N/A	33%
Employment	1,793,000	N/A	2,387,665	N/A	33%
Traffic crashes (2017)	217	73,366	N/A	N/A	N/A

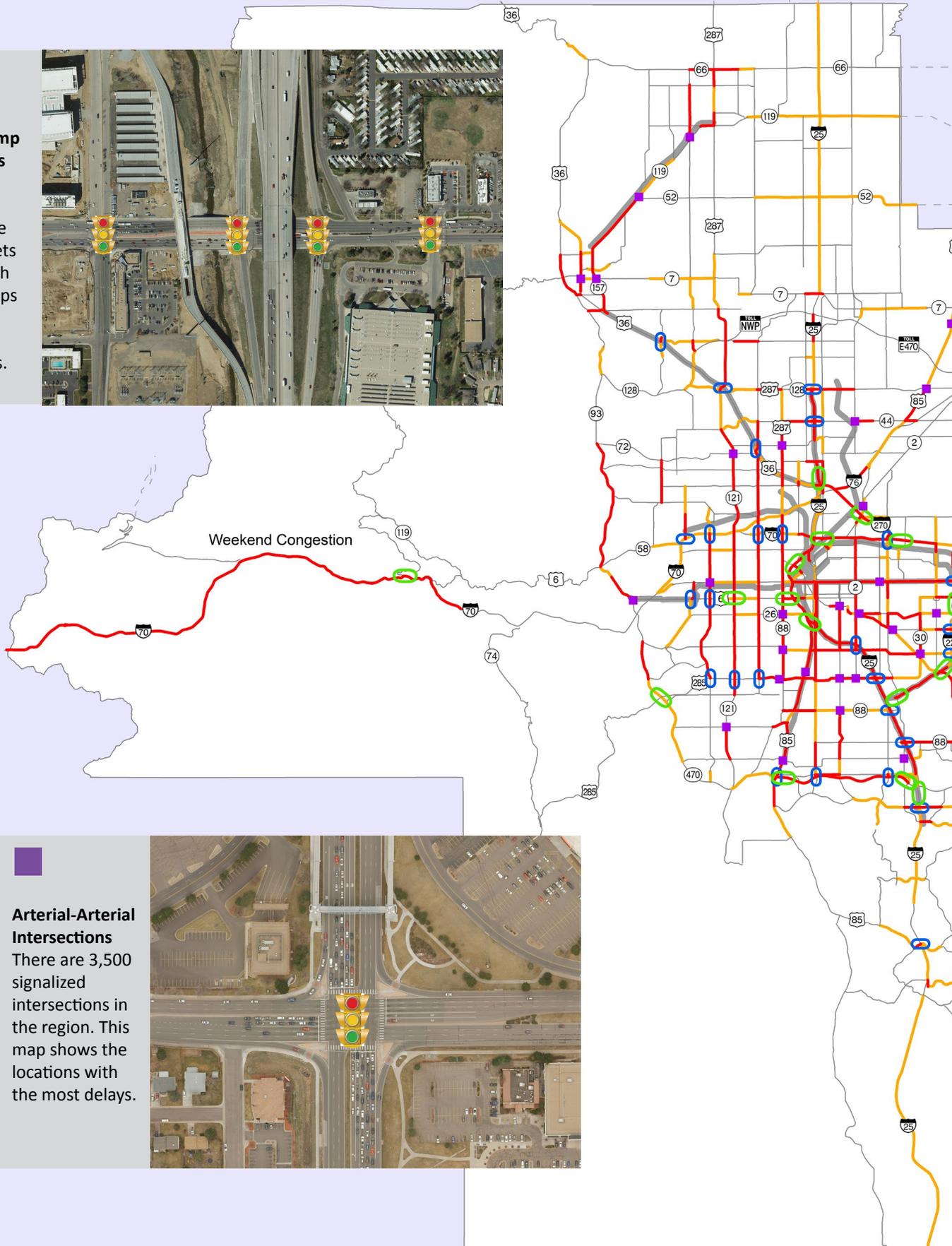
Sources: DRCOG Congestion Management Program database, RTD ridership statistics, 2040 Regional Transportation Plan

Technical notes:

- (1) Annual total estimate is "Average weekday" total multiplied by 338
- (2) Assumption of 1,922,270 driven registered vehicles in 2018 and 2,564,710 in 2040
- (3) Cost calculations incorporate \$12 per hour per adult in car, \$48.30 per hour per light commercial vehicle operator and \$71 per hour for heavy commercial.

Arterial-Freeway Ramp Intersections

Extensive congestion occurs where arterial streets intersect with freeway ramps in a series of signalized intersections.



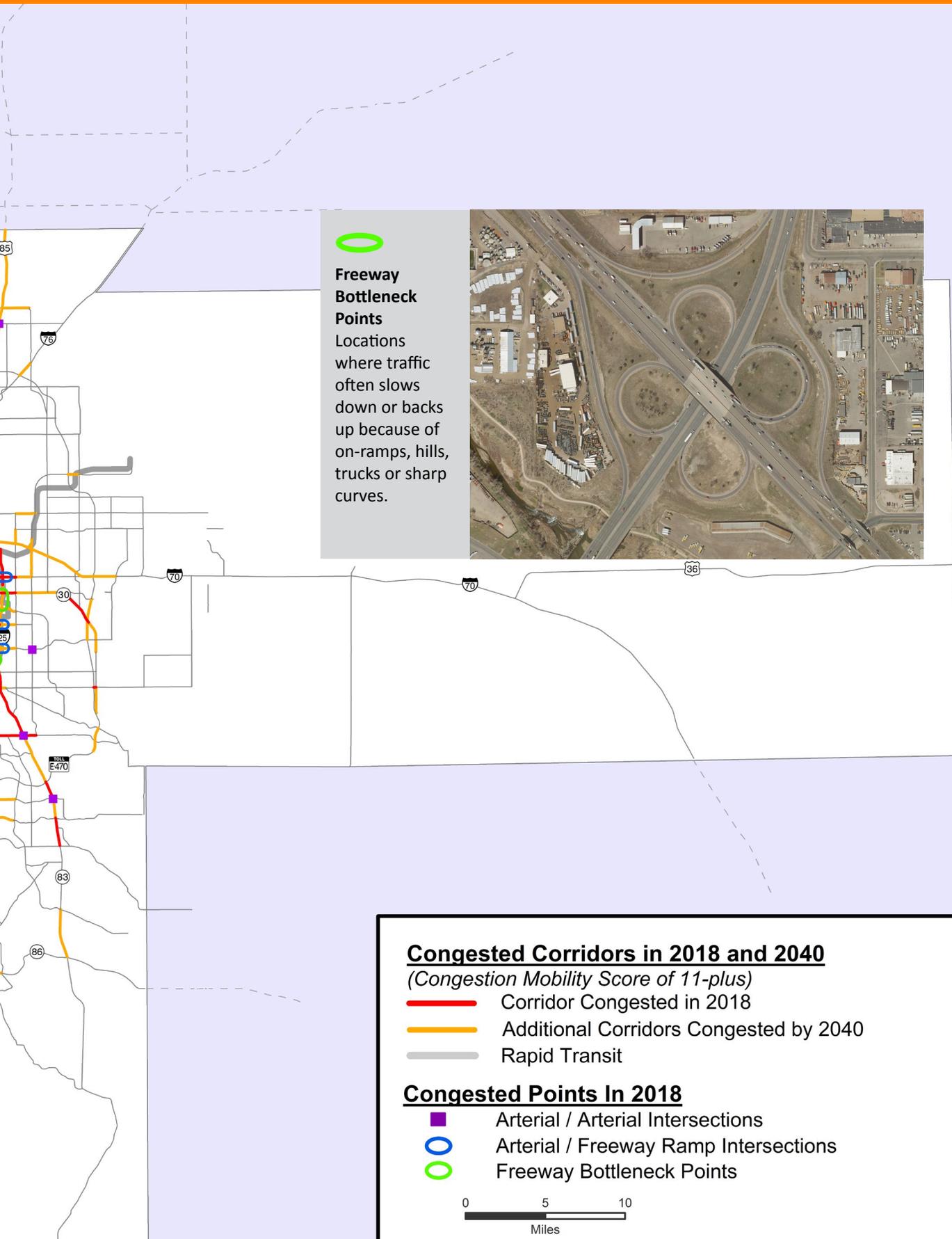
Arterial-Arterial Intersections

There are 3,500 signalized intersections in the region. This map shows the locations with the most delays.



Locations in 2018 and 2040

Mobility Score of 11 or higher



5. Incident management

Open a traffic app on your mobile phone. You'll likely see crash or incident locations on the map. Incidents create both additional travel delays beyond routine traffic congestion, and conditions that increase the chance of secondary crashes. On an average day in the Denver region, authorities receive more than 200 crash reports. Even more minor incidents or breakdowns are never reported. Though increased travel delays inconvenience other roadway users, the most critical factor is the **safety** of people involved in crashes, individuals along the roadside and first responders.

A) Incidents, traffic congestion and unreliability

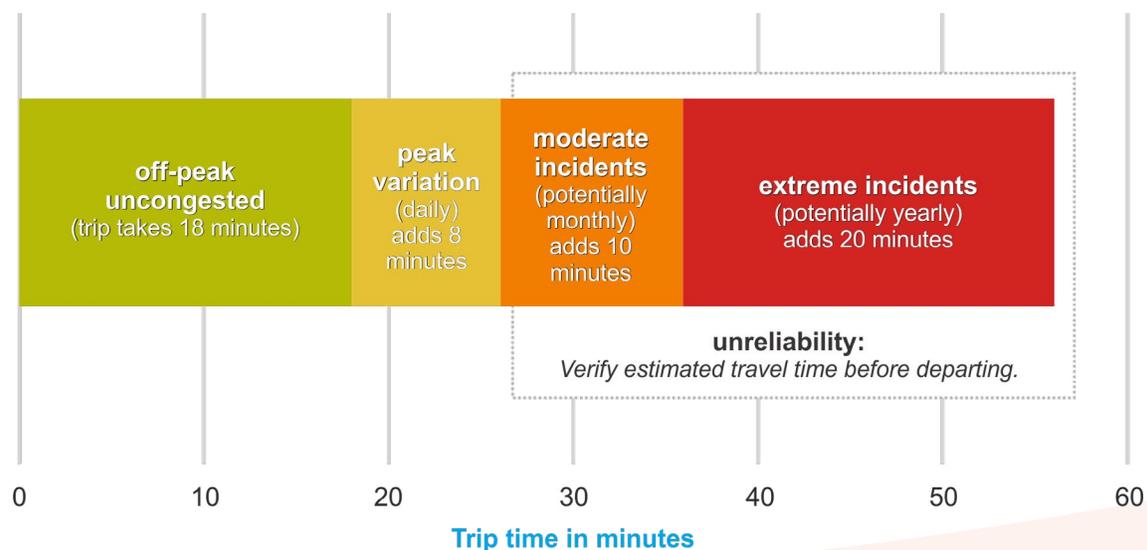
Incidents along highways or streets disrupt the roadway capacity by physically blocking lanes or stimulating vehicle slowdowns that are justified (for safety) or not (rubberneckers on opposite side of highway). Incidents may also divert traffic from the scene and overload nearby routes. For example, vehicles may detour onto other roadways.

Congested traffic conditions with extra delay for travelers occur every day. Daily peak period morning and afternoon rush hours cause routine travel time variations for most

drivers. Typically, a person traveling by car or truck during rush hour may plan for a 20% to 30% increase in travel time over off-peak times. Peak hour delay is predictable. "Figure 3: Sample 18-minute off-peak trip" on page 10 below displays the types of travel delay potentially associated with a trip. Routine congestion during rush hour may add 8 minutes to the trip when compared to off-peak travel time. If a moderate incident occurs along the travel route, the trip may include an additional 10 minutes of delay. Extreme incidents occur less frequently, but might add another 20 minutes or more to the trip. Such moderate and extreme incidents cause unreliability in predicted travel time, as well as close to half of all delay encountered by travelers. Motorists and passengers should check traffic apps, the Colorado Department of Transportation's cotrip.org or other sources for incidents prior to starting a trip. If possible, they can then choose to either:

- adjust their departure time
- travel via a different mode (contact Way to Go, waytogo.org)
- take a different route, or
- cancel the trip

Figure 3: Sample 18-minute off-peak trip



Southbound I-25 completely reopened after semitrailer spills sheet metal on highway

Thornton police advise commuters use alternative routes to avoid crash at 84th Avenue

B) Planned incidents: Prepare prior to a specific event.

Planned incidents at specific locations, such as construction, are generally scheduled ahead of time or reasonably expected. Anticipated incidents, such as snowstorms, can affect the entire region. Roadway operations staff, event organizers and law enforcement agencies can plan ahead for specific times and sites. The media and traffic app providers can be notified beforehand. Roadway operations staff can be ready to mobilize personnel, equipment and logistical elements for things such as:

- construction and utility work zones
- scheduled events (such as sporting events, festivals, runs and parades)
- forecast bad weather (However, unpredicted weather may catch travelers and road crews by surprise.)

C) Unplanned incidents: response and management

Unplanned incidents occur more frequently and cause a greater and less predictable level of traffic congestion. They happen at unforeseen times and locations. Critical roadway locations such as bridges or tunnels (for example, the Eisenhower-Johnson Memorial Tunnel on I-70) may have preplanned logistics and equipment set up for when sudden incidents occur. The types of incidents that occur along roadways include:

- crashes (reported)
- crashes (unreported)

- vehicle breakdowns
- rockfalls, landslides and avalanches (precautionary actions may be done at known locations)
- fallen debris on roadways
- emergency road repairs
- crime scenes or public disturbances

In the aftermath of major incidents, first responders and support staff review procedures and actions that went well or can be improved. They may use data from monitoring sources (such as INRIX or Google Maps) to measure congestion effects including roadway and incident clearance times, vehicle queue backups and dispersion time, and secondary crashes. The new DR 3447 Colorado Crash Report form includes a section in which to identify whether a crash was secondary to a previously occurring crash or related to a construction zone.

Many smaller incidents and vehicle breakdowns also require quick detection and response, even when not as many resources are deployed as in the example “[After a crash occurs](#)” on page 12. For example, the Colorado Department of Transportation State Farm Safety Patrol monitors freeways in the Denver area during peak periods and weekends, assisting about 30,000 motorists annually (approximately 80 each day).



After a crash occurs

- If they did not sustain an injury in the crash, people involved or on the scene may call 911 and conduct initial efforts to assist people or clear debris. Colorado Department of Transportation State Farm Safety Patrol drivers may come upon the scene.
- Roadside cameras (closed-circuit TV), automated incident detection systems or crowd-sourced apps (such as Waze) may pick up the crash. Road operations personnel, such as in the Colorado Department of Transportation's transportation management center in Golden, may see the incident on a monitor or receive an automated notification. Roadway operations personnel:
 - post alerts or information on variable message signs and websites
 - notify applicable local government traffic staff and public information officers, media, traffic apps and the public through 511 alerts and email or text notifications
- Relevant agencies identify, dispatch and deploy the appropriate type and scale of response.
 - First responders arrive. They establish incident command and communications protocols, mobilize to assess the safety and security of scene, and follow established incident management protocols.
 - Incident command coordinates the efforts of fire, law enforcement officers, the state highway patrol, ambulance crews, emergency medical technicians, standard tow trucks, heavy tow and lift equipment, debris and hazardous material removers, and clean-up crews.
 - Responders refer to an incident management plan for the corridor, if applicable.
- Relevant agencies set up detour routes, guidance signs and equipment. They may also direct responsive traffic signal system management efforts.
- Law enforcement and traffic management centers monitor vehicle queue backups and other off-site effects of the incident. For example, they may position a police cruiser ahead of the backup.
- Relevant agencies complete crash investigations and clear of all remnants of the scene.



Photo courtesy of the Colorado Department of Transportation.

U.S. 36 stretch collapses, forcing closure of eastbound lanes and CDOT blitz to re-build bridge approach that's 45 feet above ground

“It’s too soon” to estimate how long eastbound U.S. 36 will be closed, CDOT director Shoshana Lew said

D) Emerging technologies

DRCOG and its partners are closely monitoring in-vehicle technologies and implementing roadside technologies (known as intelligent transportation systems) which will further improve incident management efforts and reduce the likelihood of their occurrence. Most newer vehicles are equipped with features such as lane-departure warning, blind spot monitoring, adaptive headlights and automated braking.

In the near future, the majority of vehicles (and mobile phones) on the road will be connected and communicate with other vehicles, roadside equipment and the wireless network. Vehicles will provide real-time advance alerts to drivers for conditions or incidents along their route such as:

- icy roadways or fog
- stopped vehicles along the road
- whether vehicles ahead have deployed air bags, used fog lights, or turned on windshield wipers
- whether drivers ahead have pumped the brakes at a certain rate or for longer than a specific duration
- pedestrians crossing the road
- stop signs or sharp curves
- traffic signal lights malfunctioning

More vehicles with connected vehicle technology operating on the region’s roadways have the potential to significantly reduce crashes. All types of roadway users should benefit.



Road collapse

A section of U.S. 36 near Church Ranch Boulevard between Broomfield and Westminster collapsed after a large crack turned into a sinkhole.



E) Supporting incident management efforts in the Denver region and Colorado

Partners within the region have formed several standing groups and formalized efforts for involvement with incident management, including:

Regional Transportation Operations Working Group: DRCOG has convened this group of boots-on-the-ground operators from local governments, the Colorado Department of Transportation and the Regional Transportation District for 25 years. It frequently discusses and makes recommendations on roadway system technologies which improve incident management activities.

The Governor’s Task Force on Responder Safety: Led by the Colorado State Patrol, this group is charged with executing the recommendations of the 2017 Task Force Report: (colorado.gov/pacific/sites/default/files/Responder%20Safety%20Task%20Force%20Report%20June%202017.pdf)

Standing program management teams: These geographic area forums meet to discuss specific traffic

incident management plans and procedures including outcomes, needs, implementation and best practices.

Traffic incident management training – The Federal Highway Administration, National Highway Traffic Safety Administration and the Colorado Department of Transportation routinely coordinate and conduct trainings for first responders and other participants. Trainings are held in classrooms, in the field and or at the new Liniger Emergency Vehicle Operations Center located in Douglas County.

6. Projects recently completed or underway

Several congestion relief projects were completed by local governments, the Colorado Department of Transportation and the Regional Transportation District in 2018 or are underway, as show in “[Table 2: Example transportation projects addressing congestion and mobility](#)” on page 15. Transit and bicycle/pedestrian projects expand and enhance non-roadway facilities that encourage people to use alternative modes, avoiding congestion and reducing traffic.



Table 2: Example transportation projects addressing congestion and mobility

Interchange and roadway projects:	Status
Tower Road at Peña Boulevard: new on-ramp	completed
E-470 from Parker Road to Quincy Avenue: widening	completed
I-25 from 120th Avenue to State Highway 7: new managed lanes	underway
C-470 from Kipling Parkway to I-25: new managed lanes	underway
I-25 from Castle Rock to El Paso county line: new managed lanes	underway
Central 70 from I-25 to Chambers Road: new managed lanes	underway
Rapid transit projects:	Status
1 G Line (Ward Road station to Denver Union Station) commuter rail	completed
Southeast Rail Extension (Lincoln to RidgeGate Parkway stations) light rail	completed
North Metro Rail Line (Denver Union Station to Eastlake-124th Station) commuter rail	underway
Bicycle/pedestrian projects:	Status
U.S. Route 6 shared use path: Colfax to Johnson Road	completed
North Metro Rail bicycle/pedestrian access to FasTrack stations	completed
Nine Mile Station: bicycle/pedestrian access improvements	completed
23rd Ave bicycle/pedestrian path at Fitzsimons Station	completed
28th Street/U.S. Route 36 multiuse bicycle/pedestrian path: Iris Avenue to Yarmouth Street	completed
2 Wonderland Creek underpass and path connection: Foothills Parkway to Diagonal Highway	completed
C-470 multiuse trail: grade separation at Yosemite Street	underway
Superior Trail: McCaslin bus rapid transit station to Davidson Mesa underpass	underway
Westerly Creek Trail to Toll Gate Trail Connector	underway
Boulder Slough multiuse path: 30th Street to Pearl Street	underway



Visit DRCOG's partner agency websites for more information:

Colorado Department of Transportation
(codot.gov)

Regional Transportation District
(rtd-denver.com)

Colorado Department of Transportation Traveler Information (cotrip.org)

For ways to avoid or adapt to congestion, visit Way to Go (waytogo.org).

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Contact Robert Spotts, planning supervisor, at rspots@drcog.org for additional information regarding DRCOG's congestion mitigation program.



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