



# An update to the 8-hour ozone conformity determination for the Denver Southern Subarea, for the 2024-amended 2050 Regional Transportation Plan, triggered by new Transportation Improvement Program years

For the:

- Denver Regional Council of Governments' (DRCOG) Fiscally Constrained Element of the 2050 Metro Vision Regional Transportation Plan
- DRCOG 2026-2029 Transportation Improvement Program
- Southern Subarea Portion of the Upper Front Range 2045 Regional Transportation Plan
- 2025-2028 State Transportation Improvement Program for the Upper Front Range Transportation Planning Region

**Public Comment Draft, March 19, 2025**

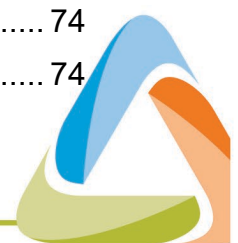
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## Executive summary

The Denver Regional Council of Governments (DRCOG) completed this transportation conformity determination as part of the transportation and air quality planning process. DRCOG’s amendment of the long-range transportation plan triggered the need to perform the conformity analysis – the transition to the 2026-2029 Transportation Improvement Program prompted the update to this document. The ozone nonattainment area continues to meet air quality conformity standards associated with the Denver and Upper Front Range Transportation Planning Regions respective long-range transportation plans and short-range transportation improvement programs.

## Proposed amendments

There are no amendments to the Regional Transportation Plan or conformity determination. This update is to accommodate the transition to the 2026-2029 Transportation Improvement Program. With no new amendments or regionally significant projects, a new conformity determination is *not* required.

## Emissions test results

Table 1 shows the budgets for volatile organic compounds and nitrogen oxides, the pollutants that directly contribute to ozone. The modeled emissions must be below budget to pass conformity tests. All staging-year results for the Denver Southern Subarea are reported in Table 1. All tests are passed based on model results for emissions being below the budgets. This means the plans associated with this determination meet conformity requirements for the 2020 Ozone State Implementation Plan budgets (2008 and 2015 ozone standards). The emissions estimates were generated by the Colorado Air Pollution Control Division using the transportation inputs from the Council’s travel demand models and the Environmental Protection Agency’s Motor Vehicle Emission Simulator model (MOVES), version 3.0.

**Table 1. 8-Hour ozone conformity modeling results for the Denver Southern Subarea (in emission tons per day)**

	Volatile Organic Compounds	Nitrogen Oxides
<b>2020 State Implementation Plan Budgets (per the 2008 Ozone Standard)</b>	<b>41.2</b>	<b>45.0</b>
2026 Emissions	24.6	17.1
2030 Emissions	20.2	12.9
2040 Emissions	17.3	9.1
2050 Emissions	18.8	9.8
<b>Pass or fail?</b>	<b>Pass</b>	<b>Pass</b>



## Other pollutants

This document details ozone conformity. The Denver region is no longer designated as a maintenance area for particulate matter equal to or less than 10 microns in aerodynamic diameter (also known as PM10) or carbon monoxide (also known as CO). The 20-year maintenance period requirements for both pollutants were completed in 2023 and 2022 respectively.



## What is transportation conformity?

Each metropolitan planning organization associated with an air quality nonattainment area is required to show conformity of its long-range fiscally constrained regional transportation plan and transportation improvement program with the state implementation plan for air quality before they may be adopted. Section 176(c) of the Clean Air Act, as amended in 1990, requires that new conformity determinations be made when there are major changes such as additions, deletions or project scope adjustments to funded regionally significant projects as reflected in a current conformity determination; or an update if a new Transportation Improvement Program (with different programming years) is proposed for adoption. Major changes usually occur in relation to the long-range Regional Transportation Plan. Since Transportation Improvement Program projects are contingent upon already being identified in the long-range plan, adjustments to the Transportation Improvement Program alone rarely triggers the need for a new conformity determination. This update was triggered by the DRCOG's transition from the 2024-2027 Transportation Improvement Program to the 2026-2029 Transportation Improvement Program.

The Clean Air Act defines conformity as alignment with an air quality implementation plan's purpose of eliminating or reducing the severity and number of violations of the National Ambient Air Quality Standards (NAAQSs) and achieving expeditious attainment of such standards. In addition, activities may not cause or contribute to new violations of air quality standards, exacerbate existing violations or interfere with the timely attainment of required emissions reductions toward attainment. For pollutants for which a region currently meets standards but was formerly in nonattainment, the applicable SIP may also be referred to as a maintenance plan, which demonstrates continued attainment of the standards. According to 40 CFR 93.109 of the Transportation Conformity Rule, criteria and procedures for determining conformity of transportation plans, programs, and projects must satisfy different criteria depending on whether the state has submitted a SIP revision, and whether the U.S. Environmental Protection Agency has approved the revision.

On Jan. 9, 2008, the EPA administrator signed an amendment to the conformity rule (the "Final Rule"), to implement the provisions of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users. The EPA final transportation conformity rule is located at 40 CFR Part 93, Subpart A. The Final Rule was promulgated Feb. 25, 2008. The most recent EPA revision to the conformity rule occurred on March 14, 2012 (77 FR 14979, effective April 13, 2012). To address revised standards and changes in conformity requirements, the EPA has promulgated several amendments to the final rule in recent years. The Air Quality Control Commission Regulation No. 10 or "Criteria for Analysis of Transportation Conformity," was adopted by the commission in 1998. It formally defines the process for determining conformity. The EPA approved Regulation No. 10 on Sept. 21, 2001 (66 FR 48561), making it



federally enforceable. Regulation No. 10 was updated and approved by the Air Quality Control Commission on Dec. 15, 2011.



## Ozone nonattainment area

### Area boundaries and history

The EPA's process to determine the nonattainment area dates to 1997. Within the DRCOG region, there are several key planning organizations. Table 2 depicts the three organizations, their roles in the region and their geographic boundaries. Figure 1 depicts the boundary of all three metropolitan planning organizations/transportation planning regions involved in this report's 8-hour ozone conformity determination.

DRCOG is within the nine-county Denver Metro/North Front Range (DM/NFR) Nonattainment Area (NAA) for the 2008 8-hour Ozone NAAQS and 2015 8-hour ozone NAAQS. The NAA for the 2008 8-hour ozone NAAQS and 2015 NAAQS covers the full counties of Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, Jefferson, and portions of Larimer and Weld counties. The EPA expanded the boundary of the DM/NFR NAA for the 2015 8-hour ozone NAAQS to include the entirety of Weld County. Figure 2 shows the boundaries of the DM/NFR NAA for both the 2008 and 2015 NAAQS and shows its two subareas, Northern and Southern. The boundary between the two subareas is the Boulder/Larimer County line, extended at the same latitude eastward through southern Weld County to the Morgan County line. DRCOG conducts conformity determinations for the Southern Subarea. The NFRMPO conducts conformity determinations for the Northern Subarea.

For long-term and short-term planning, DRCOG's 2050 Metro Vision Regional Transportation Plan includes the entire DRCOG transportation planning region. The DRCOG Transportation Improvement Program covers the transportation management area, while the Colorado Department of Transportation and the State Transportation Improvement Program covers the remaining portions of the region.





**Table 2. Ozone nonattainment area planning organizations.**

Organization	Role	Boundaries
Denver Regional Council of Governments	Metropolitan Planning Organization and transportation planning region for the Denver Transportation Management Area.	The transportation management area includes four urbanized areas and the portions of Adams and Arapahoe counties west of Kiowa Creek; all of Boulder County except Rocky Mountain National Park; all of Broomfield, Denver, Douglas and Jefferson counties; and parts of southwestern Weld County. The transportation planning region area includes the transportation management area plus the portions of Adams and Arapahoe counties east of Kiowa Creek, Clear Creek and Gilpin counties, and the Rocky Mountain National Park area of Boulder County.
North Front Range Metropolitan Planning Organization	Metropolitan Planning Organization for the North Front Range transportation management area.	Includes 15 local governments in portions of Larimer and Weld counties.
Upper Front Range	Transportation planning region for north-central Colorado.	Comprises Larimer, Morgan and Weld counties, and excludes the urbanized areas in Larimer and Weld counties.



**Figure 1. Planning organizations involved in the Denver Metro/North Front Range 8-hour ozone nonattainment areas.**

**Figure 1. Planning Organizations Involved in Denver Metro/North Front Range 8-Hour Ozone Nonattainment Areas**

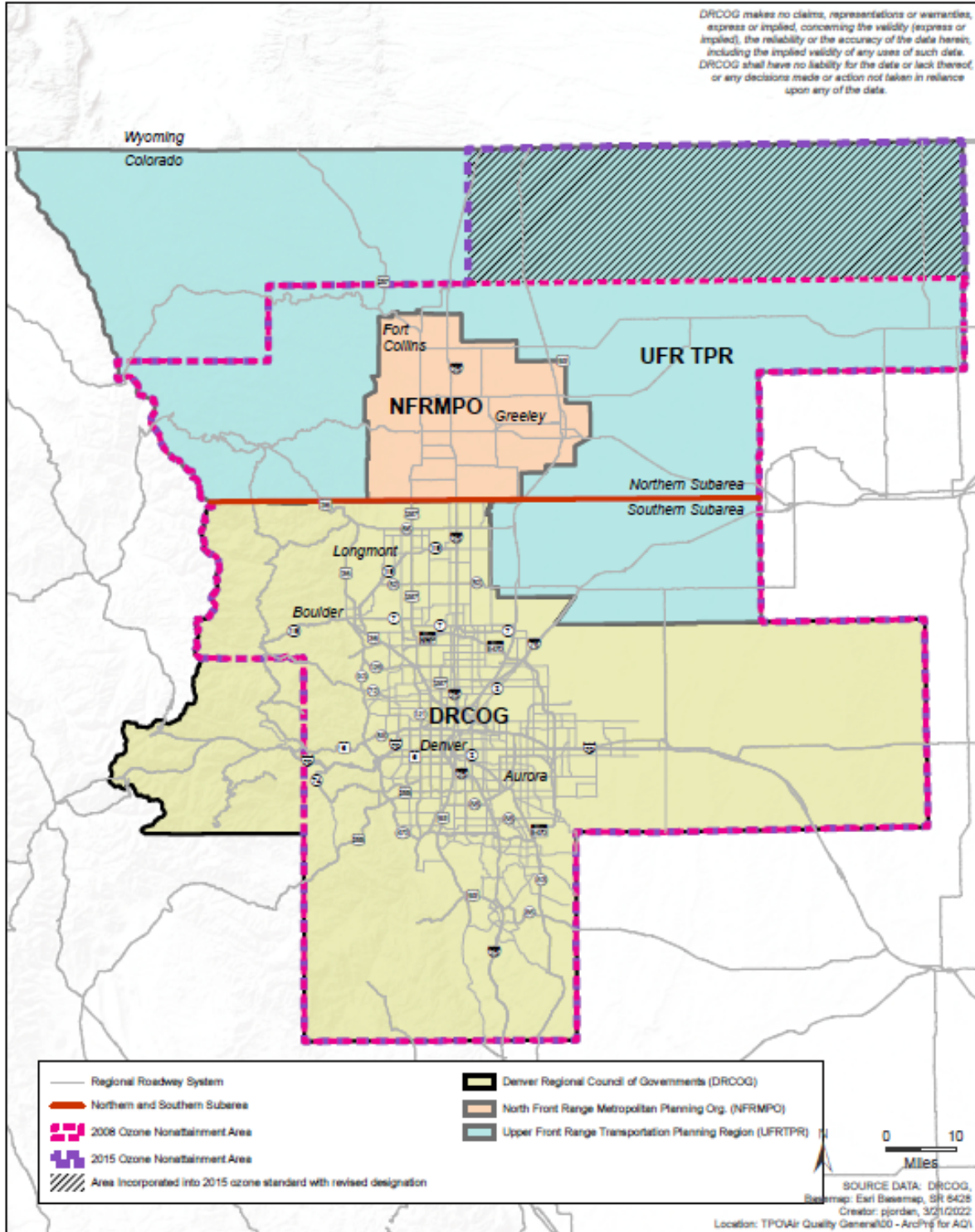


Table 3 is a historical summary of the 1997, 2008 and 2015 8-hour ozone NAAQS for the Denver Metro/North Front Range region. The 8-hour ozone nonattainment area is comprised of two subareas (Northern and Southern), shown in Figure 2. The boundary between the two subareas is the Boulder/Larimer County line extended east through southern Weld County to the Morgan County line. Per 2004 designation, the area includes nine counties in the Denver Metro/North Front Range region (Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, Jefferson and the southern portions of Larimer and Weld counties).

**Table 3. Historical summary for the 8-hour ozone National Ambient Air Quality Standards in the Denver Metro/North Front Range nonattainment area.**

Date	Milestone	Comments
<b>1997</b>	U.S. Environmental Protection Agency established the 8-hour ozone National Ambient Air Quality Standard of 80 parts per billion (ppb).	Due to litigation at the federal level, it took the EPA until 2004 to designate nonattainment area.
<b>April 30, 2004</b>	The EPA promulgated Phase I ozone implementation rule and designated nine Denver Metro/North Front Range counties as marginal nonattainment for the 1997 8-hour ozone NAAQS	nine counties in the Denver Metro/North Front Range region: Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, Jefferson, and the southern portions of Larimer and Weld  effective date: June 15, 2004 ( <a href="#">69 FR 23951</a> )
<b>March 27, 2008</b>	The EPA lowered the NAAQS for ground-level ozone to 0.075 ppm; same nine counties marginal nonattainment	new 2008 standard is 75 ppb; secondary standards are identical to the revised primary standard effective date: May 27, 2008 ( <a href="#">73 FR 16436</a> )
<b>May 21, 2012</b>	The EPA designated the Denver Metro/North Front Range region as marginal nonattainment under the new standard.	



<p><b>Conclusion of the 2014 ozone season</b></p>	<p>The Denver Metro/North Front Range region failed to attain air quality standards based on the three-year average of ozone data from 2012 to 2014.</p>	
<p><b>Oct. 26, 2015</b></p>	<p>The EPA published the final rule revising 8-hour ozone NAAQS (2015 8-hour ozone National Ambient Air Quality Standards).</p>	<p>New 2015 standard is 0.070 ppm; secondary standards are identical to the revised primary standard effective date: Dec. 28, 2015 (<a href="#">80 FR 65291</a>)</p>
<p><b>May 4, 2016</b></p>	<p>The EPA reclassified the region from a marginal to a moderate nonattainment area for the 2008 ozone NAAQS, extending the attainment year to 2017.</p>	<p>A Moderate State Implementation Plan was developed to demonstrate how the Denver Metro/North Front Range region will comply with the federal Clean Air Act.</p>
<p><b>May 2017</b></p>	<p>New motor vehicle emissions budgets were submitted to the EPA as part of the State Implementation Plan package for the 2008 ozone NAAQS.</p>	



<p><b>June 4, 2018</b></p>	<p>The EPA published a final rule designating the Denver Metro/North Front Range region as marginal for the 2015 ozone NAAQS.</p>	<p>The same nine-county Denver Metro/North Front Range geography was used as with the 2008 ozone NAAQS. Until new motor vehicle emissions budgets are approved and become effective, the Denver Metro/North Front Range nonattainment area demonstrates conformity to the 2015 ozone NAAQS by meeting the approved moderate State Implementation Plan motor vehicle emissions budget tests for the 2008 NAAQS (40 CFR 93.109I(2)(i)) effective date: Aug. 3, 2018.</p>
<p><b>December 16, 2019</b></p>	<p>Redesignated to serious for 2008 standard.</p>	<p>The Air Quality Control Commission (AQCC) adopted the Serious Area SIP including new MVEBs on December 18, 2020.</p>
<p><b>July 2020</b></p>	<p>DM/NFR Area expanded to include the entirety of Weld County for the 2015 standard.</p>	
<p><b>August 19, 2020</b></p>	<p>New motor vehicle emissions budgets were submitted to the EPA as part of the State Implementation Plan package for the 2008 ozone NAAQS serious classification.</p>	



<p><b>April 14, 2022</b></p>	<p>Redesignated to moderate for 2015 standard. Effective date is anticipated in Fall 2022.</p>	<p>EPA announced the proposed rule to reclassify to moderate for the 2015 NAAQS, which has attainment year of 2023. A SIP is currently under development for the 2015 ozone NAAQS. Until new MVEBs are approved and become effective, the DM/NFR NAA demonstrates conformity to the 2015 ozone NAAQS by meeting the approved Moderate SIP MVEB tests for the 2008 ozone NAAQS.</p>
<p><b>May 3, 2023</b></p>	<p>The US Environmental Protection Agency found the 2020 motor vehicle emissions budgets adequate (as part of the State Implementation Plan package for the 2008 National Ambient Air Quality Standard serious classification).</p>	

### Memorandum of Agreement

Federal Transportation Regulations at 23 CFR 450.314(b) states:

*“where a metropolitan planning area (MPA) does not include an entire nonattainment area, there shall be written agreement among the State Department of Transportation, state air quality agency, affected local agencies, and the MPO describing the process for cooperative planning and analysis of all projects outside the MPA within the nonattainment area.”*

A memorandum of agreement was signed in March 2008 by the Colorado Department of Public Health and Environment, Colorado Department of Transportation, Regional Air Quality Council, Upper Front Range Transportation Planning Region, North Front Range Metropolitan Planning Organization, and DRCOG. A new memorandum of agreement reflecting the updated Regulation No. 10 was signed by North Front Range Metropolitan Planning Organization, Colorado Department of Public Health and Environment, Regional Air Quality Council, and DRCOG in 2015. Both are still in effect. It updated the specific roles and responsibilities in conformity evaluations and findings for each agency. The memorandum of agreement also includes courses of action to be pursued



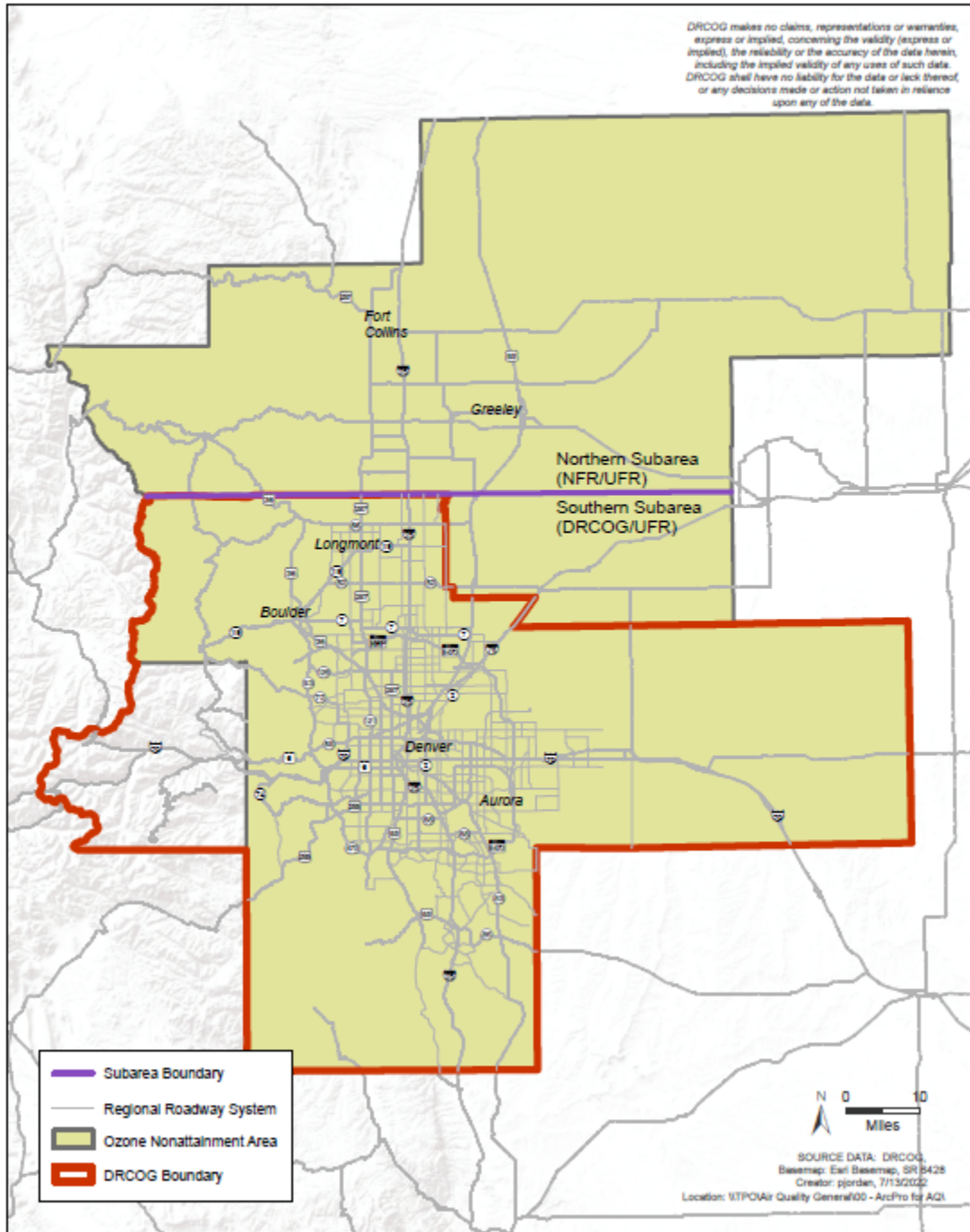
if a subarea exceeds an emission budget. This superseded the November 1998 memorandums of agreement the Colorado Department of Public Health and Environment signed with DRCOG and the North Front Range Metropolitan Planning Organization. A copy of the 2008 and 2015 memorandums of agreement are in Appendix D.

The memorandum of agreement stipulates that DRCOG will make conformity determinations for the Southern Subarea of the 8-hour ozone nonattainment area, while the North Front Range Metropolitan Planning Organization will make the conformity determination for the Northern Subarea of the 8-hour ozone nonattainment area, with boundaries as shown in Figure 2. Both the North Front Range Metropolitan Planning Organization and DRCOG worked cooperatively with an interagency consultation group (Federal Highway Administration, Federal Transit Administration, Regional Air Quality Council, North Front Range Metropolitan Planning Organization, Upper Front Range Transportation Planning Region, EPA, Colorado Department of Transportation and the Air Pollution Control Division) to review the conformity documentation and planning assumptions. Per the memorandum of agreement, the travel demand model outputs from each metropolitan planning organization are sent to the Air Pollution Control Division of the Colorado Department of Public Health and Environment for generation of emissions estimates.



**Figure 2. Denver Metro/North Front Range ozone nonattainment area and subareas.**

**Figure 2 - Denver Metro/North Front Range Ozone Nonattainment Area and Subareas**





## Motor vehicle emissions budgets

Motor vehicle emission budgets are established as part of a State Implementation Plan. The Regional Air Quality Council is the air quality planning agency for the Denver metropolitan area (Southern Subarea), the North Front Range metropolitan area (Northern Subarea), and the Upper Front Range transportation planning region (Northern Subarea) and is charged with preparing the State Implementation Plan.

The 2008 memorandum of agreement calls for the establishment of overall area motor vehicle emissions budgets based on the entire 8-hour ozone nonattainment area and allows for the option of establishing subarea emissions budgets. The memorandum of agreement describes that after the initial motor vehicle emissions budget-based conformity determination, DRCOG and the North Front Range Metropolitan Planning Organization may switch from using the total nonattainment area motor vehicle emissions budgets for joint determinations to using the subarea budgets for individual conformity determinations. If using subarea budgets, as is the current practice, **both** subareas must demonstrate conformity for their plans. If one subarea fails, the other subarea cannot adopt a new conformity determination until the failure is resolved. To switch methods DRCOG and the North Front Range Metropolitan Planning Organization must use the process as described in the Denver Metro/North Front Range Ozone State Implementation Plan. The motor vehicle emissions budgets for NOX and VOC went through the process of:

- Submittal to the EPA in 2009 as part of the SIP for the 1997 Ozone NAAQS
- EPA finding budgets adequate for transportation conformity purposes on March 4, 2010 (75 FR 9893), effective March 19, 2010
- EPA subsequently approving budgets in a final rule on Aug. 5, 2011 (76 FR 47443), effective Sept. 6, 2011

DRCOG and the North Front Range Metropolitan Planning Organization used these budgets for subsequent transportation conformity determinations until 2017. Due to the reclassification to a moderate nonattainment area in 2016, additional planning requirements were triggered including the requirement to submit updated motor vehicle emissions budgets for the 2017 attainment year. Following the same approach as under the 1997 ozone NAAQS, the Serious Area Ozone State Implementation Plan set new motor vehicle emissions budgets for the northern and southern subareas found in Table 4. These lower budgets were submitted to the EPA in August 2020 as part of the State Implementation Plan package for the 2008 ozone NAAQS. The EPA found the budgets adequate on May 3, 2023 (88 FR 29827) with an effective date of June 8, 2023.



**Table 4. 8-hour ozone conformity by subarea budgets (units are in Emission Tons per Day).**

Nonattainment area	Volatile Organic Compounds	Nitrogen Oxide
Northern Subarea Budget (North Front Range Metropolitan Planning Organization and Upper Front Range Transportation Planning Region Subarea)	8.2	9.7
Southern Subarea Budget (DRCOG and Upper Front Range Transportation Planning Region Subarea)	41.2	45.0
<b>Total Nonattainment Area Budget (Entire Nonattainment Area)</b>	<b>49.4</b>	<b>54.7</b>

### Relevant planning efforts

#### *DRCOG Metro Vision Regional Transportation Plan*

DRCOG’s Metro Vision plan is the long-range growth and development strategy for the Denver region. It integrates plans for growth and development, transportation and environmental quality into a single comprehensive foundation for regional planning. Metro Vision calls for a balanced multimodal surface transportation system including rapid transit, a regional bus network, bicycle and pedestrian facilities, and improvements to the existing roadway system. Among Metro Vision’s regional objectives is to “Improve air quality and reduce greenhouse gas emissions,” which reflects the region’s commitment to improve air quality through local and regional initiatives that reduce ground-level ozone, greenhouse gas emissions and other air pollutants. Supporting objectives include:

- Increase collaboration with local and regional partners on air quality initiatives.
- Increase public awareness of air quality issues.
- Improve the fuel economy of the region’s vehicle fleet.

The Metro Vision Regional Transportation Plan implements the transportation element of Metro Vision. The Metro Vision Regional Transportation Plan contains an unconstrained vision plan, outlining the region’s total transportation needs, as well as the Fiscally Constrained Regional Transportation Plan, which includes those projects that can be implemented given reasonably anticipated revenues through 2050. When the 2050 Metro Vision Regional Transportation Plan is referenced in this document it denotes the fiscally constrained element of the plan.

The 2026-2029 Transportation Improvement Program identifies transit, multimodal and roadway projects to be funded from fiscal years 2026 through 2029. Regionally significant projects funded in the TIP must first be identified in the 2050 Metro Vision Regional Transportation Plan. Regionally significant projects are listed in Appendix A; since there are no new regionally significant projects since the last determination, a new



determination is not required. The TIP will implement selected projects and strategies identified in the first staging periods of the 2050 Metro Vision Regional Transportation Plan.

DRCOG staff fostered public participation throughout development of the 2050 Metro Vision Regional Transportation plan and 2026-2029 Transportation Improvement Program and continue to facilitate youth and civic engagement on a regular basis. DRCOG provided numerous public participation opportunities, including workshops, county forums, stakeholder meetings, surveys, interactive online forums, a Youth Advisory Panel and a Civic Advisory Group.

#### *Upper Front Range Regional Transportation Plan*

The Upper Front Range Transportation Planning Region provided its 2045 Regional Transportation Plan for public comment in May of 2020 and was approved by the Upper Front Range Regional Planning Commission in September 2020. The Upper Front Range Transportation Planning Region 2045 Regional Transportation Plan contains both a vision plan as well as a fiscally constrained plan. Short-range transportation projects in the plan are contained in the Statewide Transportation Improvement Program. There have been no regionally significant amendments to either of these documents since the last determination.

Consistent with the process used for the memorandum of understanding, information about and summaries of DRCOG's public hearings were circulated within the Upper Front Range Transportation Planning Region, available through DRCOG's website and in the office. Additionally, the public was encouraged to provide input to their local elected officials and government staff who work closely with DRCOG.



## Transportation control measures

For this conformity determination, there are no transportation control measures identified for timely completion or implementation as part of the applicable implementation plan. The 8-hour ozone State Implementation Plan that was adopted by the Air Quality Control Commission in December 18, 2020 did not include any transportation control measures.



# Emissions test process and assumptions

## Background and staging years

The transportation plan and program must pass a series of 8-hour ozone emissions tests to demonstrate conformity. These emissions tests relate to the two ozone precursors, NOX and VOC. The plan and program must meet the motor vehicle emissions budget in the applicable State Implementation Plan or plan submittal. Satisfying these tests involves demonstrating that relevant emissions in future years are less than or equal to the emissions budget established in the State Implementation Plan.

In accordance with EPA regulations 40 CFR 93.118, the Interagency Consultation Group agreed upon the following reporting years for this 8-hour ozone conformity determination.

- **2026**
- **2030**
- **2040**
- **2050**

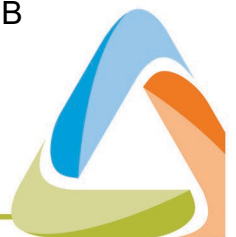
Under the terms of the memorandum of agreement (as described above), DRCOG is responsible for the 8-hour ozone nonattainment area's Southern Subarea, while the North Front Range Metropolitan Planning Organization is responsible for the conformity determination for the 8-hour ozone nonattainment area's Northern Subarea, as shown in Figure 1.

## Technical models

The technical process used to estimate future pollutant emission levels is based on the latest planning assumptions in effect at the time of this conformity determination. Assumptions behind the analysis were derived from estimates of current and future population, employment, travel and congestion most recently developed by DRCOG. Information concerning vehicle miles traveled and operating speeds was updated as part of this conformity finding process.

The memorandum of agreement stipulates that the emissions estimates are to be performed by the Air Pollution Control Division. The Air Pollution Control Division of the Colorado Department of Public Health and Environment estimates air pollution emissions using the EPA MOVES model. The conformity analysis for this 8-hour ozone conformity determination began in December 2023 when DRCOG transferred initial travel model output files to Air Pollution Control Division to be used with EPA's MOVES3 mobile source emission model to estimate emissions.

The DRCOG travel demand model covers the whole Southern Subarea. Appendix B describes the modeling structure and recent enhancements for the DRCOG travel



demand model in more detail. Appendix C of this conformity determination includes more information on the transportation and demographic assumptions used in this emissions analysis.

## Demographic assumptions

Growth in population and employment is the principal factor for the increased demand for travel on the region’s transportation facilities and services. The population forecast for the Southern Subarea of the Denver Metro/North Front Range 8-hour Ozone Nonattainment Area in 2050 is 4,404,997. This is an increase of 31 percent over the 2020 estimated population of 3,358,999. The employment forecast for 2050 is 2,970,635 compared to the 2020 estimate of 2,160,276, an increase of 38 percent. Table 5 shows the latest forecasts of population and employment for 2020, 2023, 2030, 2040 and 2050 for the Southern Subarea of the Denver Metro/North Front Range Nonattainment Area. Table 6 lists 2020 and 2050 population and employment estimates by each of the counties in the DRCOG ozone modeling Southern Subarea.

**Table 5. Population and employment forecasts for the Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, Jefferson and southern Weld counties. Sourcing is from the Colorado Department of Local Affairs, State Demography Office.**

Year	Population	Employment
2020	3,358,999	2,160,276
2023	3,520,911	2,241,691
2030	3,806,424	2,443,012
2040	4,180,711	2,706,188
2050	4,404,997	2,970,635

**Table 6. 2020 and 2050 population estimates by County. Sourcing is from the Colorado Department of Local Affairs, State Demography Office. Weld County portioning was applied by DRCOG staff.**

County	2020 Population	2050 Population
Adams County	523,778	842,689
Arapahoe County	659,564	837,991
Boulder County	331,025	420,105
Broomfield County	72,773	98,239
Denver County	736,531	883,165
Douglas County	354,508	464,189
Jefferson County	586,965	661,332
Southern Weld County	93,855	197,287
<b>Total DRCOG Ozone Modeling Southern Subarea</b>	<b>3,358,999</b>	<b>4,404,997</b>



**Table 7. 2020 and 2050 employment estimates by County. Sourcing is from the Colorado Department of Local Affairs, State Demography Office. Weld County portioning was applied by DRCOG staff.**

County	2020 Employment	2050 Employment
Adams County	267,686	365,949
Arapahoe County	426,173	584,069
Boulder County	248,111	339,920
Broomfield County	48,254	66,192
Denver County	646,251	885,225
Douglas County	174,176	238,725
Jefferson County	313,198	429,177
Southern Weld County	36,427	61,378
<b>Total DRCOG Ozone Modeling Southern Subarea</b>	<b>2,160,276</b>	<b>2,970,635</b>

## Transportation network assumptions

### *Denver Regional Council of Governments*

Emission tests were based on the 2020, 2023, 2030, 2040 and 2050 transportation networks and associated planning assumptions as defined in DRCOG’s 2050 Metro Vision Regional Transportation Plan. The networks included financially constrained roadway and transit system improvements and resulting networks to be completed by the year 2050. The networks include both federally and locally funded projects. The Metro Vision Regional Transportation Plan and Transportation Improvement Program also include many other projects that will help to reduce emissions associated with ozone such as:

- Transit operating funds and bus purchases
- Bicycle and pedestrian facilities
- Transportation demand management programs
- Intelligent transportation systems infrastructure
- Traffic signal systems and coordination
- Master plans for areas around transit stations and urban centers

All roadway and rapid transit projects and staging years through 2050 are shown in the figures found in Appendix A. The full project list is also detailed in Appendix A.

### *Upper Front Range Transportation Planning Region*

There were no regionally significant transportation improvement projects in the Upper Front Range Transportation Planning Region portion of the Southern Subarea, and no amendments are proposed for this cycle.



### *Other mobile source reduction strategies*

Two categories of strategies to reduce regional emissions are funded and assumed to continue through 2050, but are not specifically analyzed in the future year transportation and air quality modeling:

- Transportation demand management programs such as DRCOG's regional Way to Go program, transit pass subsidies and other transportation demand management actions will help to reduce the amount of single-occupant-vehicle driving by the growing population of the region. Such efforts will also take advantage of the increased provision of pedestrian and bicycling facilities across the region.
- The DRCOG Regional Transportation Operations and Technology Program will implement projects that allow the transportation systems to operate much more efficiently. The projects cover four key areas:
  - Traffic signal system equipment
  - Traffic signal coordination and timing
  - Transportation incident management and communications
  - Intelligent transportation systems technological improvements covering a range of communications (vehicle and infrastructure), monitoring, public information and other projects





# Conclusion

## Emissions test results

The results of the Denver Southern Subarea emissions tests by year are reported in Table 1, included in the executive summary and repeated here. The emissions estimates were generated by Air Pollution Control Division using the transportation inputs from DRCOG’s travel demand models and the MOVES model. The 8-hour ozone conformity analysis was performed and is reported for the years 2023, 2030, 2040 and 2050, which meet the requirements for the staging years specified in 40 CFR 93.118.

**Table 8. 8-Hour ozone conformity modeling results for the Denver Southern Subarea (in emission tons per day)**

	Volatile Organic Compounds	Nitrogen Oxides
<b>2020 State Implementation Plan Budgets (per the 2008 Ozone Standard)</b>	<b>41.2</b>	<b>45.0</b>
2026 Emissions	24.6	17.1
2030 Emissions	20.2	12.9
2040 Emissions	17.3	9.1
2050 Emissions	18.8	9.8
<b>Pass or fail?</b>	<b>Pass</b>	<b>Pass</b>

## Summary statement

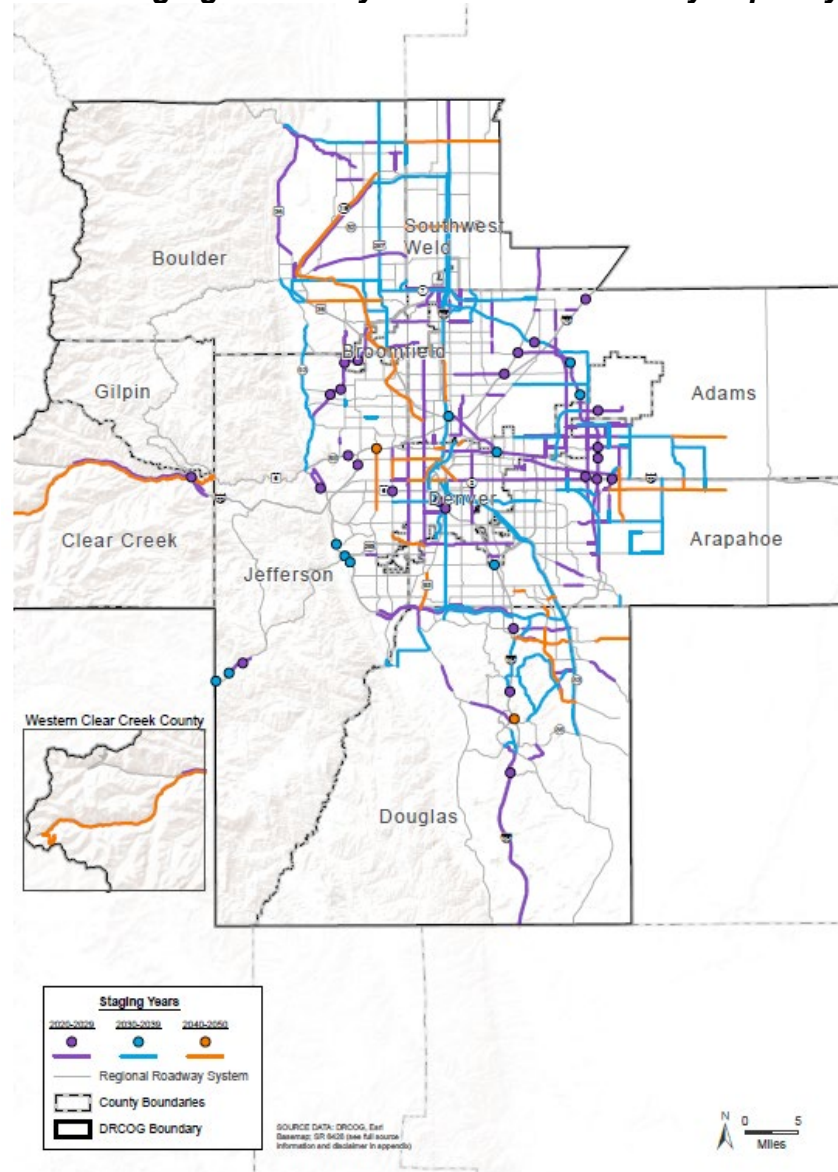
DRCOG has assessed its compliance with the applicable ozone conformity criteria requirements and affirms conformity. The test results do not indicate any failures in the reporting years of the program or plan that would lead to a finding of nonconformity for the 2020 Serious State Implementation Plan budgets (2008 Ozone Standard and 2015 Ozone Standard). Based on the quantitative conformity analysis, DRCOG staff has determined conformity is demonstrated for the amended DRCOG 2050 Metro Vision Regional Transportation Plan, Upper Front Range 2045 Regional Transportation Plan, and the regionally significant projects funded in the DRCOG 2026-2029 Transportation Improvement Program and 2025-2028 Statewide Transportation Improvement Program Vwithin the Denver Southern Subarea associated with the 2008 and 2015 8-hour ozone standards.



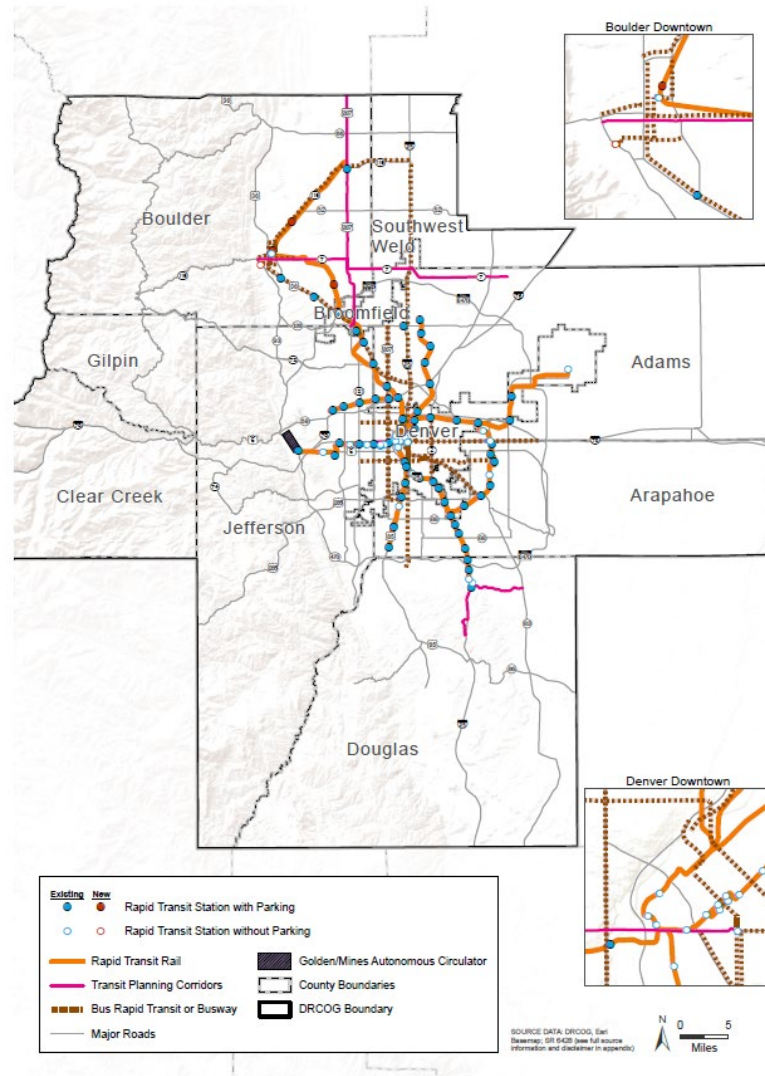


## Appendix A. DRCOG transportation network and project assumptions

**Figure 3. 2050 staging of fiscally constrained roadway capacity projects.**



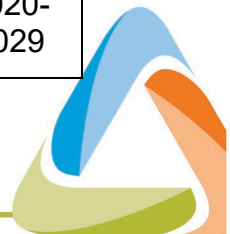
**Figure 4. 2050 Fiscally Constrained Rapid Transit System Guideway Facilities and Stations.**



***Table 9. Colorado Department of Transportation administered funds for multimodal capital projects and programs.***



Project name or corridor	Location or limits	Project description	County	Project cost	Staging period
Regional system preservation, enhancement, and operations	Varies	'Road resurfacing; traffic signals, optimization, communication, variable message signs; bridge replacement, rehabilitation, preservation; and other systematic repairs and preventative maintenance	Regional	\$11,409,000,000	2020-2050
C-470	U.S. Route 285/Morrison/Quincy	Interchange complex reconstruction	Jefferson	\$150,000,000	2030-2039
Federal Blvd.	6th Ave. to Howard Pl.	Widen from 5 to 6 lanes	Denver	\$23,400,000	2020-2029
I-25 North (Segment 5)	State Hwy. 66 to Weld County Rd. 38 (DRCOG boundary)	Add 1 toll/managed lane each direction	Weld	\$175,000,000	2020-2029
I-25 North (Segment 4)	State Hwy. 7 to State Hwy. 66	Managed lanes, State Hwy. 119 mobility hub, intelligent transportation systems, bicycle and pedestrian trail connections	Broomfield, Weld	\$150,000,000	2030-2039
I-25 North	E-470 to State Hwy. 7	Managed lanes, State Hwy. 7 interchange reconstruction and State Hwy. 7 mobility hub	Adams, Broomfield	\$200,000,000	2030-2039
I-25 North	84th Ave. to 104th Ave.	Operational improvements, center-loading transit station at 88th Ave. and general purpose lane	Adams	\$230,000,000	2040-2050
I-25 Central Improvements	Santa Fe Blvd. to 20th St.	Safety, operations, multimodal mobility, transit, and community connections	Denver	\$645,000,000	2040-2050
I-25	Speer Blvd/23rd Ave	Bridge replacements with safety and multimodal mobility improvements	Denver	\$75,000,000	2020-2029
I-25	Santa Fe Dr. (U.S. Route 85) to Alameda Ave.	Bridge replacement, intersection safety, and multimodal mobility improvements	Denver	\$35,000,000	2020-2029



I-25	Belleview Ave.	Interchange reconstruction and pedestrian connections	Arapahoe	\$112,000,000	2030-2039
I-25	El Paso County Line to north of Crystal Valley Pkwy.	Add 1 toll/managed-lane each direction	Douglas	\$300,000,000	2020-2029
I-270	I-25/U.S. Route 36 to I-70	New managed lanes	Adams	\$500,000,000	2020-2029
I-270	I-25/U.S. Route 36 and I-70	New freeway "direct connects" at each end of I-270	Adams	\$300,000,000	2030-2039
I-70 Floyd Hill eastbound improvements	Floyd Hill to Veterans Memorial Tunnel	Eastbound interchange improvements with frontage road extension from the Hidden Valley interchange to U.S. Route 6 interchange	Clear Creek	\$250,000,000	2020-2029
I-70 Floyd Hill westbound improvements	Floyd Hill to Veterans Memorial Tunnel	Addition of a new express travel lane from the top of Floyd Hill to Veterans Memorial Tunnels, and eastbound auxiliary lane from the bottom to top of Floyd Hill	Clear Creek	\$450,000,000	2020-2029
I-70	Eisenhower-Johnson Memorial Tunnels	Major rehabilitation of the Eisenhower-Johnson Memorial Tunnels	Clear Creek	\$142,000,000	2020-2050
I-70	Twin Tunnels to Empire Junction (U.S. Route 40)	Add 1 westbound peak period managed lane	Clear Creek	\$50,000,000	2020-2029
I-70	Kipling St.	Interchange reconstruction and pedestrian connections	Jefferson	\$80,000,000	2040-2050
I-70	I-25 to Chambers Rd.	Add 2 new managed lanes	Adams, Denver	\$1,175,700,000	2020-2029
State Hwy. 66	Lyons to Hover St.	Operational/safety improvements from Lyons to Longmont in alignment with PEL	Boulder	\$5,000,000	2030-2039



State Hwy. 66	Hover St. to Main St. (U.S. Route 287)	Widen from 2 to 4 lanes	Boulder	\$5,000,000	2020-2029
State Hwy. 83 (Parker Rd.)	State Hwy. 86 to E. Mississippi Ave.	Corridor planning/investment for multimodal mobility, operations and safety	Arapahoe, Douglas	\$150,000,000	2030-2039
U.S. Route 6	Wadsworth Blvd.	Interchange capacity	Jefferson	\$80,000,000	2020-2029
U.S. Route 85	120th Ave	New interchange	Adams	\$100,000,000	2020-2029
U.S. Route 85	104th Ave.	New interchange	Adams	\$100,000,000	2020-2029
U.S. Route 85	Louviere to milepost 191.75	Widen from 2 to 4 lanes	Douglas	\$59,000,000	2020-2029
U.S. Route 85	Sedalia to Daniels Park	Widen from 2 to 4 lanes	Douglas	\$35,000,000	2020-2029
U.S. Route 85	Daniels Park to Meadows Pkwy	Widen from 2 to 4 lanes	Douglas	\$32,000,000	2020-2029
U.S. Route 285	Pine Valley Rd. (County Rd. 126)/Mt. Evans Blvd.	New interchange	Jefferson	\$40,000,000	2030-2039
U.S. Route 285	Parker Ave.	New interchange	Jefferson	\$25,000,000	2030-2039
U.S. Route 285	Shaffers Crossing to Kings Valley Dr.	Widen from 3 to 4 lanes (add 1 southbound lane)	Jefferson	\$60,000,000	2020-2029
U.S. Route 285	Kings Valley Dr.	New interchange	Jefferson	\$15,000,000	2020-2029
U.S. Route 285	Kings Valley Dr. to Richmond Hill Rd.	Widen from 3 to 4 lanes (add 1 southbound lane)	Jefferson	\$25,000,000	2020-2029
Vasquez Blvd.	60th Ave.	Intersection improvements	Adams	\$80,000,000	2020-2029

**Combined project and program costs from the Colorado Department of Transportation total \$17,263,100,000.**

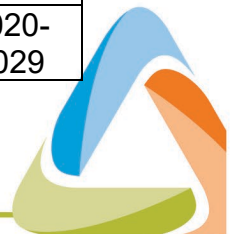




***Table 10. Denver Regional Council of Governments administered funds for multimodal capital projects and programs.***



Project name or corridor	Location or limits	Project description	County	Project cost	Staging period
TIP Set-Asides	Varies	Investment in transportation demand management, air quality, operations and technology and human services transportation	Regional	\$375,000,000	2020-2050
88th Ave.	I-76 northbound ramps to State Hwy. 2	Widen from 2 to 4 lanes	Adams	\$21,500,000	2020-2029
104th Ave.	Colorado Blvd. to McKay Rd.	Widen from 2 to 4 lanes	Adams	\$8,100,000	2020-2029
120th Ave.	I to E-470	Widen from 2 to 4 lanes	Adams	\$24,000,000	2020-2029
Broncos Pkwy./Easter Ave. corridor	Havana t to Parker Rd.	Multimodal corridor and intersection improvements	Arapahoe	\$35,000,000	2040-2050
County Line Rd	Phillips St. to University Blvd.	Widen from 2 to 4 lanes	Douglas	\$9,500,000	2020-2029
Gun Club Rd.	State Hwy. 30 to 6th Ave.	Widen from 2 to 4 lanes, includes stream crossing upgrade at Coal Creek, multimodal corridor improvements	Arapahoe	\$60,000,000	2020-2029
Gun Club Rd.	Quincy Ave. to Aurora Pkwy.	Widen from 2 to 4 lanes, multimodal corridor improvements, and transit service	Arapahoe	\$30,000,000	2020-2029
I-25 North	104th Ave. to 120th Ave.	Shoulders; general purpose lanes; bridge	Adams	\$70,000,000	2040-2050
I-25	Broadway	Interchange capacity	Denver	\$50,000,000	2020-2029
I-25	Lincoln Ave.	Interchange capacity	Douglas	\$49,400,000	2020-2029
I-25	Happy Canyon Rd.	Interchange reconstruction	Douglas	\$30,000,000	2020-2029



I-25	Meadows Pkwy/Founders Pkwy	Interchange reconstruction	Douglas	\$50,000,000	2040-2050
I-25	Crystal Valley Pkwy.	New interchange and south frontage road	Douglas	\$80,000,000	2020-2029
I-225/Yosemite St.	DTC Blvd. to I-25 on-ramp	Interchange and ramp reconstruction	Arapahoe	\$60,000,000	2020-2029
Indiana (State Hwy. 72)	W. 80th Ave. to W. 86th Pkwy.	Widen from 2 to 4 lanes	Jefferson	\$39,000,000	2030-2039
Kipling St.	Kentucky Ave. to I-70	Multimodal corridor improvements	Jefferson	\$250,000,000	2040-2050
Lincoln Ave.	Oswego to Keystone	Multimodal corridor improvements	Douglas	\$24,000,000	2020-2029
Martin Luther King Jr. Blvd.	Havana St./Iola St. to Peoria St.	Widen 2 to 4 lanes; new 4-lane road	Denver	\$15,000,000	2020-2029
Peña Blvd.	I-70 to 64th Ave.	Add 1 managed lane in each direction	Denver	\$139,000,000	2030-2039
Peña Blvd.	64th Ave. to E-470	Add 1 managed lane in each direction	Denver	\$124,000,000	2030-2039
RidgeGate Pkwy.	Havana St. to Lone Tree eastern city limit	Widen from 2 to 4 lanes	Douglas	\$8,000,000	2020-2029
Smoky Hill Rd.	Buckley Rd. to Picadilly St.	Safety, operational, and multimodal corridor improvements and transit service	Arapahoe	\$10,000,000	2020-2029
State Hwy. 7	164th Ave. to Dahlia St.	Widen from 2 to 4 lanes	Adams	\$24,000,000	2020-2029
State Hwy. 30	Airport Blvd. to Quincy Ave.	Widen from 2 to 4 lanes, multimodal corridor improvements, and transit service	Arapahoe	\$175,000,000	2030-2039



State Hwy. 52	Weld County Rd. 1 to Weld County Rd. 13	Planning and Environment Linkages study outcomes — safety, operational and multimodal improvements	Weld	\$20,000,000	2040-2050
State Hwy. 66	U.S. Route 287/Main Street to E. County Line Rd.(Weld County Rd. 1)	Capacity, operations and bicycle/pedestrian	Boulder	\$15,000,000	2030-2039
State Hwy. 66	E. County Line Rd. (Weld County Rd. 1) to Weld County Rd. 19	Widen 2 to 4 lanes, pedestrian improvements	Weld	\$35,000,000	2040-2050
State Hwy. 93	State Hwy. 58 to State Hwy. 170	Widen from 2 to 4 lanes and safety/transit improvements	Jefferson	\$200,000,000	2030-2039
U.S. Route 6	Heritage Rd.	New interchange	Jefferson	\$30,000,000	2020-2029
U.S. Route 85 (Santa Fe)	C-470 to Bowles	Corridor planning/investment for multimodal mobility, operations and safety	Arapahoe	\$150,000,000	2040-2050
U.S. Route 85	Highlands Ranch Pkwy. to north of County Line Rd.	Widen from 4 to 6 lanes	Douglas	\$50,000,000	2020-2029
U.S. Route 287/120th Ave.	Midway Blvd. to Lowell Blvd.	Improve circulation, safety, active transportation access, business access, congestion and transit operations	Broomfield	\$150,000,000	2020-2029
Wadsworth Blvd.	35th Ave. to 48th Ave.	Widen from 4 to 6 lanes	Jefferson	\$31,000,000	2020-2029
Wadsworth Blvd.	17th Ave. to 35th Ave.	Multimodal corridor improvements	Jefferson	\$60,000,000	2040-2050

**Combined project and program costs from the Denver Regional Council of Governments total \$2,501,500,000.**



**Table 11. Regional Transportation District administered funds for multimodal capital projects and programs.**

Project name or corridor	Location or limits	Project description	County	Project cost	Staging period
Northwest Rail	Westminster Station to downtown Longmont	Implement peak period service plan	Adams, Boulder, Broomfield, Jefferson	\$700,000,000	2040-2050
Base System and FasTracks Debt Service	Varies	Repayment of debt service for the construction of RTD's FasTracks and base system	Regional	\$6,424,000,000	2020-2050
Base System and FasTracks Operations and Maintenance	Varies	On-going and preventative maintenance for transit vehicles and facilities to operate RTD's FasTracks and base system.	Regional	\$27,287,000,000	2020-2050

**Combined project and program costs from the Regional Transportation District total \$34,411,000,000.**



**Table 12. Regional bus rapid transit projects.**



Project name or corridor	Location or limits	Project description	County	Project cost	Staging period
New bus maintenance facility	TBD (RTD northern area)	Construction of a new bus maintenance facility in the RTD's northern service area	Regional	\$50,000,000	2020-2029
38th/Park BRT	Wadsworth Blvd to Colfax Ave.	Bus rapid transit service and supporting safety/multimodal improvements	Denver, Jefferson	\$40,000,000	2040-2050
Alameda BRT	Wadsworth to R-Line	Bus rapid transit service and supporting safety/multimodal improvements	Arapahoe, Denver, Jefferson	\$61,000,000	2030-2039
Broadway/Lincoln BRT	Colfax to Highlands Ranch Pkwy.	Bus rapid transit service and supporting safety/multimodal improvements	Arapahoe, Denver, Douglas	\$61,000,000	2030-2039
Colfax Ave. BRT	Union Station to I-225	Bus rapid transit service (dedicated lanes) and supporting safety/multimodal improvements	Adams, Arapahoe, Denver	\$250,000,000	2020-2029
Colfax Ave. Extension BRT	I-225 to E-470	Bus rapid transit service and supporting safety/multimodal improvements	Adams, Arapahoe	\$100,000,000	2020-2029
Colorado Blvd. BRT	A Line to I-25	Bus rapid transit service and supporting safety/multimodal improvements	Denver	\$35,000,000	2020-2029
Federal Blvd. BRT	120th to Santa Fe/Dartmouth	Bus rapid transit service and supporting safety/multimodal improvements	Adams, Denver	\$94,000,000	2020-2029
North I-25 BRT	Union Station to State Hwy. 119	Bus rapid transit service and supporting safety/multimodal improvements	Adams, Broomfield, Denver, Weld	\$97,000,000	2030-2039



Speer/Leetsdale/Parker BRT	Colfax to I-225	Bus rapid transit service and supporting safety/multimodal improvements	Arapahoe, Denver	\$95,000,000	2030-2039
State Hwy. 119 BRT	Downtown Boulder to downtown Longmont	Bus rapid transit service and supporting safety/multimodal improvements, including a separated bikeway	Boulder	\$200,000,000	2020-2029
State Hwy. 119 Extension BRT	Downtown Longmont to I-25/State Hwy. 119 mobility hub	Bus rapid transit service and supporting safety/multimodal improvements, including the Firestone-Longmont Mobility Hub	Boulder, Weld	\$100,000,000	2030-2039

**Combined project and program costs for regional bus rapid transit projects total \$1,183,000,000.**





**Table 13. Corridor transit planning projects and program.**



Project name or corridor	Location or limits	Project description	County	Project cost	Staging period
Regional mobility hubs	Varies	Construction of multimodal mobility hubs	Regional	\$200,000,000	2020-2050
Regional strategic transit	Varies	Investment in regional transit services including Bustang, human services transportation, and rural transportation	Regional	\$200,000,000	2020-2050
Castle Pines transit mobility corridor	Castle Pines to RidgeGate RTD Station	Transit corridor	Douglas	\$20,000,000	2030-2039
W. Colfax Ave.	Sheridan Blvd. to Broadway Blvd/Lincoln St.	Transit corridor and supporting safety/multimodal improvements	Denver	\$26,573,077	2040-2050
Golden/Mines autonomous circulator	Downtown Golden, School of Mines, RTD W Line	Autonomous circulator	Jefferson	\$3,500,000	2020-2029
RidgeGate Pkwy. transit mobility corridor	Mainstreet in Parker to Lone Tree City Center RTD Station	Transit corridor	Douglas	\$100,000,000	2040-2050
S. Boulder Rd.	Lafayette to Boulder	Multimodal corridor improvements	Boulder	\$75,000,000	2040-2050
State Hwy. 7	US-36/28th St. to 63rd St.	Convert two general purpose lanes to Business Access Transit (BAT) lanes	Boulder	\$150,000	2020-2029
State Hwy. 7	Boulder to Brighton	Multimodal corridor improvements	Adams, Arapahoe, Boulder, Weld	\$100,000,000	2030-2039



U.S. Route 36/28th St. and State Hwy. 93/Broadway	U.S. Route 36/28th St. and State Hwy. 93/Broadway	Transit corridor and supporting safety/multimodal improvements	Boulder	\$15,200,000	2030-2039
U.S. Route 287	U.S. Route 36 to Larimer County Line	Safety, operational and multimodal improvements	Boulder, Broomfield	\$200,000,000	2030-2039

**Combined project and program costs for corridor transit planning total \$940,423,077.**



**Table 14. Arterial safety/Regional Vision Zero/Complete Streets Retrofit projects and program.**

Project name or corridor	Location or limits	Project description	County	Project cost	Staging period
Arterial Safety/Regional Vision Zero/Complete Streets retrofits set-aside	High-Injury Network/critical corridors	Vision Zero, safety, and Complete Streets improvements	Regional	\$249,000,000	2020-2050
Brighton Blvd.	Race St to York St	Reconstruction, Vision Zero, safety and freight improvements	Denver	\$19,800,000	2040-2050
Chambers Rd.	40th Ave. to E. E. 56th	Vision Zero corridor improvements	Denver	\$16,700,000	2020-2029
Colfax safety improvements	Wadsworth Blvd to Sheridan Blvd	Multimodal arterial safety	Jefferson	\$12,000,000	2020-2029
Federal Blvd. multimodal improvements	52nd Ave. to 120th Ave.	Bicycle/pedestrian/transit improvements; Turn lanes; bus/business access lanes	Adams	\$50,000,000	2020-2029
W. Mississippi Ave.	South Federal Blvd. to S. Broadway	Vision Zero and pedestrian improvements	Denver	\$18,600,000	2020-2029
Sheridan safety improvements	52nd Ave. to Hampden Ave.	Vision Zero corridor improvements	Denver, Jefferson	\$17,100,000	2020-2029
State Hwy. 42	Louisville and Lafayette	Safety and operational improvements	Boulder	\$50,000,000	2030-2039
U.S. Route 36	Boulder to Lyons	Corridor safety improvements	Boulder	\$20,000,000	2020-2029
U.S. Route 85 operational and safety improvements	Weld County Rd. 2 to Weld County Rd. 10	Safety and operational improvements	Weld	\$6,100,000	2020-2029
U.S. Route 285 congestion mitigation improvements	Knox Ct./Lowell Blvd. (west) to Havana (east)	Speed and reliability corridor and Vision Zero improvements	Arapahoe, Denver	\$88,200,000	2020-2029



**Combined project and program costs for arterial safety, Regional Vision Zero, and Complete Streets retrofitting total \$547,500,000.**

*Table 15. Active transportation projects and program.*



Project name or corridor	Location or limits	Project description	County	Project cost	Staging period
Active transportation set-aside	Zones, areas, and corridors identified in the active transportation	Bicycle and pedestrian improvements	Regional	\$822,000,000	2020-2050
Bear Creek Trail	(not specified)	Upgrade trail for safe crossings and consistent cross section. Integrate intelligent transportation systems/artificial intelligence equipment.	Denver	\$31,200,000	2040-2050
Boulder to Erie Trail	Boulder to Erie	Regional trail	Boulder	\$6,000,000	2020-2029
Clear Creek Greenway	Jefferson County Line to Loveland Ski Area	Clear Creek Greenway portion of Peaks to Plains trail system	Clear Creek	\$50,000,000	2040-2050
McCaslin Regional trail	Rock Creeky Pkwy. to State Hwy. 128	Regional trail	Boulder	\$3,000,000	2020-2029
S. Platte River Trail	Northern city limits (near 53rd Ave.) to southern city limits (Harvard Ave.)	Complete missing links and upgrade trail section	Denver	\$25,000,000	2020-2029
S. Platte River Trail	Northern city limits (near 53rd Ave.) to southern city limits (Harvard Ave)	Complete missing links and upgrade trail section	Denver	\$25,000,000	2030-2039
Smith Rd. bicycle/pedestrian facilities	Peoria Street to Powhaton Rd.	New share use path	Adams	\$4,000,000	2020-2029
St. Vrain Greenway	Longmont to Lyons	Regional trail	Boulder	\$4,000,000	2020-2029



**Combined project and program costs for active transportation total \$970,200,000.**

***Table 16. Freight projects and program.***

Project name or corridor	Location or limits	Project description	County	Project cost	Staging period
Freight set-aside	Varies	Freight improvements including but not limited to bridge reconstructions, overpasses/underpasses, new bridges	Regional	\$76,000,000	2020-2050
47th Ave./48th Ave.	I-25 to Pecos St.	Bridge reconstruction, new multimodal underpass and new bicycle/pedestrian bridge	Denver	\$45,225,000	2040-2050
Alameda Pkwy. Bridge over I-225	Potomac St. and Abilene St.	Bridge reconstruction	Arapahoe	\$20,000,000	2020-2029
Peoria St. Bridge	Sand Creek	Bridge reconstruction	Adams	\$19,000,000	2020-2029
Ward Rd./BNSF	I-70 frontage road north and Ridge Rd.	Multimodal grade separation	Jefferson	\$60,000,000	2020-2029

**Combined project and program costs for freight total \$220,225,000.**

***Table 17. Local government funded projects and programs.***



Project name or corridor	Location or limits	Project description	County	Project cost	Staging period
104th Ave.	Marion St. to Colorado Blvd.	Widen from 4 to 6 lanes	Adams	\$6,276,340	2020-2029
104th Ave.	McKay Rd. to U.S. Route 85	Widen from 2 to 4 lanes	Adams	\$40,600,000	2020-2029
120th Ave.	E-470 to Picadilly Rd.	Widen from 2 to 6 lanes	Adams	\$15,500,000	2030-2039
120th Ave.	Sable Blvd. to E-470	Widen from 4 to 6 lanes	Adams	\$15,500,000	2030-2039
144th Ave.	U.S. Route 287 to Zuni St.	Widen from 2 to 4 lanes	Broomfield	\$21,200,000	2020-2029
144th Ave.	Washington St. to York St.	Widen from 2 to 4 lanes	Adams	\$12,795,250	2020-2029
144th Ave.	York St. to Colorado Blvd.	Widen from 2 to 4 lanes	Adams	\$10,433,050	2020-2029
152nd Ave.	Washington St. to York St.	Widen from 2 to 4 lanes	Adams	\$13,074,650	2030-2039
17th Ave.	Alpine St. to Ute Creek Dr.	Widen from 2 to 4 lanes	Boulder	\$2,302,510	2020-2029
48th Ave.	Imboden Rd. to Manila Rd.	Widen from 2 to 4 lanes	Adams	\$4,800,000	2030-2039
48th Ave.	Picadilly Rd. to Powhaton Rd.	New 6-lane road	Adams	\$40,706,040	2020-2029
48th Ave.	Powhaton Rd. to Monaghan Rd.	New 2-lane road	Adams	\$7,500,000	2020-2029
48th Ave.	Powhaton Rd. to Monaghan Rd.	Widen from 2 to 4 lanes	Adams	\$7,500,000	2030-2039
56th Ave.	E-470 to Powhaton Rd.	Widen from 2 to 6 lanes	Adams	\$19,400,000	2020-2029
56th Ave.	Havana St. to Peña Blvd.	Widen from 4 to 6 lanes	Denver	\$15,000,000	2030-2039





56th Ave.	Imboden Rd. to Schumaker Rd.	New 2-lane road	Adams	\$19,000,000	2040-2050
56th Ave.	Peña Blvd. to Tower Rd.	Widen from 4 to 6 lanes	Denver	\$17,300,000	2020-2029
56th Ave.	Peoria St. to Peña Blvd.	Widen from 2 to 4 lanes	Denver	\$40,000,000	2020-2029
56th Ave.	Picadilly Rd. to E-470	Widen from 2 to 6 lanes	Adams	\$9,696,450	2020-2029
56th Ave.	Powhaton Rd. to Imboden Rd.	Widen from 2 to 4 lanes	Adams	\$24,000,000	2030-2039
56th Ave	Genoa St. to Picadilly Rd.	Widen from 5 to 6 lanes	Denver	\$5,800,000	2020-2029
58th Ave.	Washington St. to York St.	Widen from 2 to 4 lanes	Adams	\$10,346,093	2020-2029
64th Ave.	Denver/Aurora city limit to Himalaya St.	Widen from 2 to 6 lanes	Adams	\$6,452,362	2020-2029
64th Ave.	Harvest Mile Rd. to Powhaton Rd.	New 2-lane road	Adams	\$6,452,362	2020-2029
64th Ave.	Harvest Mile Rd. to Powhaton Rd.	Widen from 2 to 4 lanes	Adams	\$10,934,700	2020-2029
64th Ave.	Himalaya Rd. to Harvest Mile Rd.	Widen from 2 to 4 lanes	Adams	\$39,000,000	2030-2039
64th Ave.	Himalaya Rd. to Harvest Mile Rd.	Widen from 4 to 6 lanes	Adams	\$39,000,000	2030-2039
64th Ave.	Powhaton Rd. to Monaghan Rd.	New 4-lane road	Adams	\$6,709,410	2020-2029
64th Ave.	Tower Rd. to Denver/Aurora City Limits	Widen from 2 to 4 lanes	Denver	\$700,000	2020-2029
6th Ave. (SH-30)	Airport Blvd to 6th Pkwy	Widen from 4 to 6 lanes	Arapahoe	\$24,257,000	2030-2039
6th Ave.	6th Pkwy. to Harvest Rd.	Widen from 2 to 6 lanes	Arapahoe	\$13,194,030	2020-2029



6th Ave.	Harvest Mile Rd. to Watkins Rd.	New 6-lane road	Arapahoe	\$19,200,000	2040-2050
6th Ave.	Manila Rd. to Schumaker Rd.	New 2-lane road	Arapahoe	\$9,600,000	2040-2050
6th Ave.	Watkins Rd. to Manila Rd.	New 4-lane road	Arapahoe	\$19,200,000	2040-2050
72nd Ave.	Simms St. to Kipling St.	Widen from 2 to 4 lanes	Jefferson	\$20,000,000	2030-2039
96th Ave.	I-76 to Heinz Way	Widen from 2 to 4 lanes	Adams	\$14,500,000	2020-2029
96th Ave.	State Hwy. 2 to Tower Rd.	Widen from 2 to 4 lanes	Adams	\$46,672,500	2030-2039
96th Ave.	Tower Rd. to Picadilly Rd.	Widen from 2 to 6 lanes	Adams	\$14,668,500	2030-2039
Arapahoe Rd.	Himalaya Way to Liverpool St.	Widen from 4 to 6 lanes	Arapahoe	\$6,176,772	2020-2029
Arapahoe Rd.	Waco St. to Himalaya St.	Widen from 2 to 6 lanes	Arapahoe	\$20,400,000	2020-2029
Bridges & culverts	Varies	'Bridge replacement, rehabilitation, preservation, and systematic repairs	Regional	\$3,367,673,000	2020-2050
Broncos Pkwy.	Havana St. to Peoria St.	Widen from 4 to 6 lanes	Arapahoe	\$8,134,350	2020-2029
Broncos Pkwy.	Jordan Rd. to Parker Rd.	Widen from 4 to 6 lanes	Arapahoe	\$6,934,200	2020-2029
Buckley Rd.	118th Ave. to Cameron Dr.	Widen from 2 to 6 lanes	Adams	\$13,897,737	2020-2029
Buckley Rd.	136th Ave. to Bromley Rd.	Widen from 2 to 4 lanes	Adams	\$7,747,000	2020-2029



C-470 eastbound (S. Kipling Pkwy. to I-25)	Broadway to I-25	Add 1 high- occupancy toll lane	Douglas	\$80,000,000	2030-2039
C-470 eastbound (S. Kipling Pkwy. to I-25)	S. Kipling Pkwy. to Wadsworth Blvd.	Add 1 high- occupancy toll lane	Jefferson	\$45,000,000	2020-2029
C-470 westbound (S. Kipling Pkwy. to I-25)	Colorado Blvd. to Lucent Blvd.	Add 1 high- occupancy toll lane	Douglas	\$80,000,000	2030-2039
C-470 westbound (S. Kipling Pkwy. to I-25)	Wadsworth Blvd. to S. Kipling Pkwy.	Add 1 high- occupancy toll lane	Jefferson	\$45,000,000	2020-2029
Canyonside Blvd.	Crowfoot Valley Rd. to Hess Rd.	New 4-lane road	Douglas	\$16,000,000	2030-2039
Chambers Rd./Bayou Gulch Rd.	Crowfoot Valley Rd. to Parker south town limit, new road	New 2-lane road	Douglas	\$5,000,000	2020-2029
Chambers Rd./Bayou Gulch Rd.	Crowfoot Valley Rd. to Parker south town limit, widening	Widen from 2 to 4 lanes	Douglas	\$4,500,000	2030-2039
Chambers Rd./Bayou Gulch Rd.	Parker Rd. to Vistancia Dr.	Widen from 2 to 4 lanes	Douglas	\$18,000,000	2040-2050
Chambers Rd./Bayou Gulch Rd.	Vistancia Dr. to southern boundary	New 2-lane road	Douglas	\$6,000,000	2020-2029
Chambers Rd./Bayou Gulch Rd.	Vistancia Dr. to southern boundary	Widen from 2 to 4 lanes	Douglas	\$6,000,000	2040-2050
Chambers Rd.	Crowfoot Valley Rd. to Hess Rd.	New 2-lane road	Douglas	\$19,500,000	2020-2029
Chambers Rd.	Crowfoot Valley Rd. to Hess Rd.	Widen from 2 to 4 lanes	Douglas	\$17,500,000	2030-2039



Chambers Rd.	Crowfoot Valley Rd. to Hess Rd.	Widen from 4 to 6 lanes	Douglas	\$12,000,000	2040-2050
Chambers Rd.	E-470 to Arapahoe/Douglas County Line	Widen from 4 to 6 lanes	Douglas	\$12,500,000	2040-2050
Chambers Rd.	Hess Rd. to Mainstreet	Widen from 4 to 6 lanes	Douglas	\$10,000,000	2040-2050
Chambers Rd.	Mainstreet to Lincoln Ave.	Widen from 4 to 6 lanes	Douglas	\$16,000,000	2040-2050
Colorado Blvd.	144th Ave. to 156th Ave.	Widen from 2 to 4 lanes	Adams	\$23,500,000	2030-2039
Colorado Blvd.	156th Ave. to 168th Ave.	New 4-lane road	Adams	\$23,500,000	2030-2039
Crowfoot Valley Rd.	Chambers Rd. to Stroh Rd.	Widen from 2 to 4 lanes	Douglas	\$11,500,000	2030-2039
Crowfoot Valley Rd.	Founders Pkwy. to Macanta Rd./Canyonside Blvd.	Widen from 2 to 4 lanes	Douglas	\$10,000,000	2030-2039
Crowfoot Valley Rd.	Macanta Rd./Canyonside Blvd. to Chambers Rd.	Widen from 2 to 4 lanes	Douglas	\$38,000,000	2030-2039
E. Bromley Ln.	Tower Rd. to I-76	Widen from 4 to 6 lanes	Adams	\$1,853,032	2020-2029
E. Bromley Ln.	U.S. Route 85 to Sable Blvd.	Widen from 4 to 6 lanes	Adams	\$1,333,500	2020-2029
E. County Line Rd.	9th Ave. to State Hwy. 66	Widen from 2 to 4 lanes	Boulder	\$9,779,000	2030-2039
East County Line Rd.	SH-7 to Arapahoe Rd Relocation	Widen from 2 to 4	Boulder, Weld	\$12,000,000	
East County Line Rd.	SH-7 to Arapahoe Rd Relocation	Widen from 2 to 4	Weld	\$12,000,000	
Green Valley Ranch Blvd.	Chambers Rd. to Peña Blvd.	Widen from 4 to 6 lanes	Denver	\$9,900,000	2020-2029



Green Valley Ranch Blvd.	Peña Blvd. to Tower Rd.	Widen from 4 to 6 lanes	Denver	\$1,700,000	2020-2029
Hampden Ave.	Picadilly Rd. to Gun Club Rd.	Widen from 2 to 4 lanes	Arapahoe	\$12,353,544	2020-2029
Harvest Mile Rd./Powhaton Rd.	I-70 to 26th Ave.	New 4-lane road	Adams	\$12,000,000	2020-2029
Harvest Mile Rd./Powhaton Rd.	I-70 to 26th Ave.	Widen from 4 to 6	Adams	\$8,000,000	2030-2039
Harvest Mile Rd.	56th Ave. to 64th Ave.	New 3-lane road	Adams	\$6,452,235	2020-2029
Harvest Mile Rd.	56th Ave. to 64th Ave.	Widen from 3 to 6 lanes	Adams	\$7,760,970	2030-2039
Harvest Mile Rd.	Jewell Ave. to Mississippi Ave.	Widen from 2 to 6 lanes	Arapahoe	\$13,313,410	2030-2039
Harvest Rd.	6th Ave. to I-70	New 6-lane road	Arapahoe	\$13,313,410	2020-2029
Harvest Rd.	Alameda Ave. to 1st Ave.	Widen from 4 to 6 lanes	Arapahoe	\$6,657,340	2020-2029
Harvest Rd.	Mississippi Ave. to Alameda Ave.	Add new 6-lane road	Arapahoe	\$13,313,410	2020-2029
Havana St.	Lincoln Ave.	Grade separation of Havana St. and Lincoln Ave. with safety, operational, and multimodal corridor improvements	Douglas	\$60,000,000	2020-2029
Hess Rd.	Canyonside Blvd. to Chamber Rd.	Widen from 2 to 4 lanes	Douglas	\$17,000,000	2030-2039
Hilltop Rd.	Canterberry Pkwy. to Singing Hills Rd.	Widen from 2 to 4 lanes	Douglas	\$20,000,000	2020-2029



Huron St.	150th Ave. to 160th Ave.	Widen from 2 to 4 lanes	Broomfield	\$8,572,500	2020-2029
Huron St.	160th Ave. to State Hwy. 7	Widen from 2 to 4 lanes	Broomfield	\$5,080,000	2020-2029
I-70	32nd Ave. Interchange	Interchange reconstruction	Jefferson	\$22,400,000	2020-2029
I-70	Harvest Mile Rd.	Add new interchange	Adams, Arapahoe	\$39,566,215	2020-2029
I-70	Picadilly Rd.	Add new interchange	Adams	\$27,490,547	2020-2029
I-76	Bridge St.	Add new interchange	Adams	\$25,400,000	2020-2029
I-76	WCR 8	New interchange	Weld	\$180,000,000	2020-2029
Imboden Mile Rd./Quail Run Rd.	29th Ave./Quail Run Rd to Imboden Rd./40th Ave.	New 4-lane road	Adams	\$24,000,000	2030-2039
Imboden Mile Rd.	40th Ave. to 48th Ave.	Widen from 2 to 4 lanes	Adams	\$4,000,000	2030-2039
Imboden Rd.	48th Ave. to 56th Ave.	Widen from 2 to 4 lanes	Adams	\$24,000,000	2030-2039
Jewell Ave.	E-470 to Gun Club Rd.	Widen from 2 to 6 lanes	Arapahoe	\$4,848,860	2020-2029
Jewell Ave.	Gun Club Rd. to Harvest Mile Rd.	Widen from 2 to 6 lanes	Arapahoe	\$9,950,450	2020-2029
Jewell Ave.	Harvest Rd. to Monaghan Rd.	Widen from 2 to 6 lanes	Arapahoe	\$9,700,000	2030-2039
Jewell Ave.	Himalaya St. to E-470	Widen from 3 to 6 lanes	Arapahoe	\$13,194,030	2020-2029
Jewell Ave.	Monaghan Rd. to Watkins Rd.	Widen from 2 to 4 lanes	Arapahoe	\$14,400,000	2030-2039
Lincoln Ave.	1st St. to Keystone Blvd.	Widen from 4 to 6 lanes	Douglas	\$18,000,000	2030-2039



Lincoln Ave.	Keystone Blvd. to Parker Rd.	Widen from 4 to 6 lanes	Douglas	\$20,250,000	2020-2029
Lincoln Ave.	Peoria St. to 1st Ave.	Widen from 4 to 6 lanes	Douglas	\$4,000,000	2030-2039
Mainstreet	Canterberry Pkwy. to Delbert Rd.	Widen from 2 to 4 lanes	Douglas	\$28,000,000	2040-2050
Manila Rd.	6th Ave. to I-70	New 4-lane road	Arapahoe	\$5,000,000	2030-2039
Manila Rd.	I-70 to 48th Ave.	Widen from 2 to 4 lanes	Adams	\$15,000,000	2030-2039
McIntyre St.	52nd Ave. to 60th Ave.	Widen from 2 to 4 lanes	Jefferson	\$6,500,000	2020-2029
Monaghan Rd.	26th Ave. to 56th Ave.	Widen from 2 to 4 lanes	Adams	\$26,000,000	2030-2039
Monaghan Rd.	56th Ave. to 64th Ave.	New 4-lane road	Adams	\$25,000,000	2030-2039
Monaghan Rd.	I-70 to 26th Ave.	New 4-lane road	Adams	\$25,000,000	2030-2039
Monaghan Rd.	Quincy Ave. to Yale Ave.	New 6-lane road	Arapahoe	\$22,860,000	2030-2039
Nelson Rd.	75th St. to Affolter Dr.	Widen from 2 to 4 lanes	Boulder	\$5,198,110	2020-2029
New non-regional roadway system	Varies	'Construction of new arterials, collectors, and local roads	Regional	\$48,275,895,000	2020-2050
NW Pkwy Managed Lanes (96th St).	96th St. west of Northwest Pkwy. to State Hwy. 128	Add 2 toll lanes	Broomfield	\$39,370,000	2020-2029
Pace St.	5th Ave. to 17th Ave.	Widen from 2 to 4 lanes	Boulder	\$3,827,780	2020-2029
Pecos St.	52nd Ave. to 0.72 miles north of 52nd Ave.	Widen from 2 to 4 lanes	Adams	\$8,647,748	2020-2029
Peña Blvd.	E-470 to Jackson Gap St.	Widen from 6 to 8 lanes	Denver	\$33,000,000	2020-2029



Peña Blvd.	Gun Club Rd.	Interchange capacity	Denver	\$15,000,000	2020-2029
Peña Blvd.	Jackson Gap St. west ramps to DEN terminal	Widen from 6 to 8 lanes	Denver	\$10,200,000	2020-2029
Peoria St.	0.75 miles south of Lincoln Ave. to Mainstreet/RidgeGate Pkwy.	Widen from 2 to 4 lanes	Douglas	\$5,000,000	2030-2039
Peoria St.	E-470 to 0.75 mile south of Lincoln Ave.	Widen from 2 to 4 lanes	Douglas	\$7,000,000	2030-2039
Picadilly Rd.	48th Ave. to 56th Ave.	Widen from 2 to 6 lanes	Adams	\$13,568,680	2020-2029
Picadilly Rd.	56th Ave. to 70th Ave./Aurora city limits	New 6-lane road	Adams	\$20,353,020	2020-2029
Picadilly Rd.	6th Pkwy. to Colfax Ave.	Widen from 2 to 6 lanes	Arapahoe	\$5,000,000	2020-2029
Picadilly Rd.	70th Ave. to 82nd Ave.	New 6-lane road	Denver	\$11,400,000	2020-2029
Picadilly Rd.	82nd Ave. to 96th Ave.	New 6-lane road	Adams	\$21,590,000	2030-2039
Picadilly Rd.	96th Ave. to 120th Ave.	New 6-lane road	Adams	\$49,022,000	2030-2039
Picadilly Rd.	Colfax Ave. to I-70	New 6-lane road	Adams	\$12,904,724	2020-2029
Picadilly Rd.	I-70 to Smith Rd.	Widen from 2 to 6 lanes	Adams	\$5,332,730	2020-2029
Picadilly Rd.	Smith Rd. to 48th Ave.	Widen from 2 to 6 lanes	Adams	\$22,496,780	2020-2029
Picadilly Rd.	State Hwy. 30 to 6th Pkwy.	New 4-lane road	Arapahoe	\$7,000,000	2020-2029
Plum Creek Pkwy.	Gilbert St. to Ridge Rd.	Widen from 2 to 4 lanes	Douglas	\$5,080,000	2020-2029





Plum Creek Pkwy.	Wolfensberger Rd. to I-25	Widen from 2 to 4 lanes	Douglas	\$5,080,000	2020-2029
Powhaton Rd.	26th Ave. to 48th Ave.	Widen from 2 to 6 lanes	Adams	\$40,000,000	2020-2029
Powhaton Rd.	Jewell Ave. to 26th Ave.	Widen from 2 to 4 lanes	Adams, Arapahoe	\$24,500,000	2040-2050
Powhaton Rd.	Smoky Hill Rd. to County Line Rd.	Widen from 2 to 6 lanes	Arapahoe	\$3,491,230	2030-2039
Prairie Hawk Dr.	.2miles s/Topeka Way to Morningbird LN	Widen from 2 to 4	Douglas	\$9,000,000	2030-2039
Prairie Hawk Dr.	Plum Creek Pkwy to .2miles s/Topeka Way	Add New Road	Douglas	\$9,000,000	2030-2039
Quail Run Rd.	6th Ave. to I-70	New 4-lane road	Arapahoe	\$5,000,000	2040-2050
Quail Run Rd.	I-70 to 29th Ave./Quail Run Rd.	New 4-lane road	Adams	\$36,391,342	2030-2039
Quebec St.	120th Ave. to 128th Ave.	Widen from 2 to 4 lanes	Adams	\$8,432,800	2020-2029
Quebec St.	132nd Ave. to 160th Ave.	Widen from 2 to 4 lanes	Adams	\$21,010,880	2020-2029
Quincy Ave.	Hayesmount Rd. to Watkins Rd.	Widen from 2 to 6 lanes	Arapahoe	\$16,002,000	2030-2039
Quincy Ave.	Irving St. to Federal Blvd.	New 2-lane road	Arapahoe	\$3,810,000	2020-2029
Quincy Ave.	Monaghan Rd. to Hayesmount Rd.	Widen from 2 to 6 lanes	Arapahoe	\$18,935,700	2030-2039
Quincy Ave.	Plains Pkwy. to Gun Club Rd.	Widen from 2 to 6 lanes	Arapahoe	\$13,335,000	2020-2029
Quincy Ave.	Simms St. to Kipling Pkwy.	Widen from 2 to 4 lanes	Jefferson	\$12,001,500	2020-2029
Rampart Range Rd.	Waterton Rd. to Titan Rd.	Widen from 2 to 4 lanes	Douglas	\$10,000,000	2030-2039
Ridge Rd.	Plum Creek Pkwy. To State Hwy. 86	Widen from 2 to 4 lanes	Douglas	\$3,810,000	2020-2029



Sheridan Pkwy.	Lowell Blvd. to Northwest Pkwy.	Widen from 2 to 4 lanes	Broomfield	\$7,620,000	2020-2029
Sheridan Pkwy.	Northwest Pkwy. to Preble Creek	Widen from 2 to 4 lanes	Broomfield	\$5,715,000	2020-2029
Smoky Hill Rd.	Pheasant Run Pkwy. to Versailles Pkwy.	Widen from 4 to 6 lanes	Arapahoe	\$33,909,000	2030-2039
State Hwy. 58	Cabela St.	Add new interchange	Jefferson	\$19,558,000	2020-2029
State Hwy. 7	Boulder County Line to Sheridan Pkwy.	Widen from 2 to 4 lanes	Broomfield	\$6,604,000	2020-2029
State Hwy. 7	Riverdale Rd. to U.S. Route 85	Widen from 2 to 4 lanes	Adams	\$16,319,500	2030-2039
State Hwy. 7	Sheridan Pkwy. to I-25	Widen from 2 to 6 lanes	Broomfield	\$10,172,700	2020-2029
Stephen D. Hogan Pkwy. (6th Pkwy.)	E-470 to Gun Club Rd.	Widen from 2 to 6 lanes	Arapahoe	\$34,904,680	2030-2039
Stephen D. Hogan Pkwy. (6th Pkwy.)	State Hwy. 30 to E-470	Widen from 2 to 6 lanes	Arapahoe	\$34,904,680	2030-2039
Stroh Rd.	Chambers Rd. to Crowfoot Valley Rd.	New 4-lane road	Douglas	\$14,000,000	2020-2029
Stroh Rd.	Crowfoot Valley Rd. to J. Morgan Blvd.	Widen from 2 to 4 lanes	Douglas	\$9,250,000	2020-2029



System preservation, enhancement, and operations	Varies	'Road resurfacing; traffic signals, optimization, communication, variable message signs; and other systematic repairs and preventative maintenance	Regional	\$17,025,351,000	2020-2050
Titan Rd.	Rampart Range Rd. to Santa Fe Dr.	Widen from 2 to 4 lanes	Douglas	\$25,000,000	2030-2039
Toll authority debt service	Varies	'Repayment of debt service for the construction of toll facilities	Regional	\$1,850,678,000	2020-2050
Tower Rd./Buckley Rd.	105th Ave. to 118th Ave.	New 4-lane road	Adams	\$8,801,100	2020-2029
Tower Rd.	45th Ave. to Green Valley Ranch Blvd. (48th Ave.)	Widen from 4 to 6 lanes	Denver	\$2,500,000	2020-2029
Tower Rd.	48th Ave. to 56th Ave.	Widen from 4 to 6 lanes	Denver	\$5,300,000	2020-2029
Tower Rd.	56th Ave. to Peña Blvd.	Widen from 4 to 6 lanes	Denver	\$16,000,000	2020-2029
Tower Rd.	6th Ave. to Colfax Ave.	New 2-lane road	Arapahoe	\$25,820,370	2020-2029
Tower Rd.	6th Ave. to Colfax Ave.	Widen from 2 to 6 lanes	Arapahoe	\$25,820,370	2030-2039
Tower Rd.	Colfax Ave. to Smith Rd.	Widen from 2 to 6 lanes	Adams	\$8,727,440	2020-2029



Tower Rd.	Peña Blvd. to 105th Ave.	Widen from 4 to 6 lanes	Adams	\$20,000,000	2020-2029
U.S. Route 85	Titan Rd. to Highlands Ranch Pkwy.	Widen from 4 to 6 lanes	Douglas	\$5,000,000	2030-2039
Washington St.	152nd Ave. to 160th Ave.	Widen from 2 to 6 lanes	Adams	\$37,300,000	2020-2029
Waterton Rd.	State Hwy. 121 to Campfire St.	Widen from 2 to 4 lanes	Douglas	\$16,000,000	2030-2039
Watkins Rd.	Quincy Ave. to I-70	Widen from 2 to 6 lanes	Arapahoe	\$54,673,500	2030-2039
Wolfensberger Rd.	Coachline Rd. to Prairie Hawk Dr.	Widen from 2 to 4 lanes	Douglas	\$7,500,000	2030-2039
Yale Ave.	Monaghan Rd. to Hayesmount Rd.	Widen from 2 to 6 lanes	Arapahoe	\$17,335,500	2030-2039
York St.	152nd Ave. to E-470	Widen from 2 to 4 lanes	Adams	\$13,074,650	2030-2039
York St.	160th Ave. (State Hwy. 7) to 168th Ave.	Widen from 2 to 4 lanes	Adams	\$7,493,000	2020-2029
York St.	78th Ave. to State Hwy. 224	Widen from 2 to 4 lanes	Adams	\$12,800,000	2020-2029
York St.	88th Ave. to 78th Ave.	Widen from 2 to 4 lanes	Adams	\$13,500,000	2020-2029
York St.	E-470 to State Hwy. 7	Widen from 2 to 4 lanes	Adams	\$10,668,000	2020-2029
York St.	State Hwy. 224 to 58th Ave.	Widen from 2 to 4 lanes	Adams	\$20,000,000	2020-2029

**Combined local project and program costs total \$73,665,664,273.**

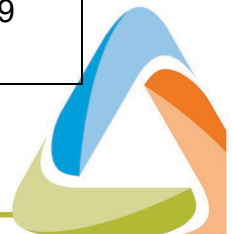
***Table 18. Public highway toll authority projects and programs.***



Project name or corridor	Location or limits	Project description	County	Project cost	Staging period
E-470 multiuse trails	Varies	Trail projects anticipated to be linked with E-470 widenings	Adams, Arapahoe, Douglas	\$28,600,000	2020-2050
E-470 pavement overlays	Varies	Pavement overlays needed before reconstruction associated with anticipated widenings	Adams, Arapahoe, Douglas	\$25,618,000	2020-2050
E-470 ramp signalization and geometric improvements	Varies	Signalize ramp terminal intersections and geometric interchange improvements	Adams, Arapahoe, Douglas	\$62,444,000	2020-2050
E-470 renewal and replacement program	Varies	Infrastructure renewal, replacement and maintenance items	Adams, Arapahoe, Douglas	\$679,022,419	2020-2050
E-470	U.S. Route 85 to I-25 North	Widen 4 to 6 lanes	Adams	\$28,000,000	2030-2039
E-470	I-76 to U.S. Route 85	Widen 4 to 6 lanes	Adams	\$21,096,000	2030-2039
E-470	Peoria St	Widen to 6 through-lanes plus turn lanes	Adams	\$21,096,000	2030-2039
E-470	Sable Blvd	New interchange	Adams	\$16,000,000	2020-2029



E-470	104th Ave. to I-76	Widen 4 to 6 lanes	Adams	\$106,500,000	2020-2029
E-470	Peña Blvd. to I-76	Widen 6 to 8 lanes	Adams	\$27,700,000	2030-2039
E-470	I-76	Add ramps for fully directional interchange	Adams	\$15,822,000	2030-2039
E-470	I-76	Add ramps for fully directional interchange	Adams	\$18,000,000	2020-2029
E-470	112th Ave.	New interchange	Adams	\$15,822,000	2020-2029
E-470	Peña Blvd.	Add separated auxillary lanes	Denver	\$23,000,000	2020-2029
E-470	I-70 to 104th Ave.	Widen 4 to 6 lanes	Adams	\$30,589,000	2020-2029
E-470	88th Ave.	New interchange	Adams	\$102,000,000	2020-2029
E-470	48th Ave.	New Interchange	Adams	\$19,885,000	2020-2029
E-470	38th Ave	New Interchange	Adams	\$56,950,000	2020-2029
E-470/I-70 interchange Complex	I-70	Directional I-70 interchanges	Adams, Arapahoe	\$74,000,000	2020-2029
E-470	Quincy Ae. to I-70	Widen 4 to 6 lanes	Arapahoe	\$83,100,000	2020-2029
E-470	Smoky Hill Rd to I-70	Widen 6 to 8 lanes	Arapahoe	\$41,000,000	2020-2029
E-470	Parker Rd. to Smoky Hill	Widen 6 to 8 lanes	Arapahoe, Douglas	\$109,000,000	2020-2029
E-470	I-25 South to Parker Rd.	Widen 6 to 8 lanes	Douglas	\$1,750,000	2020-2029
Jefferson Pkwy.	State Hwy. 128/96th St. to State Hwy. 93 north of 64th Ave.	New 4-lane road	Jefferson	\$51,816,000	2020-2029



Jefferson Pkwy.	Indiana St./State Hwy. 128	Add New Interchange	Jefferson	\$51,816,000	2020-2029
Jefferson Pkwy.	Candelas Pkwy.	Add new interchange	Jefferson	\$51,816,000	2020-2029
Jefferson Pkwy.	Simms St.	Add new interchange	Jefferson	\$51,816,000	2020-2029
Jefferson Pkwy.	State Hwy. 72	Add new interchange	Jefferson	\$51,816,000	2020-2029

**Combined public highway toll authority project and program costs total \$1,866,074,419.**





## Appendix B. Summary of transportation model calibration and validation



## Introduction

The Denver Regional Council of Governments maintains the Regional UrbanSim Socio-economic Model and the Focus regional travel demand modeling system. Outputs from the Focus Model are used in the Motor Vehicle Emission Simulator model by the Colorado Department of Public Health and Environment to calculate emissions of several pollutants:

- Greenhouse gas CO<sub>2</sub>
- Ozone precursors: Nitrogen oxides and volatile organic compounds
- Particulate matter 10 microns or less

The Focus Model simulates the millions of trips made throughout the region on a typical weekday. It considers virtually all the types of decisions considered by people when making choices on where, when and how to travel, whether for a two-block walk to the store, or a cross-region drive to visit relatives. Currently, there are about 15 million trips made by individuals every weekday. The Focus Model sums all travel to forecast how many vehicles will be driven on major roads, travel speed and delay, as well as how many people will walk, ride a bicycle or use transit to get to where they want to go. To realistically simulate each person's daily household travel, the Focus Model simulates the many choices each person makes through activity-based model components including:

1. Where to work.
2. Where to go to school.
3. How many automobiles are available in the person's household.
4. How many trips each person makes in a day, and for what purposes.
5. Which trips are chained together within home-to-home tours.
6. The location where each individual trip begins and ends.
7. The travel mode used for each trip.
8. Which roadways or bus routes were chosen to reach each destination.

In addition to the activity-based model components for household travel, the Focus model also incorporates three add-on gravity models for:

- Commercial vehicle trips by light, medium and heavy-duty vehicles. This model reflects non-household vehicles used for everything from the hauling of large goods, construction materials and small packages to the provision of business and household services (e.g., electrical, plumbing, health care, landscaping). An estimated 1.7 million commercial vehicle trips are made within the region every day.
- External station trips starting or ending outside the DRCOG modeling area. This model represents trips that pass through the region (such as on I-25 from Colorado Springs to Fort Collins) and trips between the inside of the Denver region and outside (such as between Denver and Summit County).
- Denver International Airport trips – for trips not fully captured by the activity-based model components. Denver International Airport is unique in terms of the types of trips and vehicles: drop-offs/pick-ups, rental cars, shuttle vehicles and employees.



An UrbanSim model is used to forecast household and employment levels by small-area transportation analysis zones. The Focus Model considers many characteristics of people, such as their age, gender, employment status and income, as well as how the region's demographics will change over time. It also considers characteristics of the built environment, such as transit stops and stations, household and employment density, bicycling facilities, shared-use paths, sidewalks and walkability. The Focus Model creates an origin and destination for each trip (15 million weekday trips in the 2020 base model). Specific groupings of origins and destinations were initially estimated based on detailed data from a 1998 survey called the Travel Behavior Inventory. In 2016, the Focus Model was recalibrated using more recent data sources including roadway counts, transit boardings, American Community Survey Census data and results from the following surveys:

- The Regional Transportation District's 2008 Regional On-Board Transit Survey – a questionnaire handed out to light rail and bus travelers to understand transit travel patterns and choice factors. The survey contains information on almost 24,000 transit trips.
- The 2010 Front Range Travel Counts Household Survey – a survey of over 12,000 households along the Colorado Front Range, including 7,000 in the Denver region, using a format similar to the 1998 Travel Behavior Inventory described above.

In 2020 and 2022, further refinements were made to the Focus Model based on additional results of the 2010 Front Range Travel Counts Survey, the 2016 Commercial Vehicle Survey and RTD's updated 2018 Regional On-Board Survey. The final trip assignment outputs of Focus were validated against traffic counts, operating travel speed observations, and RTD ridership data to make sure the overall regional travel patterns being forecasted were reasonable.



## Regional socio-economic forecasts

DRCOG staff uses county-level forecasts of population, households and employment produced by the Colorado State Demography Office as the basis for future growth reflected in the Focus Model. Table 19 shows the population, household and employment forecasts by model staging years for the DRCOG full region and the metropolitan planning organization area.

**Table 19. Socio-economic forecasts.**

	Model Area	DRCOG	MPO
<b>2025</b>			
Population	3,655,852	3,609,906	3,583,810
Households	1,513,712	1,497,432	1,486,067
Employment	2,343,134	2,320,916	2,308,241
<b>2030</b>			
Population	3,855,518	3,805,523	3,776,311
Households	1,588,772	1,570,673	1,558,656
Employment	2,467,276	2,440,736	2,427,554
<b>2040</b>			
Population	4,232,276	4,174,425	4,140,898
Households	1,761,980	1,740,370	1,726,703
Employment	2,733,137	2,702,026	2,687,621
<b>2050</b>			
Population	4,456,092	4,386,631	4,348,527
Households	1,882,036	1,854,938	1,839,296
Employment	3,000,648	2,964,774	2,948,769



## Small area development forecasts

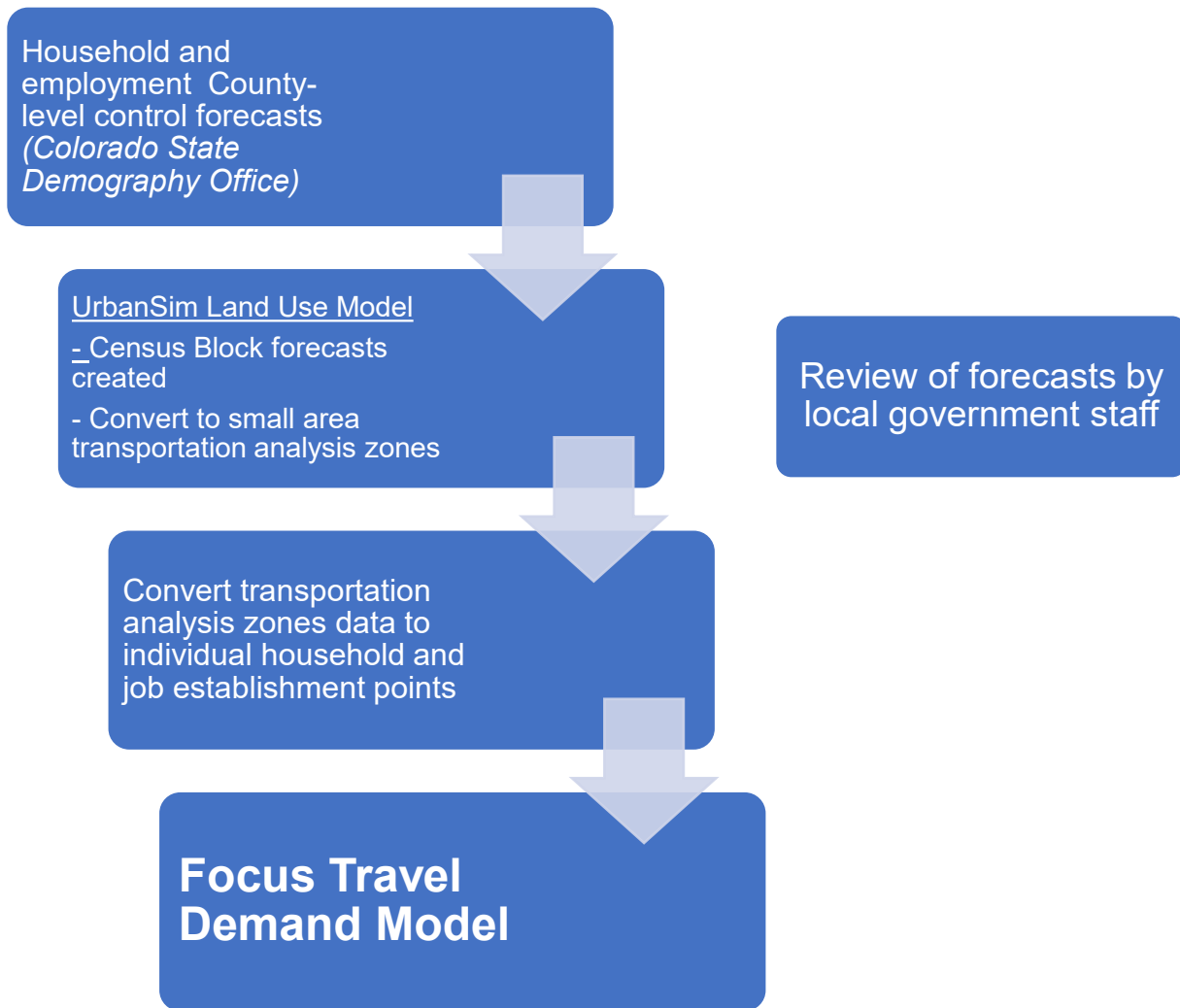
To provide household and employment data at a level of detail necessary for the travel model, the regional socioeconomic forecasts are disaggregated into 2,800 transportation analysis zones. The allocation of households and employment to transportation analysis zones is carried out within the UrbanSim model based on the dynamics of urban land markets and the simulated decisions of land developers and residential and commercial land customers. The UrbanSim model considers questions such as:

- What parcels of land are profitable for development, and for what uses?
- What is the level of transportation accessibility?
- Where should a firm locate to conduct its business in accordance with zoning regulations, and with suitable transportation access to workers, supplies and finished product markets?
- Does a family's current residence continue to meet its needs and be convenient to jobs, schools and other activities, or should the family move to a “better” location?
- What size and types of residence does a family need based on the number and ages of its members and its household income?
- Where are designated open spaces, parks and other undevelopable lands located?

The UrbanSim model outputs are used in a population synthesizer that creates a descriptive database record for each household in the region (about 1.4 million records for 2020) and each person (about 3.4 million records in 2020). Figure 5 shows a flowchart for the process of socioeconomic forecasting in the Denver region.



**Figure 5. Socioeconomic model elements and flow.**



## Focus Model process overview

Figure 6 shows a simplified diagram of how the Focus Model components flow after the socioeconomic forecast has been completed.

First, travel time and cost information between zones are calculated by travel mode and time of day. Tours are the first travel elements to be created. Figure 4 shows a diagram depicting an example set of tours for a person in one day, including intermediate stops.

The model runs through a set of steps for each tour, including activity generation, location choice, mode choice and time of day choice model components. Then the model runs through a parallel set of model components for each trip within a tour.

A key use of the model is to estimate the travel patterns that result from before and after changes to model network facilities or inputs. Such changes can be made to population/employment, road/transit projects, cost of transportation fuels, fares, and services and many other model factors. The model is designed to estimate varying output values (e.g., traffic volume, delays and ridership) due to people in the model adjusting travel paths, travel modes, and travel demand due to the model changes mentioned above. This includes newly induced trips or trips to destinations further away. For a new transportation project(s) the model clearly depicts:

- Diversion of existing (assigned) trips between different roadway paths or transit routes.
- Mode shift of trips between driving, auto passenger, transit, walk and bicycle.
- Increase in traffic volume or transit ridership due to planned household and employment developments.
- Induced new trips or longer trips due to significant changes in travel time.
- Induced trips associated with changes in the location or timing of developments (new housing units or employment establishments), within the limits of state established demographic control totals.



**Figure 6. Focus activity-based model elements.**

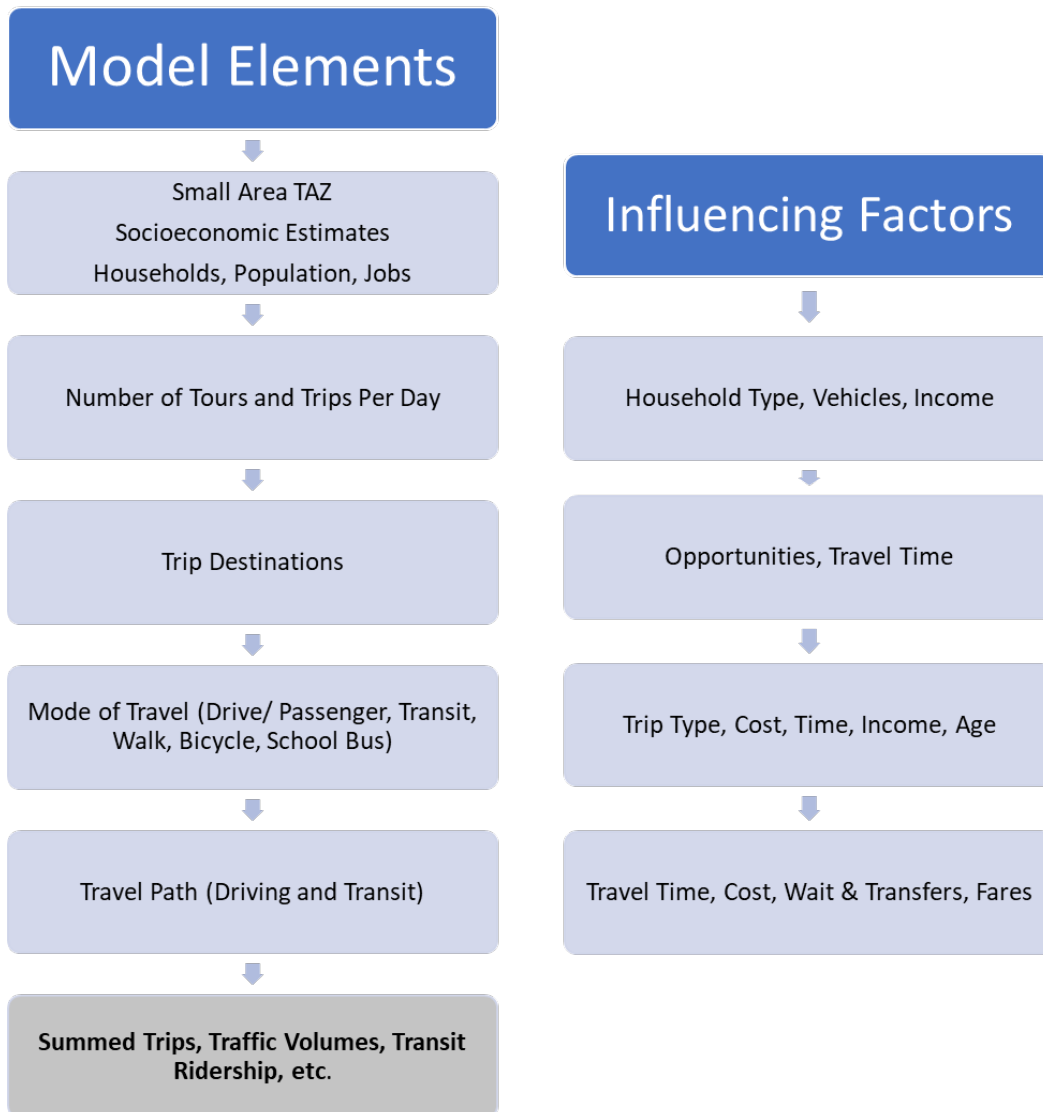
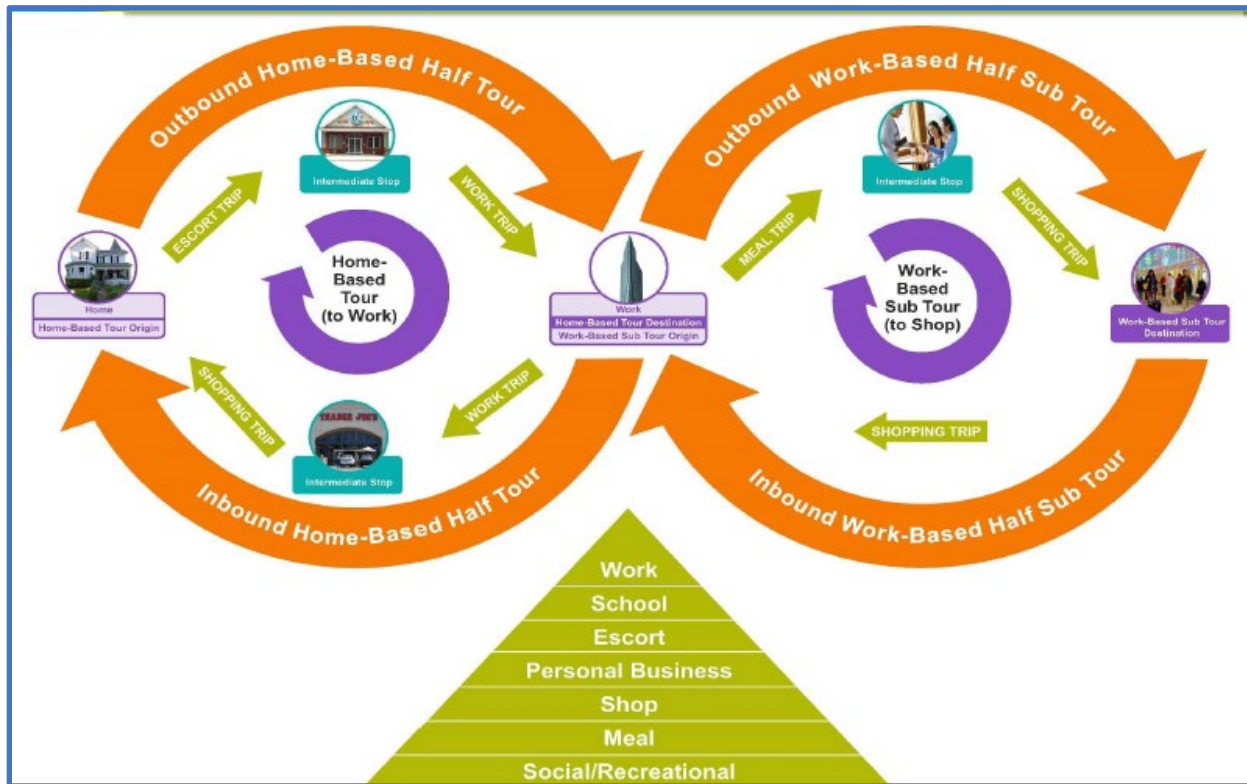


Figure 7. Sample tour diagram.



## Roadway and transit system

The most critical feature of the model is the representation of the transportation system. The roadway network is represented by over 25,000 directional road segments, described by location, length, number of lanes, functional classification and area type. High-occupancy vehicle and managed lanes also are represented as special links. Tollway links are assessed an additional cost impedance to reflect toll charges. The model also includes a fully detailed representation of transit facilities, including all bus and rapid transit lines, Park-n-Ride lots, bus stops, stations and walk access/egress routes. Bus routes follow the same roadway network as auto trips, and bus travel speeds are based on auto speeds. Bus rapid transit facilities use a formula to reflect less delay time than general purpose lane auto travel. Overall transit travel time also includes access, wait and transfer time. Rail speeds are developed based on transit schedule information. Capture areas for Park-n-Ride lots are quite broad, permitting trip-makers in the model to select the lot that produces the most convenient overall transit path to their destination. As part of the process of estimating roadway and transit use, minimum impedance travel paths are calculated using time, distance, fares, tolls and other operating costs.

## Model components

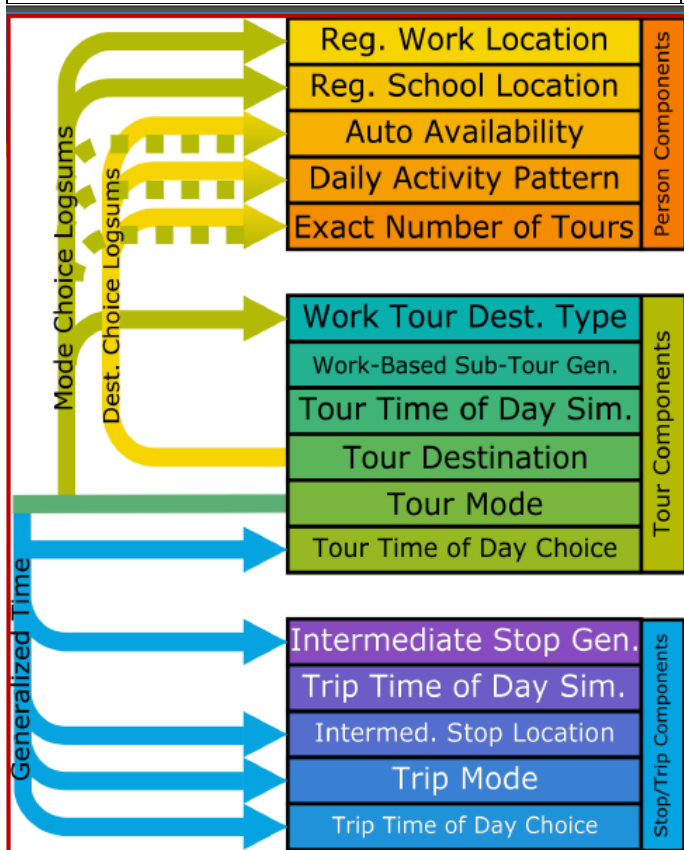
The most important model components are briefly described in the sections below, and Figure 8 lists all model components. Most model components are multinomial logit or nested logit models, which are statistical models that have two or more discrete choice outcomes.





**Figure 8. Key Focus model components (activity-based model components in red italics)**

1. TransCAD model software initialization	14. <i>Tour time of day simulation</i>
2. Size sum variable calculator	15. <i>Tour primary destination choice</i>
3. TransCAD trip generation	16. <i>Tour priority assignment</i>
4. TransCAD skimming (path selection)	17. <i>Tour main mode choice</i>
5. TransCAD airport, commercial vehicle, and external travel distribution and mode choice	18. <i>Tour time of day choice</i>
6. <i>Regular workplace location</i>	19. <i>Intermediate stop generation choice</i>
7. <i>Regular school location</i>	20. <i>Trip time of day simulation</i>
8. <i>Auto availability</i>	21. <i>Intermediate stop location choice</i>
9. <i>Aggregate destination choice log sum generation</i>	22. <i>Trip mode choice</i>
10. <i>Daily activity pattern</i>	23. <i>Trip time of day</i>
11. <i>Exact number of tours</i>	24. Write trips to TransCAD
12. <i>Work tour destination type</i>	25. TransCADhighway and transit assignment
13. <i>Work-based subtour generation</i>	



## Roadway and transit skims (path selection)

Representative roadway and transit paths are initially used for all origin-destination transportation analysis zone pairs (2,800 zones by 2,800 zones) and each of the ten time-of-day periods. The paths consider travel time, travel cost and other factors. The time and cost matrices are used extensively in later model components such as location choice, mode choice and time of day choice.

## Denver International Airport/commercial vehicle/internal-external/external-external vehicle trips

After optimal paths are identified via the skims, three additional Compass Gravity Model components must be run to generate and assign:

1. Trips to and from Denver International Airport
2. External trips to, from and through the DRCOG region
3. Commercial vehicle trips.

## Regular workplace and school location

The work location choice model assigns all regional workers a regular work location transportation analysis zone and point. Characteristics of the worker and their home location are used in combination with other characteristics to determine the relative attractiveness of each transportation analysis zone.

The regular school location choice model assigns each student a regular school location associated with a transportation analysis zone. The model uses information about the student, such as income and age as well as information like total school enrollment and distance from home to determine which schools will be attractive for students. There are four school location choice models by student grade level: pre-school, kindergarden-8th grade, 9th-12th grade and university. Four separate models are used to reflect the widely differing characteristics of school location decision making associated with each of the four grade ranges. The models are all multinomial logit with the choice being the location of the school zone.

## Auto availability choice

The auto availability choice model is a multinomial logit model that selects number of automobiles available for each household in the region. The choices range from zero cars to 4-plus cars. The model uses information about households such as income, household size and household accessibility to work and school to determine how many autos are available to households.

## Tour models

After the Focus Model has assigned the long-term decisions about work and school locations and auto availability, it forecasts daily activities of chained trips that start and end at home, known as tours.

The **daily activity pattern** model determines which combinations of up to seven purposes (work, school, escort a family member, personal business, shopping, dining and social or recreational) a person will make tours or stops along a tour.



The **exact number of tours** model determines how many tours of each type each person will make in their day. The tour types predicted for each person include: work, school, escort, personal business, shop, meal and social recreation.

The **work tour destination** type model determines whether a person making a work tour will travel to their usual work location, or somewhere else, perhaps to meet with clients or customers, or for off-site training. If the regular workplace is selected, this information is entered into the tours table in the database.

**Work-based subtour generation** determines whether someone will leave their regular workplace and return during the middle of the day. For example, a person may be eating out, running errands or attending meetings. After this point, the Focus Model treats work-based subtours similarly to home-based ones.

In reality, a person might consider the interactions of destination, mode and departure time choices together in creating an itinerary for the day's travel and activities. Despite its complexity, the Focus Model needs to have some simplifying assumptions to make its mathematical relationships and software workable. **Tour time of day simulation** is one such simplification, allowing destination and mode choices to be modeled as if the time of travel is known (so the right time and cost matrices can be used) as an initial guess. The simulated times of days are based on observed survey distributions. The later **tour time of day choice** confirms whether the initially simulated time of day was reasonable, or whether a shift earlier or later might be justified.

The **tour primary destination choice** model selects the destination of tour based the development (e.g., jobs and households) located within the zone. It then assigns a point within each zone as the final destination.

After the tour destination is known, the **tour main mode choice** model predicts the main travel mode used on the tour. The mode chosen is based on the impedances associated with each mode from the tour origin to the tour destination, zonal characteristics such as density, travel mode facilities, and demographic person characteristics. The tour main mode is used for most of the distance of the tour, but not necessarily for all trips. For example, if a parent is driving a child to school, the return trip would, necessarily, be driving alone. In other cases, stops along a tour might be close enough that walking or bicycling would be more attractive than a motorized tour mode. The tour and trip modes are related by rules of precedence used to simplify the Focus Model.

Given the known tour origin, destination and mode from previous models, the **tour arrival and departure time model** predicts the time arriving at the primary destination of the tour and the time leaving the primary destination, both to within one-hour periods.

## Trip models

After the tour-level models are run, a series of trip-level models are run. The first trip level model is the **intermediate stop generation** model, which determines the number of intermediate stops on each tour, if any.

As with the tour models, there is a **trip time of day simulation** component to simplify the location and mode choices that are modeled next.



The **intermediate stop location choice** model selects the zone for each intermediate stop. The locations of all intermediate stops on tours are modeled one at a time, first for stops from home to the primary activity and then for stops from the primary activity to home.

The **trip mode choice** model determines the mode of travel for all trips. The tour mode is used in combination with skim data, zonal data, and person data to determine the modes for each trip on these tours.

Given the origin, destination and mode of each trip, the **trip time of day choice** model predicts the time each intermediate stop will occur. The trip time of day choice model has 24 alternatives corresponding to each hour period.

After the trip models have been run, the following information is known for every trip internal to the region:

- Origin and destination zone and point location.
- Trip purpose (work, school, escort, personal business, shop, social recreation).
- Trip mode (driving alone, shared ride of two individuals, shared ride of three or more individuals, walk to transit, drive to transit, walk, bicycle, school bus).
- Trip time of day (one of 24 hours).
- Which tour the trip is part of.
- Which person made the trip.
- What household the person who made the trip belongs to.

The **write trips to TransCAD** component assembles the individual records for auto and transit trips into origin-destination trip tables (matrices) that Transportation Computer Assisted Design can use for assignment. These trip tables are then combined with those developed for DEN, commercial vehicle, internal-external, external-internal and external-external trips developed earlier.

## Network assignment

Household vehicle, airport trips, internal-external trips, commercial vehicle trips and external-external trips are assigned to the roadway network via a “user equilibrium” algorithm. The user equilibrium process assigns the trips between each origin and each destination transportation analysis zone in such a way that, by the end of the process, no trip can reduce its travel time by changing its path. The process accounts for the congestion produced by all other trips in the region, each trip is following its minimum path. High-occupancy vehicles are loaded simultaneously with single-occupant vehicles. During this process, TransCAD keeps track of which vehicles are eligible to use high-occupancy vehicle facilities, and which might need to pay a toll to use high-occupancy/toll lanes, such as the reversible I-25 express lanes north of downtown Denver. The model also accounts for the effect of toll costs in roadway route choice by converting toll costs into equivalent time cost using an estimated value of time for automobile trip-makers.

Transit assignment is performed separately, using an all-or-nothing algorithm that does not account for the possibility that high demand or crowding on some transit routes may motivate some riders to shift to other routes. RTD has special modeling tools that allow them to use Focus Model forecasts for more detailed operational planning.



Finally, the model is run through several iterations, feeding back the output speeds from roadway assignment to the input stages that require them as input (among them, the trip distribution stage) until the output speeds and the input speeds match closely enough.

### Core model outputs

Final core model results for the base validation year and future reporting years are presented below. Detailed output results are shown in Appendix A. Once comparisons were made of model results against the observed datasets, each model component was calibrated. The calibration involved changing the coefficients describing the mathematical models and travel and adding variables. Then the model was re-run, results compared again, and modifications made again. This process was repeated until satisfactory results were achieved.

The major regional level model results of the validation review for 2020 are shown in Table 20 and Table 21.

**Note the 2020 values actually represent the time and travel patterns prior to the COVID-19 pandemic.** These tables demonstrate that the aggregate model results reflect the observed representative counts and transit boardings sufficiently well. When summed over the region, the links with observed traffic counts were observed to carry about 28.0 million vehicles per weekday. The sum of Focus Model estimates was within 1% difference.

**Table 20. Sum of 2020 weekday observed traffic counts and modeled volumes**

	2019/2020 Observed counts sum of vehicle miles traveled	2020 Model link volume sum of vehicle miles traveled	Model variation
Colorado Department of Transportation roadways with counts	17,077,000	17,023,000	0.3%
Highway Performance Monitoring System roadways with counts	24,110,000	23,477,000	-2.6%
Highway Performance Monitoring System urbanized area network estimate	67,381,400	72,256,000	7.2%
All model links with counts	30,341,000	29,464,000	-2.9%



**Table 21. Observed estimates and modeled 2020 transit weekday boardings.**

	2019 observed (estimate)	2020 modeled	Model variation
RTD boardings	373,000	393,000	5.4%
RTD trips	261,000	264,000	1.1%

### **Air quality modeling**

Formal air pollutant emissions modeling is conducted by the Colorado Air Pollution Control Division for transportation conformity purposes and by DRCOG for greenhouse gas emission analyses. DRCOG, the Air Pollution Control Division and other agencies work closely together in this effort, both in developing the modeling techniques, assumptions, and parameters and in executing the model runs. Modeled link speed and vehicle miles traveled results from the Focus Model are principal inputs to the MOTO Vehicle Emission Simulator air pollutant emissions model. The model produces estimates of the amount of emissions of greenhouse gases, carbon monoxide, volatile organic compounds, oxides of nitrogen and particulate matter generated by motor vehicles. The results are then combined with numerous assumptions concerning meteorology and atmospheric chemical reactions to produce air pollutant concentration estimates.



## Appendix C. Modeling summary tables



**Table 22. Socio-economic modeling outcomes.**

Category	2020	2050
Total population	3,408,152	4,478,343
Total employment	2,180,587	3,000,647
Total dwelling units (or households)	1,361,781	1,882,031
Persons/dwelling unit (or household)	2.50	2.38

**Table 23. Vehicle miles traveled modeling outcomes.**

Roadway type	2020 vehicle miles traveled	2050 vehicle miles traveled
Freeways	30,758,698	39,207,414
Tollways: E-470 & Northwest Parkway	1,865,436	4,474,889
Freeway express lanes	389,613	2,944,955
Expressways	5,416,461	7,289,159
Principal arterials	26,300,663	37,416,316
Minor arterials	8,514,946	12,019,522
Collector and local roads	5,390,378	8,416,719
Freeway entry and exit ramps	2,095,875	2,733,233
Freeway-to-freeway ramps	941,334	1,211,024
Centroid Connectors	8,774,341	13,415,651
<b>Total</b>	<b>90,447,745</b>	<b>129,128,881</b>

**Table 24. Average speed modeling outcomes.**

Roadway type	2020 average speed in miles per hour	2050 average speed in miles per hour
Freeways	55.9	50.3
Tollways: E-470 & Northwest Parkway	77.5	75.5
Freeway express lanes	62.5	55.2
Expressways	44.3	40.5
Principal arterials	33.3	31.5
Minor arterials	29.0	27.7
Collector and local roads	25.1	24.1
Freeway entry and exit ramps	31.6	30.0
Freeway-to-freeway ramps	38.3	32.5
Centroid Connectors	26.6	27.9
<b>Combined average speed</b>	<b>37.4</b>	<b>35.3</b>





**Table 25. Lane miles modeling outcomes.**

<b>Roadway type</b>	<b>2020 lane miles</b>	<b>2050 lane miles</b>
Freeways	1,852	1,866
Tollways: E-470 & Northwest Parkway	242	397
Freeway express lanes	64	233
Expressways	541	559
Principal arterials	4,296	5,096
Minor arterials	2,888	3,147
Collector and local roads	6,089	6,107
Freeway entry and exit ramps	328	340
Freeway-to-freeway ramps	80	88
Centroid Connectors	4,322	4,337
<b>Total</b>	<b>20,701</b>	<b>22,170</b>



## **Appendix D. Memorandums of Agreement for the transportation conformity evaluation conducted under the 8-hour ozone standard**





## Appendix E. United States Department of Transportation Conformity Finding



