

APPENDIX

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# **Air quality conformity determination documents**

# Denver Southern Subarea 8-Hour Ozone 2022 Updated 2050 Regional Transportation Plan Conformity Determination

for the Denver Regional Council of Governments Fiscally Constrained Element of the 2050 Metro Vision Regional Transportation Plan  
and the DRCOG 2022-2025 Transportation Improvement Program  
and the Southern Subarea Portion of the Upper Front Range 2045 Regional Transportation Plan  
and the 2023-2026 State Transportation Improvement Program for the Upper Front Range Transportation Planning Region

**Adopted Sept. 21, 2022**

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## Executive Summary

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The Denver Regional Council of Governments completed this transportation conformity determination as part of the transportation and air quality planning process. DRCOG's update to the long-range transportation plan triggered the need to perform the conformity analysis. The ozone nonattainment area continues to meet air quality conformity standards associated with the DRCOG and Upper Front Range Transportation Planning Region respective long-range transportation plans and short-range transportation improvement programs.

## Emissions Test Results

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Table 1 shows the budgets for volatile organic compounds (VOC) and nitrogen oxides (NOx), 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 Air Pollution Control Division using the transportation inputs from DRCOG's travel demand models and the Motor Vehicle Emission Simulator model (MOVES).

## Other Pollutants

This document details ozone conformity. Currently, the DRCOG region is designated as a maintenance area for particulate matter equal to or less than 10 microns in aerodynamic diameter ( $PM_{10}$ ). On January 14th, 2022, DRCOG completed the 20-year maintenance period requirement and is no longer required to address transportation conformity determination for carbon monoxide (CO). CO and  $PM_{10}$  were previously reported together. The conformity determination for CO and  $PM_{10}$  last adopted in April 2021 by the DRCOG Board of Directors. A determination for  $PM_{10}$  is being updated concurrently with this document.

**Table 1. 8-Hour ozone conformity for Denver southern subarea results (emission tons per day)**

	2017 State Implementation Plan budgets (2008 Ozone Standard)	Modeling results					
		2023 emissions	2026 emissions	2030 emissions	2040 emissions	2050 emissions	Pass/fail
<b>Volatile Organic Compounds (VOC)</b>	47	29	<b>25</b>	20	17	19	pass all tests
<b>Nitrogen Oxides (NOX)</b>	61	24	<b>17</b>	13	9	10	pass all tests

## Chapter 1. What is Transportation Conformity?

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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 transportation plans and programs may be adopted. Section 176(c) of the Clean Air Act, as amended in 1990, requires that new conformity determinations must be made when there are additions or deletions of funded regionally significant projects not depicted as such in a current conformity determination or if a new TIP (with different programming years) is proposed for adoption. Project additions or deletions usually occur in relation to the RTP. Since TIP projects are contingent upon already being identified in the RTP, TIP changes alone rarely trigger the need for a new conformity determination. This new determination was triggered by DRCOG's update to the RTP due through the amendment process.

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.<sup>1</sup>

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<sup>1</sup> Transportation Conformity Guidance for 2015 Ozone NAAQS Nonattainment Areas (EPA-420-B-18-023) June 2018: §93.109(c) (1) In such 8-hour ozone nonattainment and maintenance areas the budget test must be satisfied as required by §93.118 for conformity determinations made on or after:

(i) the effective date of EPA's finding that a motor vehicle emissions budget in a submitted control strategy implementation plan revision or maintenance plan for the 8-hour ozone NAAQS is adequate for transportation conformity purposes.



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.

## Chapter 2. Ozone Nonattainment Area

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### 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.

The DRCOG transportation management area boundary expansion into southwestern Weld County was approved by the governor on Feb. 21, 2008. The ozone non-attainment area includes a more expansive area of Weld County.

**Table 2. Area Planning Organizations**

Organization	Role	Boundaries
Denver Regional Council of Governments	MPO 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 MPO	MPO 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 Denver Metro North Front Range 8-Hour Ozone Nonattainment Area**

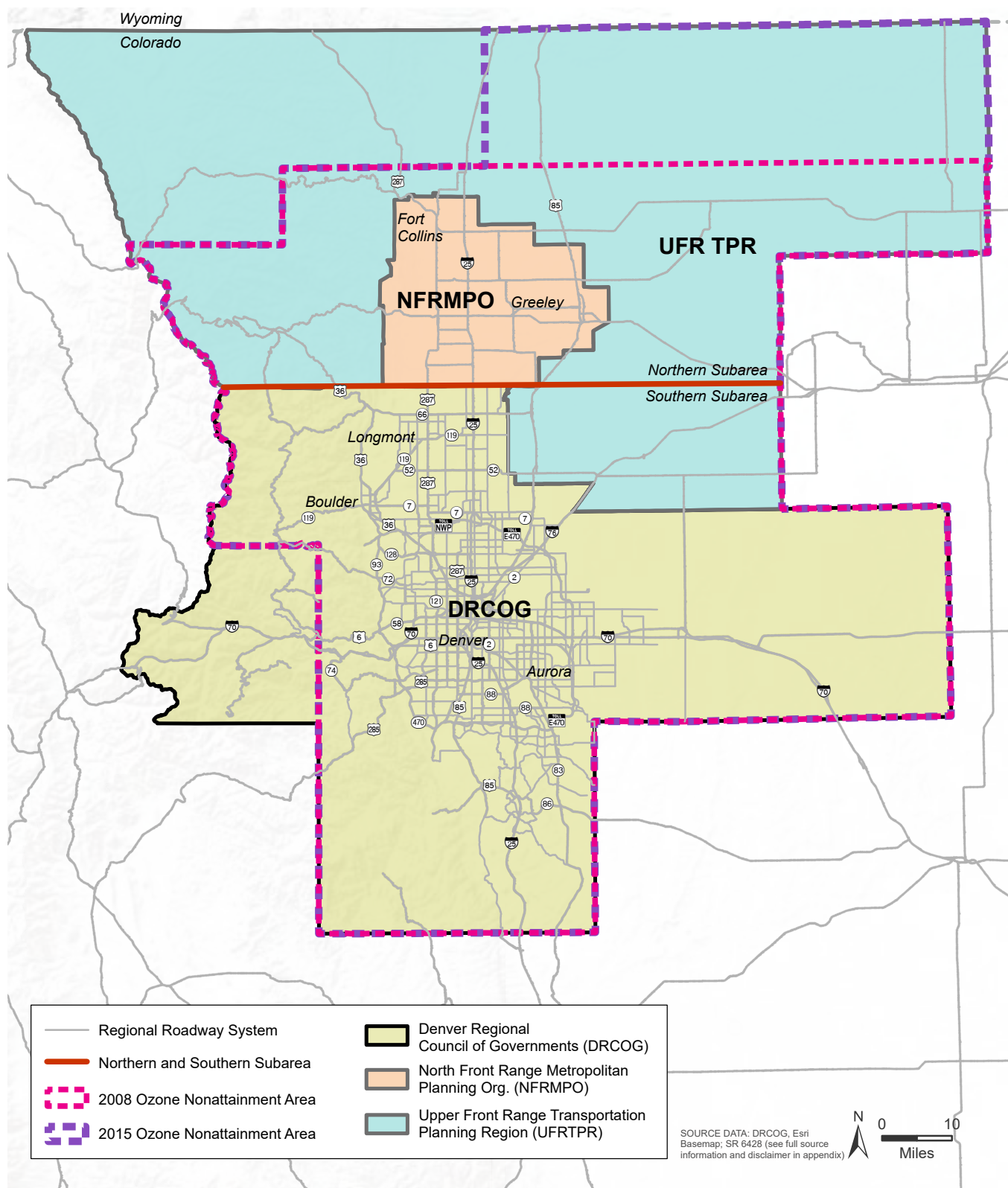


Table 3 is a historical summary of the 1997, 2008 and 2015 8-hour ozone NAAQS for the Denver Metro/North Front Range region. The 8-hour ozone nonattainment area is comprised of two subareas (Northern and Southern), shown in Figure 2. The boundary between the two subareas is the Boulder/Larimer county line extended 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
1997	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.
April 30, 2004	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 (69 FR 23951)	The Environmental Protection Agency lowered the National Ambient Air Quality Standards for ground-level ozone to 0.075 parts per million; same nine counties marginal nonattainment	New 2008 standard is 75 parts per billion; secondary standards are identical to the revised primary standard effective date: May 27, 2008 ( <a href="#">73 FR 16436</a> )
	The Environmental Protection Agency designated the Denver Metro/North Front Range region as marginal nonattainment under the new standard.	
March 27, 2008	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> )
	The Environmental Protection Agency published the final rule revising 8-hour ozone National Ambient Air Quality Standards (2015 8-hour ozone National Ambient Air Quality Standards).	New 2015 standard is 0.070 parts per million; secondary standards are identical to the revised primary standard effective date: Dec. 28, 2015 ( <a href="#">80 FR 65291</a> )
May 21, 2012	The EPA designated the Denver Metro/North Front Range region as marginal nonattainment under the new standard.	

Date	Milestone	Comments
Conclusion of the 2014 ozone season	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.	
Oct. 26, 2015	The EPA published the final rule revising 8-hour ozone NAAQS (2015 8-hour ozone National Ambient Air Quality Standards).	New 2015 standard is 0.070 ppm; secondary standards are identical to the revised primary standard effective date: Dec. 28, 2015 (80 FR 65291)
May 4, 2016	The EPA reclassified the region from a marginal to a moderate nonattainment area for the 2008 ozone NAAQS, extending the attainment year to 2017.	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.
May 2017	New motor vehicle emissions budgets were submitted to the EPA as part of the State Implementation Plan package for the 2008 ozone NAAQS	
June 4, 2018	The EPA published a final rule designating the Denver Metro/North Front Range region as marginal for the 2015 ozone NAAQS	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 93.109(c)(2)(i)) <sup>2</sup> effective date: Aug. 3, 2018.
December 16, 2019	Redesignated to serious for 2008 standard	The Air Quality Control Commission (AQCC) adopted the Serious Area SIP including new MVEBs on December 18, 2020..
July 2020	DM/NFR Area expanded to include the entirety of Weld County for the 2015 standard.	
April 14, 2022	Redesignated to moderate for 2015 standard. Effective date is anticipated in Fall 2022.	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.

<sup>2</sup> Transportation Conformity Guidance for 2015 Ozone NAAQS Nonattainment Areas (EPA-420-B-18-023), June 2018

## Memorandum of agreement

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.

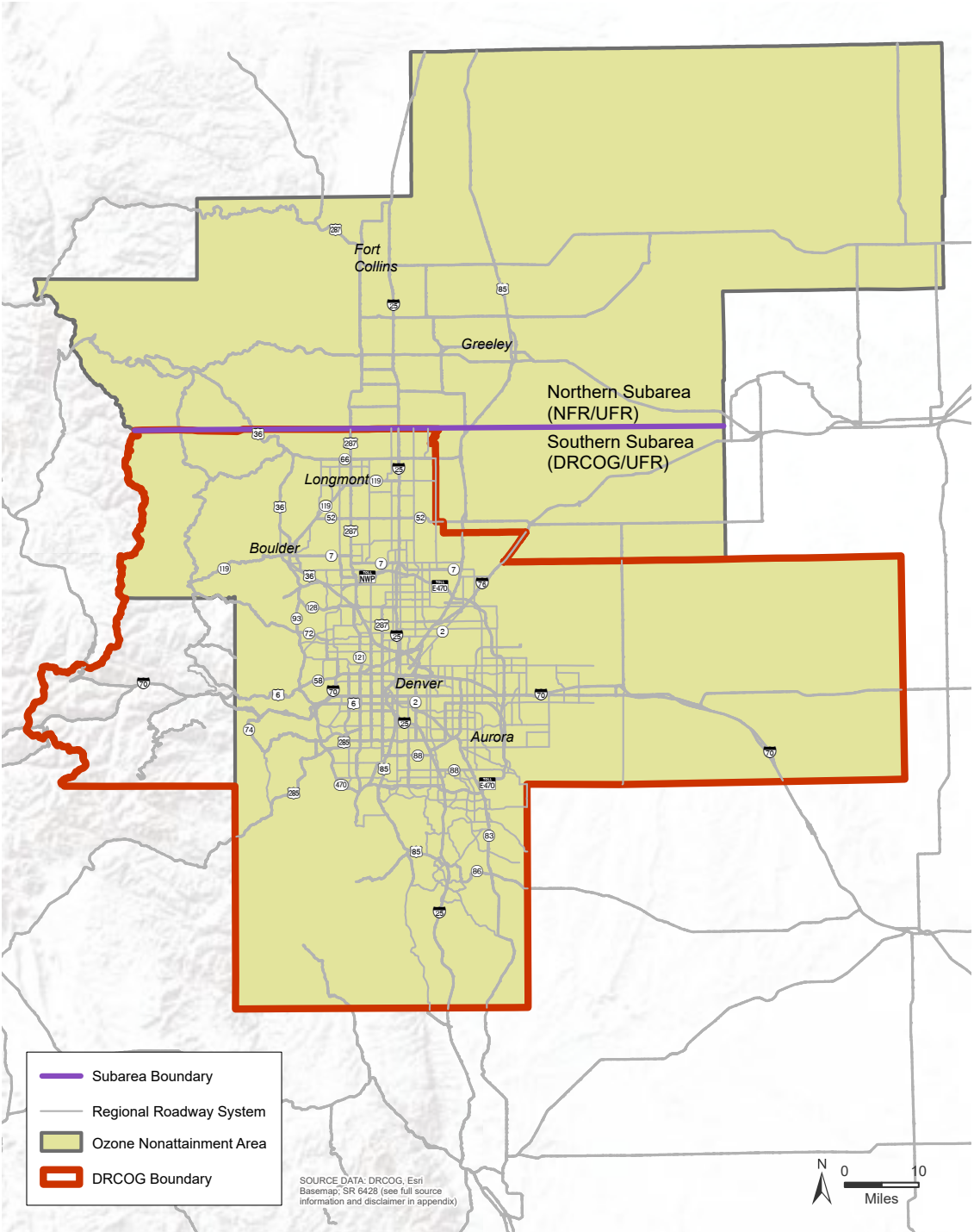
Federal Transportation Regulations at 23 Code of Federal Regulations 450.314(b) states:

“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.”

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





## Motor Vehicle Emission 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 based on subareas. 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 Moderate 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 May 2017 as part of the State Implementation Plan package for the 2008 ozone NAAQS. The EPA found the budgets adequate on March 16, 2018 (83 FR 11751) with an effective date of April 2, 2018. The Regional Air Quality Council is undergoing the process of updating the State Implementation Plan because of the reclassification to serious nonattainment, which will change the motor vehicle emissions budgets. Until new 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 93.109(c)(2)(i)) <sup>3</sup>.

**Table 4. 8-Hour ozone conformity by subarea budgets (emission tons per day)**

Motor vehicle emissions budgets	Volatile organic compounds tons per day	Nitrogen oxides tons per day
Northern subarea budget (North Front Range Metropolitan Planning Organization and Upper Front Range Transportation Planning Region subarea)	8	12
Southern subarea budget (DRCOG and Upper Front Range Transportation Planning Region subarea)	47	61
Total nonattainment area budget (entire nonattainment area)	55	73

<sup>3</sup> Transportation Conformity Guidance for 2015 Ozone NAAQS Nonattainment Areas (EPA-420-B-18-023)- June 2018

## 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 2022-2025 Transportation Improvement Program identifies transit, multimodal and roadway projects to be funded from fiscal year 2022 through fiscal year 2025. 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. 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 2022-2025 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.

## UFR RTP

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.

## Chapter 3. Transportation Control Measures

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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 November 2016 did not include any transportation control measures.

## Chapter 4. Emission 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 base and reporting years for this 8-hour ozone conformity determination.

- 2023 – regional transportation plan base year (no emissions analysis)
- 2026 – an intermediate modeling year
- 2030 – an intermediate modeling year
- 2040 – an intermediate modeling year
- 2050 – the last year (horizon) of regional transportation plan

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 2020 when DRCOG transferred initial travel model output files to Air Pollution Control Division to be used with EPA's most current mobile source emission model (MOVES2014b) to estimate emissions. An update to the EPA model was underway during the analysis for this update and will be applied in the future.

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**

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

Source: State Demography Office, Colorado Department of Local Affairs 2019 Data Pull. Weld County portioning applied by DRCOG staff.  
Counties included in totals: Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, Jefferson and southern Weld.

**Table 6. 2020 and 2050 population and employment estimates by county**

County	Population		Employment	
	2020	2050	2020	2050
Adams County	523,778	842,689	267,686	365,949
Arapahoe County	659,564	837,991	426,173	584,069
Boulder County	331,025	420,105	248,111	339,920
City and County of Broomfield	72,773	98,239	48,254	66,192
City and County of Denver	736,531	883,165	646,251	885,225
Douglas County	354,508	464,189	174,176	238,725
Jefferson County	586,965	661,332	313,198	429,177
Southern Weld County	93,855	197,287	36,427	61,378
<b>Total DRCOG ozone modeling southern subarea</b>	<b>3,358,999</b>	<b>4,404,997</b>	<b>2,160,276</b>	<b>2,970,635</b>

Source: State Demography Office, Colorado Department of Local Affairs 2019 Data Pull. Weld County portioning applied by DRCOG staff.

## Transportation Network Assumptions

### DRCOG

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



# Chapter 5. Conclusion

## Emission 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 2. 8-Hour ozone conformity for Denver southern subarea results (emission tons per day)

	2017 State Implementation Plan budgets (2008 Ozone Standard)	Modeling results					
		2023 emissions	2026 emissions	2030 emissions	2040 emissions	2050 emissions	Pass/fail
Volatile Organic Compounds (VOC)	47	29	25	20	17	19	pass all tests
Nitrogen Oxides (NOX)	61	24	17	13	9	10	pass all tests

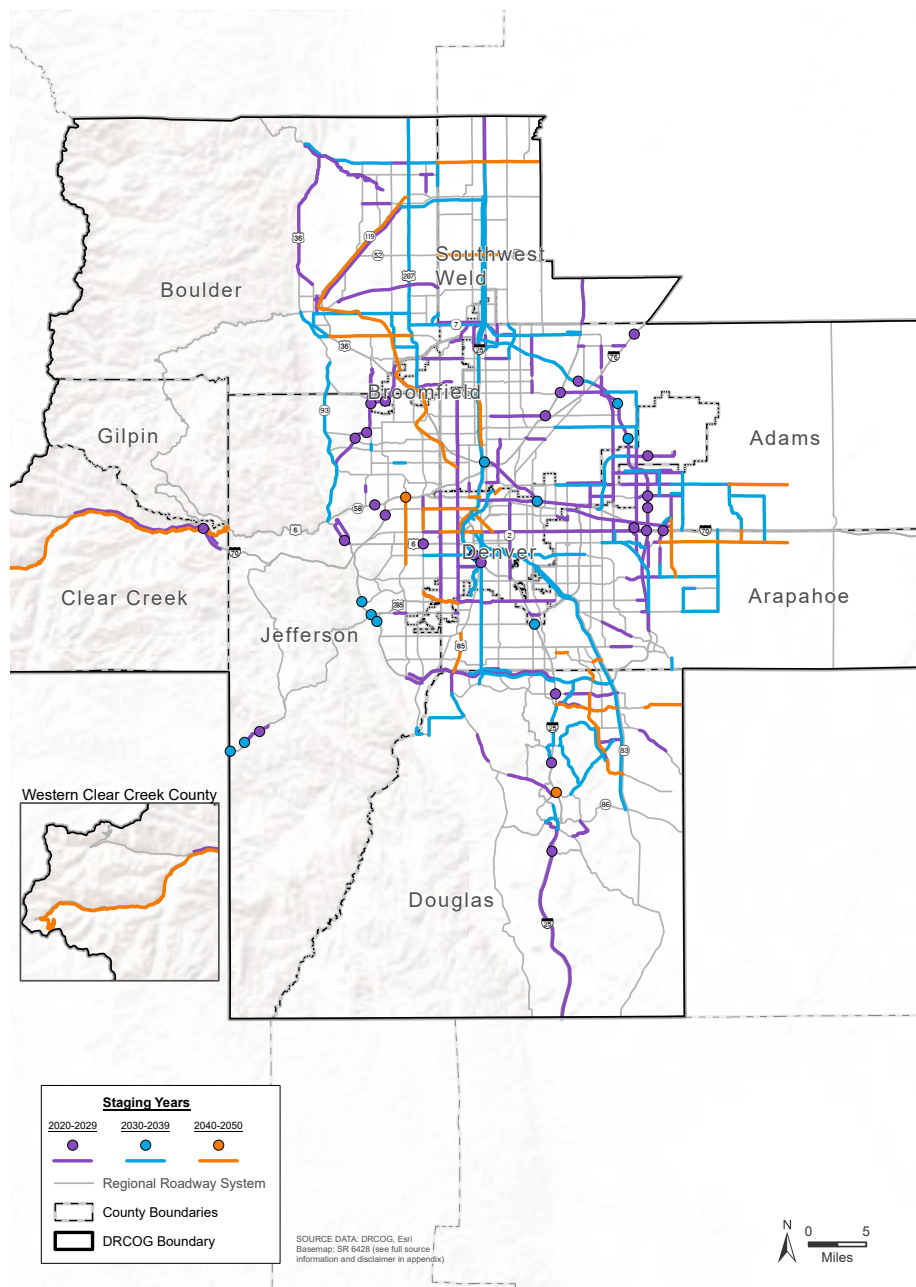
### Summary Statement

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 State Implementation Plan budgets (2008 Ozone Standard and 2015 Ozone Standard). Based on the quantitative conformity analysis, the DRCOG staff has determined conformity is demonstrated for the amended

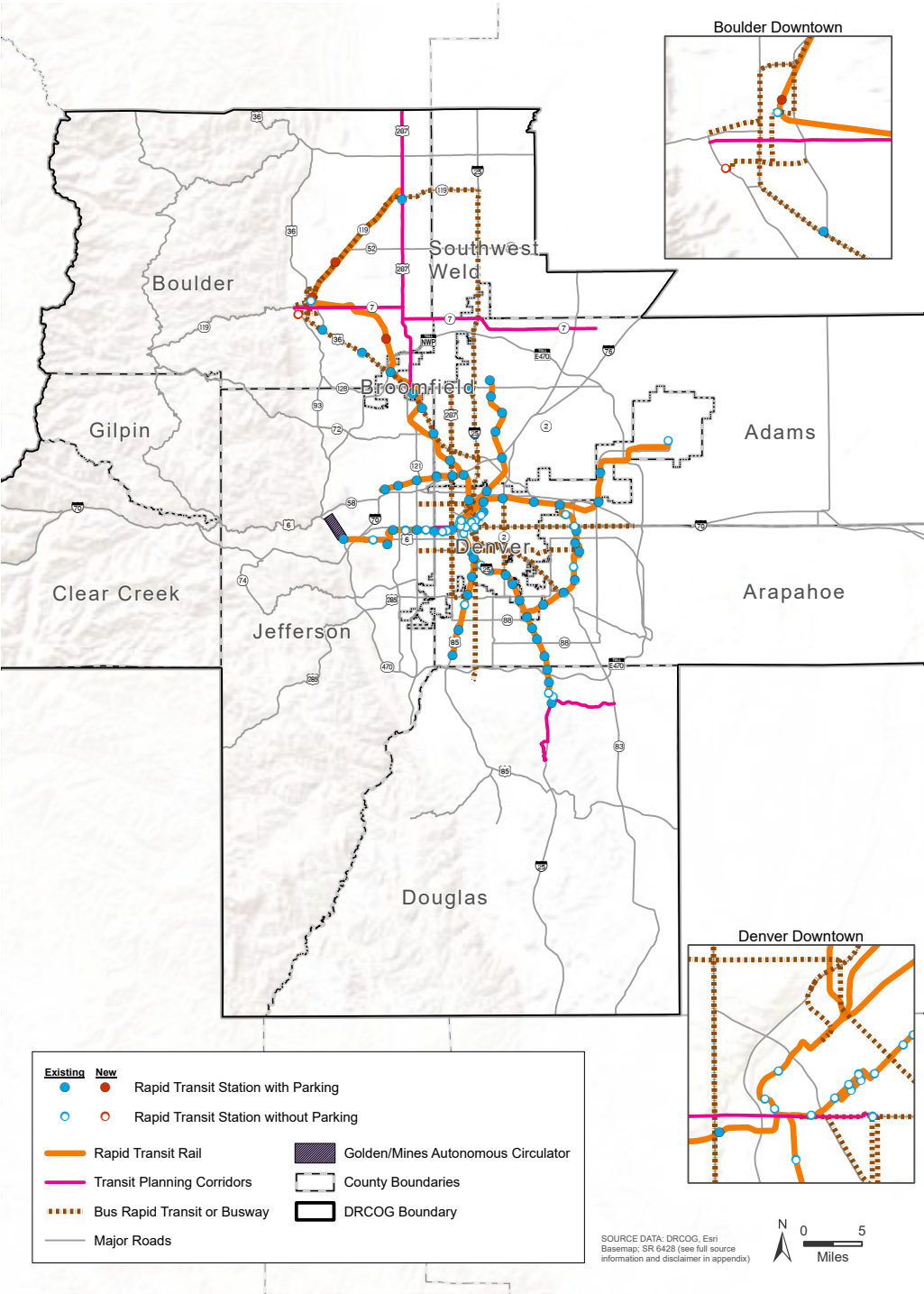
DRCOG 2050 Metro Vision Regional Transportation Plan, Upper Front Range 2045 Regional Transportation Plan, and the regionally significant projects funded in the DRCOG 2022-2025 Transportation Improvement Program and 2023-2026 Statewide Transportation Improvement Program within the Denver Southern Subarea associated with the 2008 and 2015 8-hour ozone standards.

## Appendix A: DRCOG transportation network and project assumptions

### 2050 Staging of fiscally constrained roadway capacity projects



2050 fiscally constrained rapid transit system guideway facilities and stations



**Table 3.1: Regionally funded project and program investment priorities**

Project name/ Corridor	Location/Limits	Project description
<b>2050 Metro Vision Regional Transportation Plan: regionally funded projects and programs</b>		
<b>Colorado Department of Transportation administered funds for multimodal capital projects and programs</b>		
C-470	U.S. Route 285/ Morrison/Quincy	Interchange complex reconstruction
Federal Blvd.	6th Ave. to Howard Pl.	Widen from 5 to 6 lanes
I-25 North (Segment 5)	State Hwy. 66 to Weld County Rd. 38 (DRCOG boundary)	Add 1 toll/managed lane each direction
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
I-25 North	E-470 to State Hwy. 7	Managed lanes, State Hwy. 7 interchange reconstruction and State Hwy. 7 mobility hub
I-25 North	84th Ave. to 104th Ave.	Operational improvements, center-loading transit station at 88th Ave. and general purpose lane
I-25 Central Improvements	Santa Fe Blvd. to 20th St.	Safety, operations, multimodal mobility, transit, and community connections
I-25	Speer Blvd./23rd Ave.	Bridge replacements with safety and multimodal mobility improvements
I-25	Santa Fe Dr. (U.S. Route 85) to Alameda Ave.	Bridge replacement, intersection safety, and multimodal mobility improvements
I-25	Bellevue	Interchange reconstruction and pedestrian connections
I-25	El Paso County Line to north of Crystal Valley Pkwy.	Add 1 toll/managed-lane each direction
I-270	I-25/U.S. Route 36 to I-70	New managed lanes

County	Project cost (2020)	Staging period	Multimodal Project Elements			
			Bicycle/pedestrian	Safety	Transit	Freight
Jefferson	\$150,000,000	2030-2039		●		●
Denver	\$23,400,000*	2020-2029	●	●	●	●
Weld	\$175,000,000	2020-2029		●	●	●
Broomfield/ Weld	\$150,000,000	2030-2039	●	●	●	●
Broomfield	\$200,000,000	2030-2039	●	●	●	●
Adams	\$230,000,000	2040-2050	●	●	●	●
Denver	\$645,000,000	2040-2050	●	●	●	●
Denver	\$75,000,000	2020-2029	●	●	●	●
Denver	\$35,000,000	2020-2029	●	●		●
Arapahoe	\$112,000,000	2030-2039	●	●		●
Douglas	\$300,000,000*	2020-2029	●	●	●	●
Adams	\$500,000,000	2020-2029		●	●	●

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\* This cost is not included in the fiscal constraint analysis because funding was allocated prior to 2020.

**Table 3.1: Regionally funded project and program investment priorities (continued)**

Project name/ Corridor	Location/Limits	Project description
Colorado Department of Transportation administered funds for multimodal capital projects and programs		
I-270	I-25/U.S. Route 36 and I-70	New freeway "direct connects" at each end of I-270
I-70 Floyd Hill eastbound improvements	Floyd Hill to Veterans Memorial Tunnel	TBD
I-70 Floyd Hill westbound improvements	Floyd Hill to Veterans Memorial Tunnel	TBD
I-70	Eisenhower-Johnson Memorial Tunnels	Major rehabilitation of the Eisenhower-Johnson Memorial Tunnels
I-70	Twin Tunnels to Empire Junction (U.S. Route 40)	Add 1 westbound peak period managed lane
I-70	Kipling	Interchange reconstruction and pedestrian connections
I-70	I-25 to Chambers Rd.	Add 2 new managed lanes
State Hwy. 66	Lyons to Hover	Operational/safety improvements from Lyons to Longmont
State Hwy. 66	Hover St. to Main St. (U.S. Route 287)	Widen from 2 to 4 lanes
State Hwy. 83 (Parker Rd.)	State Hwy. 86 to E. Mississippi Ave.	Corridor planning/investment for multimodal mobility, operations and safety
U.S. Route 6	Wadsworth Blvd.	Interchange capacity
U.S. Route 85	120th Ave.	New interchange
U.S. Route 85	104th Ave.	New interchange

County	Project cost (2020)	Staging period	Multimodal Project Elements			
			Bicycle/pedestrian	Safety	Transit	Freight
Adams	\$300,000,000	2030-2039		●	●	●
Clear Creek	\$250,000,000	2020-2029		●	●	●
Clear Creek	\$450,000,000	2020-2029		●	●	●
Clear Creek	\$142,000,000	2020-2050		●	●	●
Clear Creek	\$50,000,000*	2020-2029		●		●
Jefferson	\$80,000,000	2040-2050	●	●		●
Denver/Adams	\$1,175,700,000*	2020-2029	●	●	●	●
Boulder	\$5,000,000	2030-2039	●	●		●
Boulder	\$5,000,000	2020-2029	●	●		●
Arapahoe/ Douglas	\$150,000,000	2030-2039	●	●	●	●
Jefferson	\$80,000,000	2020-2029	●	●		●
Adams	\$100,000,000	2020-2029		●		●
Adams	\$100,000,000	2020-2029		●		●

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\* This cost is not included in the fiscal constraint analysis because funding was allocated prior to 2020.

**Table 3.1: Regionally funded project and program investment priorities (continued)**

Project name/ Corridor	Location/Limits	Project description
Colorado Department of Transportation administered funds for multimodal capital projects and programs		
U.S. Route 85	Louviers to milepost 191.75	Widen from 2 to 4 lanes
U.S. Route 85	Sedalia to Daniels Park	Widen from 2 to 4 lanes
U.S. Route 85	Daniels Park to Meadows	Widen from 2 to 4 lanes
U.S. Route 285	Pine Valley Rd. (County Rd. 126)/Mt. Evans Blvd.	New interchange
U.S. Route 285	Parker Ave.	New interchange
U.S. Route 285	Shaffers Crossing to Kings Valley Dr.	Widen from 3 to 4 lanes (add 1 southbound lane)
U.S. Route 285	Kings Valley Dr.	New interchange
U.S. Route 285	Kings Valley Dr. to Richmond Hill Rd.	Widen from 3 to 4 lanes (add 1 southbound lane)
Vasquez Blvd.	60th Ave.	Intersection improvements
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



County	Project cost (2020)	Staging period	Multimodal Project Elements			
			Bicycle/pedestrian	Safety	Transit	Freight
Douglas	\$59,000,000*	2020-2029		●		●
Douglas	\$35,000,000	2020-2029	●	●		●
Douglas	\$32,000,000	2020-2029	●	●		●
Jefferson	\$40,000,000	2030-2039		●		●
Jefferson	\$25,000,000	2030-2039		●		●
Jefferson	\$60,000,000	2020-2029		●		●
Jefferson	\$15,000,000	2020-2029		●		●
Jefferson	\$25,000,000	2020-2029		●		●
Adams	\$80,000,000	2040-2050		●		●
CDOT projects total	\$4,246,000,000					
Regional	\$11,408,841,041	2020-2050	●	●	●	●
CDOT programs total	\$11,408,841,041					

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\* This cost is not included in the fiscal constraint analysis because funding was allocated prior to 2020.

**Table 3.1: Regionally funded project and program investment priorities (continued)**

Project name/ Corridor	Location/Limits	Project description
<b>Denver Regional Council of Governments administered funds for multimodal capital projects and programs</b>		
88th Ave.	I-76 northbound ramps to State Hwy. 2	Widen from 2 to 4 lanes
104th Ave.	Colorado Blvd. to McKay Rd.	Widen from 2 to 4 lanes
120th Ave.	U.S. Route 85 to E-470	Widen to 4 lanes
Broncos Pkwy./Easter/Dry Creek corridor improvements	Parker Rd. to Havana	Widen to 4 lanes; bridge, multimodal corridor and intersection improvements
County Line Rd.	Phillips St. to University Blvd.	Widen from 2 to 4 lanes
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 and transit service
Gun Club Rd.	Quincy to Aurora Pkwy.	Widen from 2 to 4 lanes, multimodal corridor improvements, and transit service
I-25 North	104th Ave. to 120th Ave.	Shoulders; general purpose lanes; bridge
I-25	Broadway	Interchange capacity
I-25	Lincoln Ave.	Interchange capacity
I-25	Happy Canyon Rd.	Interchange reconstruction
I-25	Meadows/Founders	Interchange reconstruction
I-25	Crystal Valley Pkwy.	New interchange and south frontage road
I-225/Yosemite	DTC Blvd. to I-25 on-ramp	Interchange and ramp reconstruction

County	Project cost (2020)	Staging period	Multimodal Project Elements			
			Bicycle/pedestrian	Safety	Transit	Freight
Adams	\$21,500,000	2020-2029	●	●		●
Adams	\$8,100,000	2020-2029	●	●		●
Adams	\$24,000,000	2020-2029	●	●		●
Arapahoe	\$35,000,000	2040-2050	●	●		●
Douglas	\$9,500,000	2020-2029	●	●		●
Arapahoe	\$60,000,000	2020-2029	●	●	●	●
Arapahoe	\$30,000,000	2020-2029	●	●	●	●
Adams	\$70,000,000	2040-2050		●	●	●
Denver	\$50,000,000	2020-2029	●	●		●
Douglas	\$49,400,000	2020-2029	●	●		●
Douglas	\$30,000,000	2020-2029	●	●		●
Douglas	\$50,000,000	2040-2050	●	●		●
Douglas	\$80,000,000	2020-2029	●	●		●
Arapahoe	\$60,000,000	2020-2029		●		●

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**Table 3.1: Regionally funded project and program investment priorities (continued)**

Project name/ Corridor	Location/Limits	Project description
<b>Denver Regional Council of Governments administered funds for multimodal capital projects and programs</b>		
Indiana (State Hwy. 72)	W. 80th Ave. to W. 86th Pkwy.	Widen to 4 lanes
Kipling St.	Kentucky Ave. to I-70	Multimodal corridor improvements
Lincoln Ave.	Oswego to Keystone	Multimodal corridor improvements
Martin Luther King Jr. Blvd.	Havana St./Iola St. to Peoria St.	Widen 2 to 4 lanes; new 4-lane road
Peña Blvd.	I-70 to 64th Ave.	Add 1 managed lane in each direction
Peña Blvd.	64th Ave. to E-470	Add 1 managed lane in each direction
RidgeGate Pkwy.	Havana St. to Lone Tree eastern city limit	Widen from 2 to 4 lanes
Smoky Hill Rd.	Buckley Rd. to Picadilly St.	Safety, operational, and multimodal corridor improvements and transit service
State Hwy. 7	164th Ave. to Dahlia St.	Widen from 2 to 4 lanes
State Hwy. 30	Airport Blvd. to Quincy Ave.	Widen from 2 to 4 lanes, multimodal corridor improvements, and transit service
State Hwy. 52	Weld County Rd. 1 to Weld County Rd. 13	Planning and Environment Linkages study outcomes — safety, operational and multimodal improvements
State Hwy. 66	U.S. Route 287/Main Street to E. County Line Rd.(Weld County Rd. 1)	Capacity, operations and bicycle/pedestrian
State Hwy. 66	E. County Line Rd. (Weld County Rd. 1) to Weld County Rd. 19	Widen 2 to 4 lanes, pedestrian improvements

County	Project cost (2020)	Staging period	Multimodal Project Elements			
			Bicycle/pedestrian	Safety	Transit	Freight
Jefferson	\$39,000,000	2030-2039	●	●		●
Jefferson	\$250,000,000	2040-2050	●	●	●	●
Douglas	\$24,000,000	2020-2029	●	●		
Denver	\$15,000,000*	2020-2029	●			●
Denver	\$139,000,000	2030-2039		●	●	●
Denver	\$124,000,000	2030-2039		●	●	●
Douglas	\$8,000,000*	2020-2029	●			●
Arapahoe	\$10,000,000	2020-2029	●	●	●	
Adams	\$24,000,000	2020-2029	●			●
Arapahoe	\$175,000,000	2030-2039	●	●	●	●
Weld	\$20,000,000	2040-2050	●	●	●	●
Boulder	\$15,000,000	2030-2039	●	●	●	●
Weld	\$35,000,000	2040-2050	●			●

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\* This cost is not included in the fiscal constraint analysis because funding was allocated prior to 2020.

**Table 3.1: Regionally funded project and program investment priorities (continued)**

Project name/ Corridor	Location/Limits	Project description
<b>Denver Regional Council of Governments administered funds for multimodal capital projects and programs</b>		
State Hwy. 93	State Hwy. 58 to State Hwy. 170	Widen to 4 lanes and safety/transit improvements
U.S. Route 6	Heritage Rd.	New interchange
U.S. Route 85 (Santa Fe)	C-470 to Bowles	Corridor planning/investment for multimodal mobility, operations and safety
U.S. Route 287/120th Ave.	Midway Blvd. to Lowell Blvd.	Improve circulation, safety, active transportation access, business access, congestion and transit operations
U.S. Route 85	Highlands Ranch Pkwy. to north of County Line Rd.	Widen from 4 to 6 lanes
Wadsworth Blvd.	35th Ave. to 48th Ave.	Widen from 4 to 6 lanes
Wadsworth Blvd.	17th Ave. to 35th Ave.	Multimodal corridor improvements
TIP Set-Asides	Varies	Investment in transportation demand management, air quality, operations and technology and human services transportation

County	Project cost (2020)	Staging period	Multimodal Project Elements			
			Bicycle/pedestrian	Safety	Transit	Freight
Jefferson	\$200,000,000	2030-2039	●	●	●	●
Jefferson	\$30,000,000	2020-2029		●		●
Arapahoe	\$150,000,000	2040-2050	●	●	●	●
Broomfield	\$15,000,000	2020-2029	●	●	●	●
Douglas	\$50,100,000*	2020-2029	●			●
Jefferson	\$31,000,000	2020-2029	●		●	●
Jefferson	\$60,000,000	2040-2050	●	●	●	●
DRCOG projects total	\$1,918,500,000					
Regional	\$375,112,551	2020-2050	●	●	●	●
DRCOG programs total	\$375,112,551					

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\* This cost is not included in the fiscal constraint analysis because funding was allocated prior to 2020.

**Table 3.1: Regionally funded project and program investment priorities (continued)**

Project name/ Corridor	Location/Limits	Project description
<b>Regional Transportation District administered funds for multimodal capital projects and programs</b>		
Northwest Rail	Westminster Station to downtown Longmont	Implement peak period service plan
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.
Base System and FasTracks Debt Service	Varies	Repayment of debt service for the construction of RTD's FasTracks and base system
<b>Regional bus rapid transit projects</b>		
New bus maintenance facility	TBD (RTD northern area)	Construction of a new bus maintenance facility in the RTD's northern area
38th/Park BRT	Wadsworth to Colfax	Bus rapid transit service and supporting safety/ multimodal improvements
Alameda BRT	Wadsworth to R-Line	Bus rapid transit service and supporting safety/ multimodal improvements
Broadway/ Lincoln BRT	Colfax to Highlands Ranch Pkwy.	Bus rapid transit service and supporting safety/ multimodal improvements
Colfax Ave. BRT	Union Station to I-225	Bus rapid transit service and supporting safety/ multimodal improvements
Colfax Ave. Extension BRT	I-225 to E-470	Bus rapid transit service and supporting safety/ multimodal improvements



County	Project cost (2020)	Staging period	Multimodal Project Elements			
			Bicycle/pedestrian	Safety	Transit	Freight
Adams/Boulder/ Broomfield/ Jefferson	\$700,000,000	2040-2050	<div></div>	<div></div>	<div></div>	
RTD projects total	\$700,000,000					
Regional	\$27,287,056,566	2020-2050			<div></div>	
Regional	\$6,423,902,502	2020-2050				
RTD programs total	\$33,710,959,069					

TBD	\$50,000,000	2020-2029			●	
Denver/ Jefferson	\$40,000,000	2040-2050	●	●	●	
Arapahoe/ Denver/ Jefferson	\$61,000,000	2030-2039	●	●	●	
Arapahoe/ Denver/ Douglas	\$61,000,000	2030-2039	●	●	●	
Adams/ Arapahoe/ Denver	\$250,000,000	2020-2029	●	●	●	
Adams/ Arapahoe	\$100,000,000	2020-2029	●	●	●	

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**Table 3.1: Regionally funded project and program investment priorities (continued)**

Project name/ Corridor	Location/Limits	Project description
<b>Regional bus rapid transit projects</b>		
Colorado Blvd. BRT	A Line to I-25	Bus rapid transit service and supporting safety/ multimodal improvements
Federal Blvd. BRT	120th to Santa Fe/ Dartmouth	Bus rapid transit service and supporting safety/ multimodal improvements
North I-25 BRT	Union Station to State Hwy. 119	Bus rapid transit service and supporting safety/ multimodal improvements
Speer/ Leetsdale/ Parker BRT	Colfax to I-225	Bus rapid transit service and supporting safety/ multimodal improvements
State Hwy. 119 BRT	Downtown Boulder to downtown Longmont	Bus rapid transit service and supporting safety/ multimodal improvements, including a separated bikeway
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

County	Project cost (2020)	Staging period	Multimodal Project Elements			
			Bicycle/pedestrian	Safety	Transit	Freight
Denver	\$35,000,000	2020-2029	●	●	●	
Adams/ Denver	\$94,000,000	2020-2029	●	●	●	
Adams/ Broomfield/ Denver/ Weld	\$97,000,000	2040-2050		●	●	
Arapahoe/ Denver	\$95,000,000	2030-2039	●	●	●	
Boulder	\$200,000,000	2020-2029	●	●	●	
Boulder/Weld	\$100,000,000	2030-2039	●	●	●	
Regional bus rapid transit total	\$1,183,000,000					

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**Table 3.1: Regionally funded project and program investment priorities (continued)**

Project name/ Corridor	Location/Limits	Project description
<b>Corridor transit planning projects and program</b>		
Regional mobility hubs	Varies	Construction of multimodal mobility hubs
Regional strategic transit	Varies	Investment in regional transit services including Bustang, human services transportation, and rural transportation
Castle Pines transit mobility corridor	Castle Pines to RidgeGate RTD Station	Transit corridor
W. Colfax	Sheridan to Broadway/Lincoln	Transit corridor and supporting safety/multimodal improvements
Golden/Mines autonomous circulator	Downtown Golden, School of Mines, RTD W Line	Autonomous circulator
RidgeGate Pkwy. transit mobility corridor	Mainstreet in Parker to Lone Tree City Center RTD Station	Transit corridor
S. Boulder Rd.	Lafayette to Boulder	Multimodal corridor improvements
State Hwy. 7	Boulder to Brighton	Multimodal corridor improvements
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
U.S. Route 287	U.S. Route 36 to Larimer County Line	Safety, operational and multimodal improvements

County	Project cost (2020)	Staging period	Multimodal Project Elements			
			Bicycle/pedestrian	Safety	Transit	Freight
Regional	\$200,137,636	2020-2050	●		●	
Regional	\$200,137,636	2020-2050	●		●	
Douglas	\$20,000,000	2030-2039	●	●	●	
Denver	\$26,573,077	2040-2050	●	●	●	
Jefferson	\$3,500,000	2020-2029		●	●	
Douglas	\$100,000,000	2040-2050	●	●	●	
Boulder	\$75,000,000	2040-2050	●	●	●	
Adams/ Boulder/ Broomfield	\$100,000,000	2030-2039	●	●	●	
Boulder	\$15,200,000	2030-2039	●	●		
Boulder/ Broomfield	\$200,000,000	2030-2039	●	●	●	●
Transit corridor planning total	\$940,548,349					

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**Table 3.1: Regionally funded project and program investment priorities (continued)**

Project name/ Corridor	Location/Limits	Project description
<b>Arterial safety/Regional Vision Zero/Complete Streets retrofits projects and program</b>		
Arterial safety/ Regional Vision Zero/ Complete Streets retrofits set-aside	High-Injury Network and critical corridors identified in the Taking Action on Regional Vision Zero plan	Vision Zero, safety, and Complete Streets improvements
Brighton Blvd.	Race to York	Reconstruction, Vision Zero, safety and freight improvements
Chambers Rd.	E. 56th Ave. to E. 40th Ave.	Vision Zero corridor improvements
Colfax safety improvements	Wadsworth to Sheridan	Multimodal arterial safety
Federal Blvd. multimodal improvements	52nd Ave. to 120th Ave.	Bicycle/pedestrian/transit improvements; Turn lanes; bus/ business access lanes
W. Mississippi Ave.	South Federal Blvd. to S. Broadway	Vision Zero and pedestrian improvements
Sheridan safety improvements	52nd to Hampden	Vision Zero corridor improvements
State Hwy. 42	Louisville and Lafayette	Safety and operational improvements
U.S. Route 36	Boulder to Lyons	Corridor safety improvements
U.S. Route 85 operational and safety improvements	Weld County Rd. 2 to Weld County Rd. 10	Safety and operational improvements
U.S. Route 285 congestion mitigation improvements	Knox Ct./Lowell Blvd. (west) to Havana (east)	Speed and reliability corridor and Vision Zero improvements

County	Project cost (2020)	Staging period	Multimodal Project Elements			
			Bicycle/pedestrian	Safety	Transit	Freight
Regional	\$249,217,902	2020-2050	●	●		
Denver	\$19,762,500	2040-2050	●	●	●	●
Denver	\$16,712,500	2020-2029	●	●	●	
Jefferson	\$12,000,000	2020-2029	●	●	●	●
Adams	\$50,000,000	2020-2029	●	●	●	●
Denver	\$18,600,000	2020-2029	●	●	●	
Denver/ Jefferson	\$17,100,000	2020-2029	●	●	●	
Boulder	\$50,000,000	2030-2039	●	●		
Boulder	\$20,000,000	2020-2029	●	●		
Weld	\$6,100,000	2020-2029		●		
Arapahoe/ Denver	\$88,200,000	2020-2029		●	●	●
Arterial safety/ Regional Vision Zero/Complete Streets retrofits total	\$547,692,902	Continued on next page.				
Appendix S: Air quality conformity determination documents 47						

Continued on next page.

**Table 3.1: Regionally funded project and program investment priorities (continued)**

Project name/ Corridor	Location/Limits	Project description
Active transportation projects and program		
Active transportation set-aside	Short-trip opportunity zones identified in the active transportation plan	Bicycle and pedestrian improvements
Bear Creek Trail	(not specified)	Upgrade trail for safe crossings and consistent cross section. Integrate intelligent transportation systems/ artificial intelligence equipment.
Clear Creek Greenway	Jefferson County Line to Loveland Ski Area	Clear Creek Greenway portion of Peaks to Plains trail system
McCaslin Regional trail	Rock Creeky Pkwy. to State Hwy. 128	Regional trail
Boulder to Erie Regional Trail	Boulder to Erie	Regional trail
S. Platte River Trail	Northern Denver city limits (near 53rd Ave.) to southern Denver city limits (near Harvard Ave.)	Complete missing links and upgrade trail section
S. Platte River Trail	Northern Denver city limits (near 53rd Ave.) to southern Denver city limits (near Harvard Ave.)	Complete missing links and upgrade trail section
Smith Rd. bicycle/ pedestrian facilities	Peoria Street to Powhaton Rd.	New multiuse path
St. Vrain Greenway	Longmont to Lyons	Regional trail



County	Project cost (2020)	Staging period	Multimodal Project Elements			
			Bicycle/pedestrian	Safety	Transit	Freight
Regional	\$822,477,521	2020-2050	●	●		
Denver	\$31,200,000	2040-2050	●	●		
Clear Creek	\$50,000,000	2040-2050	●	●		
Boulder	\$3,000,000	2020-2029	●	●		
Boulder	\$6,000,000	2020-2029	●	●		
Denver	\$25,000,000	2020-2029	●	●		
Denver	\$25,000,000	2030-2039	●	●		
Adams	\$4,000,000	2020-2029	●	●		
Boulder	\$4,000,000	2020-2029	●	●		
Active transportation total	\$970,677,521					

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**Table 3.1: Regionally funded project and program investment priorities (continued)**

Project name/ Corridor	Location/Limits	Project description
Active transportation projects and program		
Freight set-aside	Varies	Freight improvements including but not limited to bridge reconstructions, overpasses/underpasses, new bridges
47th Ave./48th Ave.	I-25 to Pecos	Bridge reconstruction, new multimodal underpass and new bicycle/pedestrian bridge
Alameda Pkwy. Bridge over I-225	Between Potomac St. and Abilene St.	Bridge reconstruction
Peoria St. Bridge	Sand Creek	Bridge reconstruction
Ward Rd./ BNSF	I-70 frontage road north and Ridge Rd.	Multimodal grade separation

County	Project cost (2020)	Staging period	Multimodal Project Elements			
			Bicycle/pedestrian	Safety	Transit	Freight
Regional	\$75,836,451	2020-2050		●		●
Denver	\$45,225,000	2040-2050	●	●	●	●
Arapahoe	\$20,000,000	2020-2029	●	●	●	●
Adams	\$19,000,000	2020-2029	●	●		●
Jefferson	\$60,000,000	2020-2029	●	●	●	●
Freight total	\$220,061,451					

**Table 3.2: Locally funded project and programs**

Project name/ Corridor	Location/Limits	Project description
<b>2050 Metro Vision Regional Transportation Plan: locally funded projects</b>		
<b>Local government funded projects and programs</b>		
6th Ave.	Airport Blvd. to Tower Rd.	Widen from 2 to 6 lanes
6th Ave.	Tower Rd. to 6th Pkwy.	Widen from 2 to 6 lanes
6th Ave.	6th Pkwy. to Harvest Rd.	Widen from 2 to 6 lanes
6th Ave.	Harvest Mile Rd. to Watkins Rd.	New 6-lane road
6th Ave.	Watkins Rd. to Manila Rd.	New 4-lane road
6th Ave.	Manila Rd. to Schumaker Rd.	New 2-lane road
17th Ave.	Alpine St. to Ute Creek Dr.	Widen from 2 to 4 lanes
48th Ave.	Picadilly Rd. to Powhaton Rd.	New 6-lane road
48th Ave.	Powhaton Rd. to Monaghan Rd.	New 2-lane road
48th Ave.	Powhaton Rd. to Monaghan Rd.	Widen from 2 to 4 lanes
48th Ave.	Imboden Rd. to Manila Rd.	Widen from 2 to 4 lanes
56th Ave.	Havana St. to Peña Blvd.	Widen from 4 to 6 lanes
56th Ave.	Peoria St. to Peña Blvd.	Widen from 2 to 4 lanes
56th Ave.	Peña Blvd. to Tower Rd.	Widen from 4 to 6 lanes
56th Ave.	Genoa St. to Picadilly Rd.	Widen from 5 to 6 lanes
56th Ave.	Picadilly Rd. to E-470	Widen from 2 to 6 lanes
56th Ave.	E-470 to Powhaton Rd.	Widen from 2 to 6 lanes
56th Ave.	Powhaton Rd. to Imboden Rd.	Widen from 2 to 4 lanes
56th Ave.	Imboden Rd. to Schumaker Rd.	New 2-lane road
58th Ave.	Washington St. to York St.	Widen from 2 to 4 lanes
64th Ave.	Tower Rd. to Denver/Aurora City Limits	Widen from 2 to 4 lanes

County	Project cost (2020)	Staging period
Arapahoe	\$10,160,000	2020-2029
Arapahoe	\$14,097,000	2020-2029
Arapahoe	\$13,194,030	2020-2029
Adams	\$19,200,000	2040-2050
Adams	\$19,200,000	2040-2050
Adams	\$9,600,000	2040-2050
Boulder	\$2,302,510	2020-2029
Adams	\$40,706,040	2020-2029
Adams	\$7,500,000	2020-2029
Adams	\$7,500,000	2030-2039
Adams	\$4,800,000	2030-2039
Denver	\$15,000,000	2030-2039
Denver	\$40,000,000	2020-2029
Denver	\$17,300,000	2020-2029
Denver	\$5,800,000	2020-2029
Adams	\$9,696,450	2020-2029
Adams	\$19,400,000	2020-2029
Adams	\$24,000,000	2030-2039
Adams	\$19,000,000	2040-2050
Adams	\$10,346,093	2020-2029
Denver	\$700,000	2020-2029

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**Table 3.2: Locally funded project and programs (continued)**

Project name/ Corridor	Location/Limits	Project description
<b>Local government funded projects and programs</b>		
64th Ave.	Denver/Aurora city limit to Himalaya St.	Widen from 2 to 6 lanes
64th Ave.	Himalaya Rd. to Harvest Mile Rd.	Widen from 2 to 4 lanes
64th Ave.	Himalaya Rd. to Harvest Mile Rd.	Widen from 4 to 6 lanes
64th Ave.	Harvest Mile Rd. to Powhaton Rd.	New 2-lane road
64th Ave.	Harvest Mile Rd. to Powhaton Rd.	Widen from 2 to 4 lanes
64th Ave.	Powhaton Rd. to Monaghan Rd.	New 4-lane road
72nd Ave.	Simms St. to Kipling St.	Widen from 2 to 4 lanes
96th Ave.	State Hwy. 2 to Tower Rd.	Widen from 2 to 4 lanes
96th Ave.	Tower Rd. to Picadilly Rd.	Widen from 2 to 6 lanes
96th Ave.	96th St. west of Northwest Pwky. to State Hwy. 128	Add 2 toll lanes
104th Ave.	Marion St. to Colorado Blvd.	Widen from 4 to 6 lanes
104th Ave.	McKay Rd. to U.S. Route 85	Widen from 2 to 4 lanes
120th Ave.	Sable Blvd. to E-470	Widen from 2 to 6 lanes
120th Ave.	E-470 to Picadilly Rd.	Widen from 2 to 6 lanes
144th Ave.	U.S. Route 287 to Zuni St.	Widen from 2 to 4 lanes
144th Ave.	Washington St. to York St.	Widen from 2 to 4 lanes
144th Ave.	York St. to Colorado Blvd.	Widen from 2 to 4 lanes
152nd Ave.	Washington St. to York St.	Widen from 2 to 4 lanes
Arapahoe Rd.	Waco St. to Himalaya St.	Widen from 2 to 6 lanes
Arapahoe Rd.	Himalaya Way to Liverpool St.	Widen from 4 to 6 lanes
E. Bromley Ln.	U.S. Route 85 to Sable Blvd.	Widen from 4 to 6 lanes
E. Bromley Ln.	Tower Rd. to I-76	Widen from 4 to 6 lanes

County	Project cost (2020)	Staging period
Adams	\$6,452,362	2020-2029
Adams	\$39,000,000	2030-2039
Adams	\$39,000,000	2030-2039
Adams	\$6,452,362	2020-2029
Adams	\$10,934,700	2020-2029
Adams	\$6,709,410	2020-2029
Jefferson	\$20,000	2030-2039
Adams	\$46,672,500	2030-2039
Adams	\$14,668,500	2030-2039
Broomfield	\$39,370,000	2020-2029
Adams	\$6,276,340	2020-2029
Adams	\$40,600,000	2020-2029
Adams	\$29,718,000	2030-2039
Adams	\$15,500,000	2030-2039
Broomfield	\$21,200,000	2020-2029
Adams	\$12,795,250	2020-2029
Adams	\$10,433,050	2020-2029
Adams	\$13,074,650	2030-2039
Arapahoe	\$20,400,000	2020-2029
Arapahoe	\$6,176,772	2020-2029
Adams	\$1,333,500	2020-2029
Adams	\$1,853,032	2020-2029

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**Table 3.2: Locally funded project and programs (continued)**

Project name/ Corridor	Location/Limits	Project description
<b>Local government funded projects and programs</b>		
Broncos Pkwy.	Havana St. to Peoria St.	Widen from 4 to 6 lanes
Broncos Pkwy.	Jordan Rd. to Parker Rd.	Widen from 4 to 6 lanes
Buckley Rd.	136th Ave. to Bromley Rd.	Widen from 2 to 4 lanes
Buckley Rd.	118th Ave. to Cameron Dr.	Widen from 2 to 6 lanes
C-470 eastbound: S. Kipling Pkwy. to I-25	S. Kipling Pkwy. to Wadsworth Blvd.	Add 1 high-occupancy toll lane
C-470 westbound: S. Kipling Pkwy. to I-25	Wadsworth Blvd. to S. Kipling Pkwy.	Add 1 high-occupancy toll lane
C-470 westbound: S. Kipling Pkwy. to I-25	Colorado Blvd. to Lucent Blvd.	Add 1 high-occupancy toll lane
C-470 eastbound: S. Kipling Pkwy. to I-25	Broadway to I-25	Add 1 high-occupancy toll lane
Canyonside Blvd.	Crowfoot Valley Rd. to Hess Rd.	New 4-lane road
Chambers Rd.	E-470 to Arapahoe/Douglas County Line	Widen from 4 to 6 lanes
Chambers Rd.	Mainstreet to Lincoln Ave.	Widen from 4 to 6 lanes
Chambers Rd.	Hess Rd. to Mainstreet	Widen from 4 to 6 lanes
Chambers Rd.	Crowfoot Valley Rd. to Hess Rd.	New 2-lane road
Chambers Rd.	Crowfoot Valley Rd. to Hess Rd.	Widen from 2 to 4 lanes
Chambers Rd.	Crowfoot Valley Rd. to Hess Rd.	Widen from 4 to 6 lanes



County	Project cost (2020)	Staging period
Arapahoe	\$8,134,350	2020-2029
Arapahoe	\$6,934,200	2020-2029
Adams	\$7,747,000	2020-2029
Adams	\$13,897,737	2020-2029
Douglas/ Jefferson	\$45,000,000	2020-2029
Douglas/ Jefferson	\$45,000,000	2020-2029
Douglas	\$80,000,000	2030-2039
Douglas	\$80,000,000	2030-2039
Douglas	\$16,000,000	2030-2039
Douglas	\$12,500,000	2040-2050
Douglas	\$16,000,000	2040-2050
Douglas	\$10,000,000	2040-2050
Douglas	\$19,500,000	2020-2029
Douglas	\$17,500,000	2030-2039
Douglas	\$12,000,000	2040-2050

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**Table 3.2: Locally funded project and programs (continued)**

Project name/ Corridor	Location/Limits	Project description
<b>Local government funded projects and programs</b>		
Chambers Rd./ Bayou Gulch Rd.	Parker Rd. to Vistancia Dr.	Widen from 2 to 4 lanes
Chambers Rd./ Bayou Gulch Rd.	Vistancia Dr. to southern boundary	New 2-lane road
Chambers Rd./ Bayou Gulch Rd.	Vistancia Dr. to southern boundary	Widen from 2 to 4 lanes
Chambers Rd./ Bayou Gulch Rd.	Crowfoot Valley Rd. to Parker south town limit, new road	New 2-lane road
Chambers Rd./ Bayou Gulch Rd.	Crowfoot Valley Rd. to Parker south town limit, widening	Widen from 2 to 4 lanes
Colorado Blvd.	south of 168th Ave. to 168th Ave.	New 4-lane road
Colorado Blvd.	156th Ave. to south of 168th Ave.	New 4-lane road
Colorado Blvd.	144th Ave. to 156th Ave.	Widen from 2 to 4 lanes
E. County Line Rd.	9th Ave. to State Hwy. 66	Widen from 2 to 4 lanes
Crowfoot Valley Rd.	Chambers Rd. to Stroh Rd.	Widen from 2 to 4 lanes
Crowfoot Valley Rd.	Macanta Rd./Canyonside Blvd. to Chambers Rd.	Widen from 2 to 4 lanes
Crowfoot Valley Rd.	Founders Pkwy. to Macanta Rd./ Canyonside Blvd.	Widen from 2 to 4 lanes
Green Valley Ranch Blvd.	Chambers Rd. to Peña Blvd.	Widen from 4 to 6 lanes
Green Valley Ranch Blvd.	Peña Blvd. to Tower Rd.	Widen from 4 to 6 lanes

County	Project cost (2020)	Staging period
Douglas	\$18,000,000	2040-2050
Douglas	\$6,000,000	2020-2029
Douglas	\$6,000,000	2040-2050
Douglas	\$5,000,000	2020-2029
Douglas	\$4,500,000	2030-2039
Adams	\$23,500,000	2030-2039
Adams	\$23,500,000	2030-2039
Adams	\$23,500,000	2030-2039
Boulder	\$9,779,000	2030-2039
Douglas	\$11,500,000	2030-2039
Douglas	\$38,000,000	2030-2039
Douglas	\$10,000,000	2030-2039
Denver	\$9,900,000	2020-2029
Denver	\$1,700,000	2020-2029

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**Table 3.2: Locally funded project and programs (continued)**

Project name/ Corridor	Location/Limits	Project description
<b>Local government funded projects and programs</b>		
Gun Club Rd.	Yale Ave. to Mississippi Ave.	Widen from 2 to 4 lanes
Gun Club Rd.	Yale Ave. to Mississippi Ave.	Widen from 4 to 6 lanes
Gun Club Rd.	Quincy Ave. to 1.5 miles south of Quincy Ave.	Widen from 2 to 6 lanes
Hampden Ave.	Picadilly Rd. to Gun Club Rd.	Widen from 2 to 4 lanes
Harvest Mile Rd.	56th Ave. to 64th Ave.	New 3-lane road
Harvest Mile Rd.	56th Ave. to 64th Ave.	Widen from 3 to 6 lanes
Harvest Mile Rd.	I-70 to 56th Ave.	New 6-lane road
Harvest Rd.	6th Ave. to I-70	New 6-lane road
Harvest Rd.	Alameda Ave. to 1st Ave.	Widen from 4 to 6 lanes
Harvest Rd.	Mississippi Ave. to Alameda Ave.	Add new 6-lane road
Harvest Mile Rd.	Jewell Ave. to Mississippi Ave.	Widen from 2 to 6 lanes
Hess Rd.	Canyonside Blvd. to Chamber Rd.	Widen from 2 to 4 lanes
Hilltop Rd.	Canterberry Pkwy. to Singing Hills Rd.	Widen from 2 to 4 lanes
Huron St.	160th Ave. to State Hwy. 7	Widen from 2 to 4 lanes
Huron St.	150th Ave. to 160th Ave.	Widen from 2 to 4 lanes
I-70	Picadilly Rd.	Add new interchange
I-70	Harvest Mile Rd.	Add new interchange
I-70	Harvest Mile Rd.	Add new interchange
I-76	Bridge St.	Add new interchange

County	Project cost (2020)	Staging period
Arapahoe	\$10,899,140	2030-2039
Arapahoe	\$10,899,140	2030-2039
Arapahoe	\$26,670,000	2020-2029
Arapahoe	\$12,353,544	2020-2029
Adams	\$6,452,235	2020-2029
Adams	\$7,760,970	2030-2039
Adams	\$15,900,000	2030-2039
Adams	\$13,313,410	2020-2029
Arapahoe	\$6,657,340	2020-2029
Arapahoe	\$13,313,410	2020-2029
Arapahoe	\$13,313,410	2030-2039
Douglas	\$17,000,000	2030-2039
Douglas	\$20,000,000	2020-2029
Broomfield	\$5,080,000	2020-2029
Broomfield	\$8,572,500	2020-2029
Adams	\$27,490,547	2020-2029
Adams	\$39,566,215	2020-2029
Arapahoe	\$39,566,215	2020-2029
Adams	\$25,400,000	2020-2029

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**Table 3.2: Locally funded project and programs (continued)**

Project name/ Corridor	Location/Limits	Project description
<b>Local government funded projects and programs</b>		
Imboden Rd.	48th Ave. to 56th Ave.	Widen from 2 to 4 lanes
Imboden Mile Rd.	40th Ave. to 48th Ave.	Widen from 2 to 4 lanes
Imboden Mile Rd./Quail Run Rd.	North of Quail Run Rd. to Imboden Rd./40th Ave.	New 4-lane road
Jefferson Pkwy.	State Hwy. 128/96th St. to State Hwy. 93 north of 64th Ave.	New 4-lane road
Jefferson Pkwy.	Indiana St./State Hwy. 128	Add new interchange
Jefferson Pkwy.	Candelas Pkwy.	Add new interchange
Jefferson Pkwy.	State Hwy. 72	Add new interchange
Jefferson Pkwy.	State Hwy. 93 to 0.5 miles north of 64th Ave.	Widen from 2 to 4 lanes
Jewell Ave.	Himalaya St. to E-470	Widen from 3 to 6 lanes
Jewell Ave.	E-470 to Gun Club Rd.	Widen from 2 to 6 lanes
Jewell Ave.	Gun Club Rd. to Harvest Mile Rd.	Widen from 2 to 6 lanes
Jewell Ave.	Harvest Rd. to Monaghan Rd.	Widen from 2 to 6 lanes
Jewell Ave.	Monaghan Rd. to Watkins Rd.	Widen from 2 to 4 lanes
Lincoln Ave.	Peoria St. to 1st Ave.	Widen from 4 to 6 lanes
Lincoln Ave.	1st St. to Keystone Blvd.	Widen from 4 to 6 lanes
Lincoln Ave.	Keystone Blvd. to Parker Rd.	Widen from 4 to 6 lanes
Mainstreet	Canterberry Pkwy. to Delbert Rd.	Widen from 2 to 4 lanes
Manila Rd.	Alameda Ave. to I-70	New 4-lane road
Manila Rd.	I-70 to 48th Ave.	Widen from 2 to 4 lanes
McIntyre St.	52nd Ave. to 60th Ave.	Widen from 2 to 4 lanes

County	Project cost (2020)	Staging period
Adams	\$24,000,000	2030-2039
Adams	\$4,000,000	2030-2039
Adams	\$24,000,000	2030-2039
Jefferson	\$259,080,000	2020-2029
Jefferson		2020-2029
Jefferson		2020-2029
Jefferson		2020-2029
Jefferson		2020-2029
Arapahoe	\$13,194,030	2020-2029
Arapahoe	\$4,848,860	2020-2029
Arapahoe	\$9,950,450	2020-2029
Adams	\$9,700,000	2030-2039
Adams	\$14,400,000	2030-2039
Douglas	\$4,000,000	2030-2039
Douglas	\$18,000,000	2030-2039
Douglas	\$20,250,000	2020-2029
Douglas	\$28,000,000	2040-2050
Adams	\$5,000,000	2030-2039
Adams	\$15,000,000	2030-2039
Jefferson	\$6,500,000	2020-2029

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**Table 3.2: Locally funded project and programs (continued)**

Project name/ Corridor	Location/Limits	Project description
<b>Local government funded projects and programs</b>		
Monaghan Rd.	56th Ave. to 64th Ave.	New 4-lane road
Monaghan Rd.	26th Ave. to 56th Ave.	Widen from 2 to 4 lanes
Monaghan Rd.	I-70 to 26th Ave.	New 4-lane road
Monaghan Rd.	Quincy Ave. to Yale Ave.	New 6-lane road
Nelson Rd.	75th St. to Affolter Dr.	Widen from 2 to 4 lanes
Pace St.	5th Ave. to 17th Ave.	Widen from 2 to 4 lanes
Pecos St.	52nd Ave. to 0.72 miles north of 52nd Ave.	Widen from 2 to 4 lanes
Peña Blvd.	E-470 to Jackson Gap St.	Widen from 6 to 8 lanes
Peña Blvd.	Gun Club Rd.	Interchange capacity
Peña Blvd.	Jackson Gap St. west ramps to DEN terminal	Widen from 6 to 8 lanes
Peoria St.	E-470 to 0.75 mile south of Lincoln Ave.	Widen from 2 to 4 lanes
Peoria St.	0.75 miles south of Lincoln Ave. to Mainstreet/ RidgeGate Pkwy.	Widen from 2 to 4 lanes
Picadilly Rd.	96th Ave. to 120th Ave.	New 6-lane road
Picadilly Rd.	82nd Ave. to 96th Ave.	New 6-lane road
Picadilly Rd.	70th Ave. to 82nd Ave.	New 6-lane road
Picadilly Rd.	56th Ave. to 70th Ave./Aurora city limits	New 6-lane road
Picadilly Rd.	48th Ave. to 56th Ave.	Widen from 2 to 6 lanes
Picadilly Rd.	Smith Rd. to 48th Ave.	Widen from 2 to 6 lanes
Picadilly Rd.	I-70 to Smith Rd.	Widen from 2 to 6 lanes
Picadilly Rd.	Colfax Ave. to I-70	New 6-lane road



County	Project cost (2020)	Staging period
Arapahoe	\$25,000,000	2030-2039
Arapahoe	\$26,000,000	2030-2039
Arapahoe	\$25,000,000	2030-2039
Arapahoe	\$22,860,000	2030-2039
Boulder	\$5,198,110	2020-2029
Boulder	\$3,827,780	2020-2029
Adams	\$8,647,748	2020-2029
Denver	\$33,000,000	2020-2029
Denver	\$15,000,000	2020-2029
Denver	\$10,200,000	2020-2029
Douglas	\$7,000,000	2030-2039
Douglas	\$5,000,000	2030-2039
Adams	\$49,022,000	2030-2039
Adams	\$21,590,000	2030-2039
Denver	\$11,400,000	2020-2029
Adams	\$20,353,020	2020-2029
Adams	\$13,568,680	2020-2029
Adams	\$22,496,780	2020-2029
Adams	\$5,332,730	2020-2029
Adams	\$12,904,724	2020-2029

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**Table 3.2: Locally funded project and programs (continued)**

Project name/ Corridor	Location/Limits	Project description
<b>Local government funded projects and programs</b>		
Picadilly Rd.	6th Pkwy. to Colfax Ave.	Widen from 2 to 6 lanes
Picadilly Rd.	State Hwy. 30 to 6th Pkwy.	New 4-lane road
Plum Creek Pkwy.	Wolfensberger Rd. to I-25	Widen from 2 to 4 lanes
Plum Creek Pkwy.	Gilbert St. to Ridge Rd.	Widen from 2 to 4 lanes
Powhaton Rd.	26th Ave. to 48th Ave.	Widen from 2 to 6 lanes
Powhaton Rd.	Jewell Ave. to 26th Ave.	Widen from 2 to 4 lanes
Powhaton Rd./ Harvest Mile Rd.	I-70 to 26th Ave.	New 4-lane road
Powhaton Rd./ Harvest Mile Rd.	I-70 to 26th Ave.	Widen from 4 to 6 lanes
Powhaton Rd.	Smoky Hill Rd. to County Line Rd.	Widen from 2 to 6 lanes
Quail Run Rd.	I-70 to 29th Ave./Quail Run Rd.	New 4-lane road
Quail Run Rd.	6th Ave. to I-70	New 4-lane road
Quebec St.	132nd Ave. to 160th Ave.	Widen from 2 to 4 lanes
Quebec St.	120th Ave. to 128th Ave.	Widen from 2 to 4 lanes
Quincy Ave.	Simms St. to Kipling Pkwy.	Widen from 2 to 4 lanes
Quincy Ave.	Irving St. to Federal Blvd.	New 2-lane road
Quincy Ave.	Plains Pkwy. to Gun Club Rd.	Widen from 2 to 6 lanes
Quincy Ave.	Monaghan Rd. to Hayesmount Rd.	Widen from 2 to 6 lanes
Quincy Ave.	Hayesmount Rd. to Watkins Rd.	Widen from 2 to 6 lanes

County	Project cost (2020)	Staging period
Arapahoe	\$5,000,000	2020-2029
Arapahoe	\$7,000,000	2020-2029
Douglas	\$5,080,000	2020-2029
Douglas	\$5,080,000	2020-2029
Adams	\$40,000,000	2020-2029
Adams	\$24,500,000	2040-2050
Adams	\$12,000,000	2020-2029
Adams	\$8,000,000	2030-2039
Arapahoe	\$3,491,230	2030-2039
Adams	\$36,391,342	2030-2039
Adams	\$5,000,000	2040-2050
Adams	\$21,010,880	2020-2029
Adams	\$8,432,800	2020-2029
Jefferson	\$12,001,500	2020-2029
Arapahoe	\$3,810,000	2020-2029
Arapahoe	\$13,335,000	2020-2029
Arapahoe	\$18,935,700	2030-2039
Arapahoe	\$16,002,000	2030-2039

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**Table 3.2: Locally funded project and programs (continued)**

Project name/ Corridor	Location/Limits	Project description
<b>Local government funded projects and programs</b>		
Rampart Range Rd.	Waterton Rd. to Titan Rd.	Widen from 2 to 4 lanes
Ridge Rd.	Plum Creek Pkwy. To State Hwy. 86	Widen from 2 to 4 lanes
Sheridan Pkwy.	Northwest Pkwy. to Preble Creek	Widen from 2 to 4 lanes
Sheridan Pkwy.	Lowell Blvd. to Northwest Pkwy.	Widen from 2 to 4 lanes
Smoky Hill Rd.	Pheasant Run Pkwy. to Versailles Pkwy.	Widen from 4 to 6 lanes
State Hwy. 7	Boulder County Line to Sheridan Pkwy.	Widen from 2 to 4 lanes
State Hwy. 7	Sheridan Pkwy. to I-25	Widen from 2 to 6 lanes
State Hwy. 7	Riverdale Rd. to U.S. Route 85	Widen from 2 to 4 lanes
State Hwy. 30	Stephen D. Hogan Pkwy. (6th Pkwy.) to Mississippi Ave.	Widen from 2 to 4 lanes
State Hwy. 58	Cabela St.	Add new interchange
Stephen D. Hogan Pkwy. (6th Pkwy.)	State Hwy. 30 to E-470	Widen from 2 to 6 lanes
Stephen D. Hogan Pkwy. (6th Pkwy.)	E-470 to Gun Club Rd.	Widen from 2 to 6 lanes
Stroh Rd.	Chambers Rd. to Crowfoot Valley Rd.	New 4-lane road
Stroh Rd.	Crowfoot Valley Rd. to J. Morgan Blvd.	Widen from 2 to 4 lanes
Titan Rd.	Rampart Range Rd. to Santa Fe Dr.	Widen from 2 to 4 lanes
Tower Rd./ Buckley Rd.	105th Ave. to 118th Ave.	New 4-lane road

County	Project cost (2020)	Staging period
Douglas	\$10,000,000	2030-2039
Douglas	\$3,810,000	2020-2029
Broomfield	\$5,715,000	2020-2029
Broomfield	\$7,620,000	2020-2029
Arapahoe	\$33,909,000	2030-2039
Broomfield	\$6,604,000	2020-2029
Broomfield	\$10,172,700	2020-2029
Adams	\$16,319,500	2030-2039
Arapahoe	\$18,000,000	2020-2029
Jefferson	\$19,558,000	2020-2029
Arapahoe	\$34,904,680	2030-2039
Arapahoe	\$4,848,860	2020-2029
Douglas	\$14,000,000	2020-2029
Douglas	\$9,250,000	2020-2029
Douglas	\$25,000,000	2030-2039
Adams	\$8,801,100	2020-2029

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**Table 3.2: Locally funded project and programs (continued)**

Project name/ Corridor	Location/Limits	Project description
<b>Local government funded projects and programs</b>		
Tower Rd.	Peña Blvd. to 105th Ave.	Widen from 4 to 6 lanes
Tower Rd.	56th Ave. to Peña Blvd.	Widen from 4 to 6 lanes
Tower Rd.	48th Ave. to 56th Ave.	Widen from 4 to 6 lanes
Tower Rd.	45th Ave. to Green Valley Ranch Blvd.	Widen from 4 to 6 lanes
Tower Rd.	Colfax Ave. to Smith Rd.	Widen from 2 to 6 lanes
Tower Rd.	6th Ave. to Colfax Ave.	New 2-lane road
Tower Rd.	6th Ave. to Colfax Ave.	Widen from 2 to 6 lanes
U.S. Route 85	Titan Rd. to Highlands Ranch Pkwy.	Widen from 4 to 6 lanes
Washington St.	152nd Ave. to 160th Ave.	Widen from 2 to 6 lanes
Waterton Rd.	State Hwy. 121 to Campfire St.	Widen from 2 to 4 lanes
Watkins Rd.	Quincy Ave. to I-70	Widen from 2 to 6 lanes
Wolfensberger Rd.	Coachline Rd. to Prairie Hawk Dr.	Widen from 2 to 4 lanes
Yale Ave.	Monaghan Rd. to Hayesmount Rd.	Widen from 2 to 6 lanes
York St.	160th Ave. (State Hwy. 7) to 168th Ave.	Widen from 2 to 4 lanes
York St.	E-470 to State Hwy. 7	Widen from 2 to 4 lanes
York St.	152nd Ave. to E-470	Widen from 2 to 4 lanes
York St.	88th Ave. to 78th Ave.	Widen from 2 to 4 lanes
York St.	78th Ave. to State Hwy. 224	Widen from 2 to 4 lanes
York St.	State Hwy. 224 to 58th Ave.	Widen from 2 to 4 lanes

County	Project cost (2020)	Staging period
Adams	\$20,000,000	2020-2029
Denver	\$16,000,000	2020-2029
Denver	\$5,300,000	2020-2029
Denver	\$2,500,000	2020-2029
Adams	\$8,727,440	2020-2029
Arapahoe	\$25,820,370	2020-2029
Arapahoe	\$25,820,370	2030-2039
Douglas	\$5,000,000	2030-2039
Adams	\$37,300,000	2020-2029
Douglas	\$16,000,000	2030-2039
Arapahoe	\$54,673,500	2030-2039
Douglas	\$7,500,000	2030-2039
Arapahoe	\$17,335,500	2030-2039
Adams	\$7,493,000	2020-2029
Adams	\$10,668,000	2020-2029
Adams	\$13,074,650	2030-2039
Adams	\$13,500,000	2020-2029
Adams	\$12,800,000	2020-2029
Adams	\$20,000,000	2020-2029
<b>Local government projects total</b>	<b>\$3,195,863,948</b>	

Continued on next page.

**Table 3.2: Locally funded project and programs (continued)**

Project name/ Corridor	Location/Limits	Project description
<b>Local government funded projects and programs</b>		
System preservation, enhancement, and operations	Varies	Road resurfacing; traffic signals, optimization, communication, variable message signs; and other systematic repairs and preventative maintenance
Bridges & culverts	Varies	Bridge replacement, rehabilitation, preservation, and systematic repairs
New non-regional roadway system	Varies	Construction of new arterials, collectors, and local roads
Toll authority debt service	Varies	Repayment of debt service for the construction of toll facilities
<b>E-470 Public Highway Authority projects and programs</b>		
E-470	U.S. Route 85 to I-25 North	Widen 4 to 6 lanes
E-470	I-76 to U.S. Route 85	Widen 4 to 6 lanes
E-470	Peoria	Widen to 6 through-lanes plus turn lanes
E-470	Sable	New interchange
E-470	104th to I-76	Widen 4 to 6 lanes
E-470	Peña to I-76	Widen 6 to 8 lanes
E-470	I-76	Add ramps for fully directional interchange
E-470	I-76	Add ramps for fully directional interchange
E-470	112th Ave.	New interchange
E-470	Peña	Add separated auxillary lanes
E-470	I-70 to 104th	Widen 4 to 6 lanes
E-470	88th Ave.	New interchange



County	Project cost (2020)	Staging period
Regional	\$17,025,350,550	2020-2050
Regional	\$3,367,673,315	2020-2050
Regional	\$48,275,895,000	2020-2050
Regional	\$1,850,678,088	2020-2050
<b>Local government programs total</b>	<b>\$70,519,596,954</b>	

Adams	\$28,000,000	2030-2039
Adams	\$21,096,000	2030-2039
Adams	\$21,096,000	2030-2039
Adams	\$16,000,000	2020-2029
Adams	\$106,500,000	2020-2029
Adams	\$27,700,000	2030-2039
Adams	\$18,000,000	2020-2029
Adams	\$15,822,000	2030-2039
Adams	\$15,822,000	2020-2029
Denver	\$23,000,000	2020-2029
Adams	\$30,589,000	2020-2029
Adams	\$102,000,000	2020-2029

Continued on next page.

**Table 3.2: Locally funded project and programs (continued)**

Project name/ Corridor	Location/Limits	Project description
<b>E-470 Public Highway Authority projects and programs</b>		
E-470	48th Ave.	New interchange
E-470	38th Ave.	New interchange
E-470/I-70 interchange Complex	I-70	Directional I-70 interchanges
E-470	Quincy to I-70	Widen 4 to 6 lanes
E-470	Smoky Hill to I-70	Widen 6 to 8 lanes
E-470	Parker Rd. to Smoky Hill	Widen 6 to 8 lanes
E-470	I-25 South to Parker Rd.	Widen 6 to 8 lanes

<b>E-470 Public Highway Authority projects and programs</b>		
E-470 renewal and replacement program	Varies	Infrastructure renewal, replacement and maintenance items
E-470 ramp signalization and geometric improvements	Varies	Signalize ramp terminal intersections and geometric interchange improvements
E-470 pavement overlays	Varies	Pavement overlays needed before reconstruction associated with anticipated widening
E-470 multiuse trails	Varies	Trail projects anticipated to be linked with E-470 widening

County	Project cost (2020)	Staging period
Adams	\$19,885,000	2020-2029
Adams	\$56,950,000	2020-2029
Adams	\$74,000,000	2020-2029
Arapahoe	\$83,100,000	2020-2029
Arapahoe	\$41,000,000	2020-2029
Arapahoe/ Douglas	\$109,000,000	2020-2029
Douglas	\$1,750,000	2020-2029
<b>E-470 Public Highway Authority projects total</b>	<b>\$811,310,000</b>	

Adams/ Arapahoe/ Douglas	\$679,022,419	2020-2050
Adams/ Arapahoe/ Douglas	\$62,444,000	2020-2050
Adams/ Arapahoe/ Douglas	\$25,618,000	2020-2050
Adams/ Arapahoe/ Douglas	\$28,600,000	2020-2050
<b>E-470 Public Highway Authority programs total</b>	<b>\$795,684,419</b>	
<b>Projects total</b>	<b>\$13,185,847,025</b>	
<b>Programs total</b>	<b>\$119,429,696,602</b>	
<b>Investment total</b>	<b>\$131,543,848,204</b>	

## 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 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, about 15 million trips made by individuals are made every weekday. The Focus Model sums all travel to forecast how many vehicles will be driven on major roads: travel speed and delay, 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 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.
- 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.

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. (See the Calibration Report at <https://drcog.org/sites/default/files/resources/Focus%202.3.1%20Calibration%20Report.pdf>)

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. (See the Validation Report at <https://drcog.org/sites/default/files/resources/Focus%202.3.1%20Validation%20Report.pdf>.)

## Regional socioeconomic 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 1 shows the population, household and employment forecasts by model staging years for the DRCOG full region and the metropolitan planning organization area.

**Table 1: Population, household, and employment 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

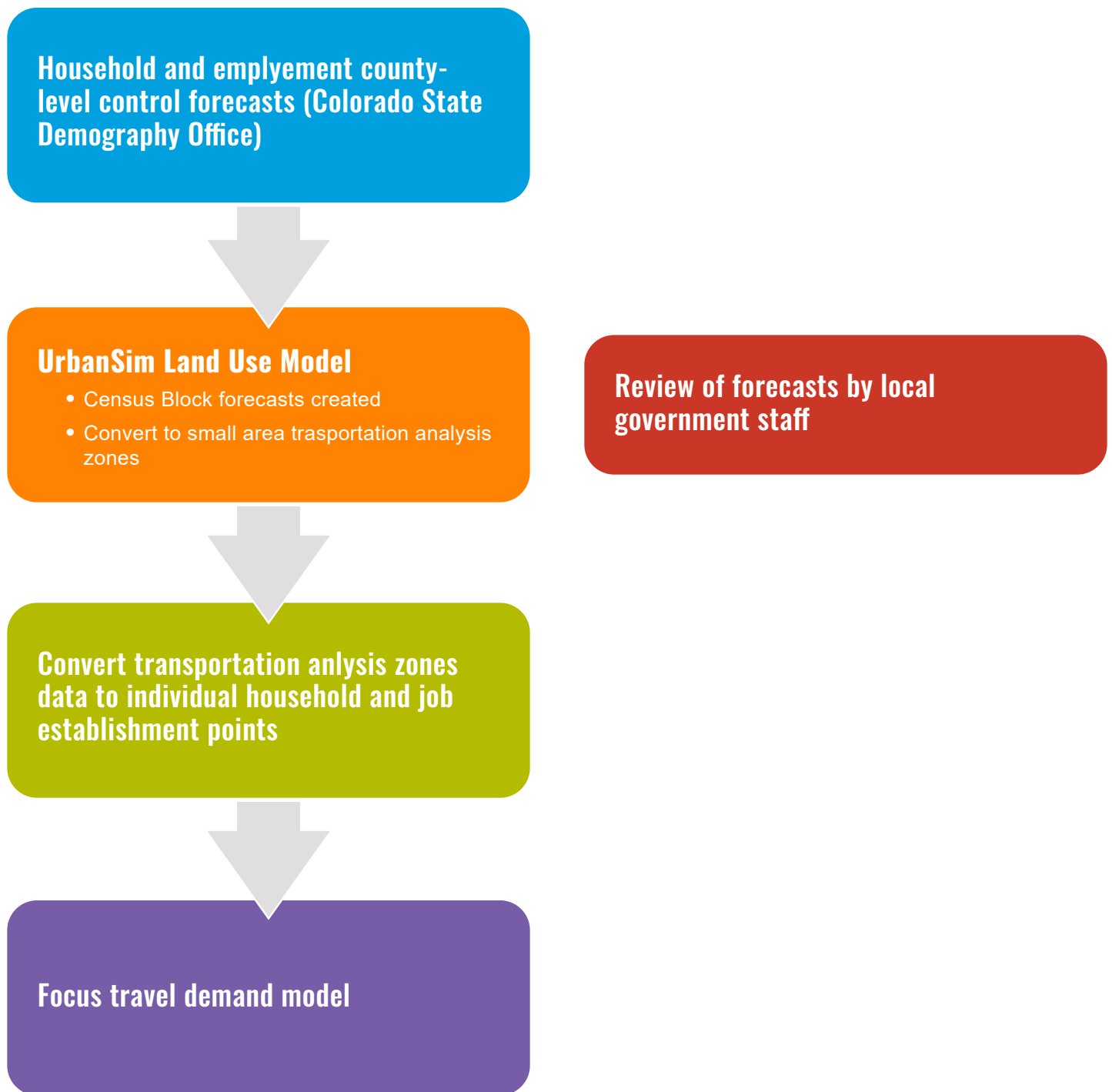
## Small area development forecasts

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, as shown in Figure 1. 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 2 shows a flowchart for the process of socioeconomic forecasting in the Denver region.

**Figure 2: Socioeconomic model elements and flow**





## Focus Model process overview

Figure 3 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 3: Focus activity-based model elements**

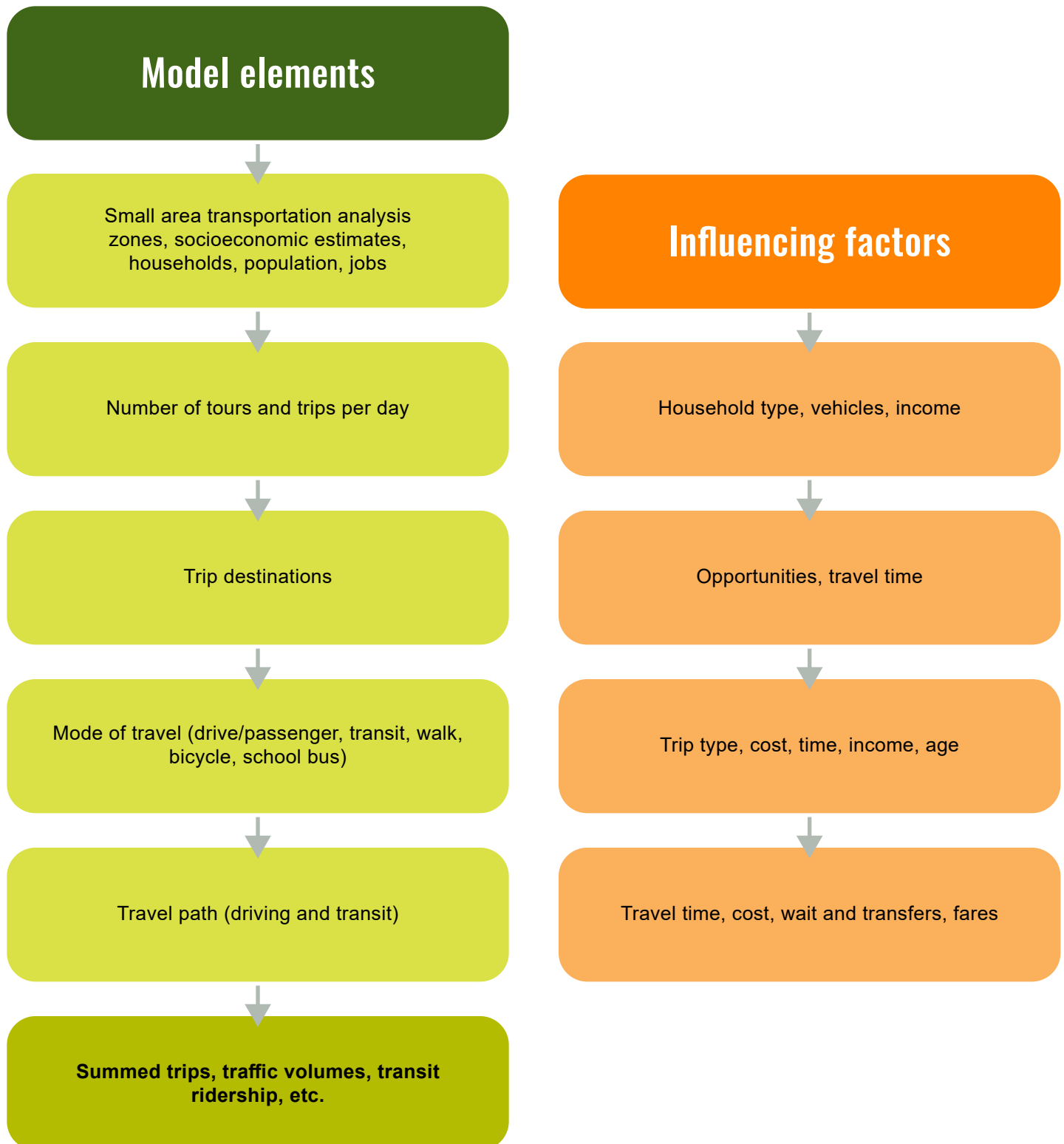
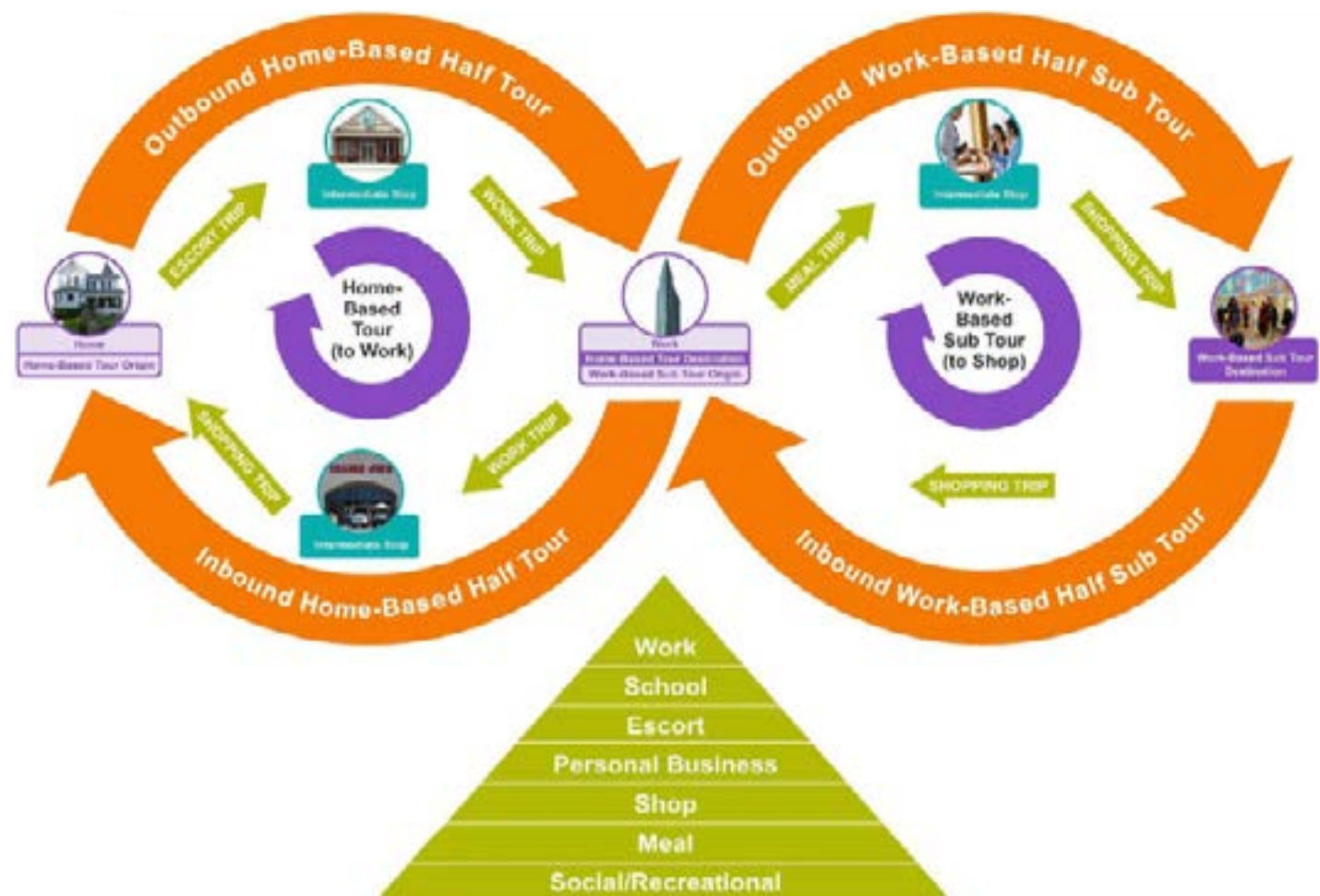


Figure 4: Sample tour diagram



## Roadway and transit system

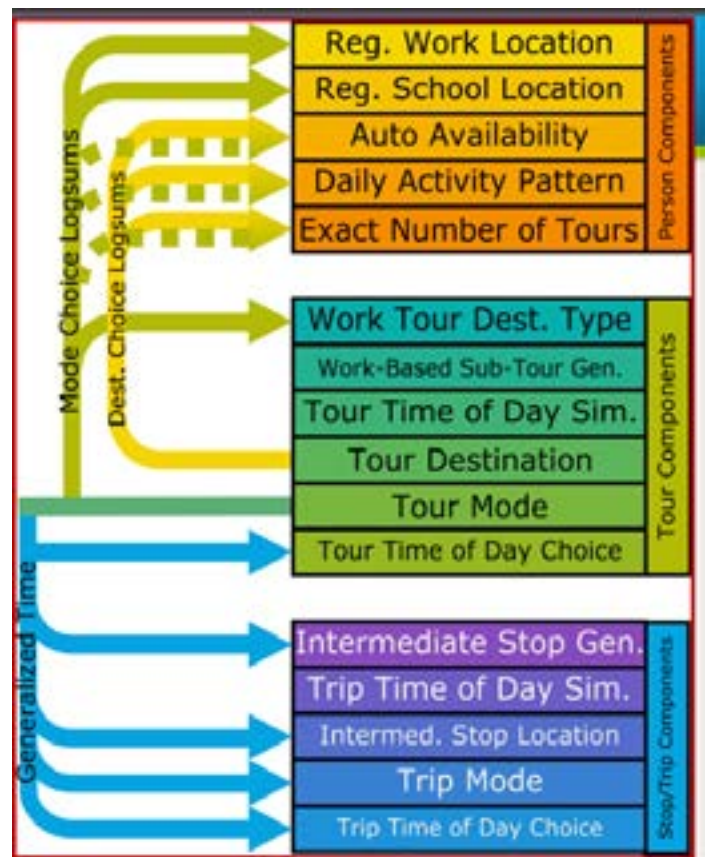
The most critical feature of the model is the representation of the transportation system. The roadway network is represented by over 25,000 directional road segments, described by location, length, number of lanes, functional classification and area type. High-occupancy vehicle and managed lanes also 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 5 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 5: Key focus model components (Activity Based Model components in red italics)**

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



## Roadway and transit skims (path selection)

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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

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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

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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 and information such as 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

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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 his or her 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 his or her 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 3 and Table 4.

***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 3: 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 4: Observed estimates and modeled 2020 transit weekday boardings**

	2019 observed (est.)	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 Table

	2020	2050
<b>Total population</b>	3,408,152	4,478,343
<b>Employment</b>	2,180,587	3,000,647
<b>Dwelling Units (Households)</b>	1,361,781	1,882,031
<b>Persons/Dwelling Unit (Household)</b>		
<b>VMT by Roadway Type</b>	2.5	2.38
-Freeway	34,056,247	47,659,781
-Expressway	5,254,677	7,116,310
-Principal	25,437,909	36,283,234
-Minor	8,604,440	12,042,677
-Other (Collectors, Centroid Connectors, Ramps)	17,202,507	26,046,738
<b>Total</b>	<b>90,555,780</b>	<b>129,148,740</b>
<b>Speed by Roadway Type (miles per hour)</b>		
-Freeway	58.8	54.2
-Expressway	43.2	39.9
-Principal	32.8	31.1
-Minor	29.3	28
-Other (Collectors, Centroid Connectors, Ramps)	27.1	27.1
<b>Total (Average Speed)</b>	<b>37.7</b>	<b>35.7</b>
<b>Lane Miles by Roadway Type</b>		
-Freeway	2,157	2,435
-Expressway	540	559
-Principal	4,293	5,098
-Minor	2,893	3,126
-Other (Collectors, Ramps)	10,823	10,890
<b>Total</b>	<b>20,706</b>	<b>22,108</b>

## Appendix D: Memorandums of Agreement – Transportation Conformity Evaluation Conducted Under the 8-Hour Ozone Standard

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Forthcoming.

## Appendix E: U.S. Department of Transportation Conformity Finding

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Forthcoming.

# PM10 2022 Updated 2050 Regional Transportation Plan Conformity Determination

for the DRCOG Fiscally Constrained Element of the 2050 Metro Vision Regional Transportation Plan and the DRCOG 2022-2025 Transportation Improvement Program and the Southern Subarea Portion of the Upper Front Range 2045 Regional Transportation Plan and the 2023-2026 State Transportation Improvement Program for the Upper Front Range Transportation Planning Region

**Adopted Sept. 21, 2022**

Denver Regional Council of Governments  
1001 17th St, Suite 700  
Denver, CO 80202

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## Executive Summary

The Denver Regional Council of Governments (DRCOG) has completed this transportation conformity determination as part of the transportation and air quality planning process. DRCOG's update to the long-range transportation plan triggered the need to perform the conformity analysis. This document demonstrates the area meets federally prescribed air pollution emissions budget tests  $PM_{10}$  and  $NO_x$  associated with  $PM_{10}$ . The attainment maintenance area continues to meet air quality conformity standards associated with DRCOG's long-range transportation plans and short-range transportation improvement programs. This document previously contained the conformity determination for carbon monoxide (CO). However, on January 14th, 2022, the Denver area completed the 20-year maintenance period requirement and is no longer required to address transportation conformity determination for carbon monoxide (CO).

## Emissions Test Results

The modeled emissions estimates were generated by the Air Pollution Control Division outputs from DRCOG's transportation model, Focus, as in input to the Motor Vehicle Emission Simulator (MOVES) model. The modeled emissions must be below the budgets to pass conformity tests. All staging year results for the Denver region are reported in Error! Reference source not found. Model results for emissions are below the budgets, thus all tests are passed and conformity requirements are met.

**Table 1. Conformity emissions test results**

Pollutant	Test	Result < budget (tons per day)	Pass/fail
$PM_{10}$	2023 Staging $\leq$ Budget	28 < 55	Pass
	2030 Staging $\leq$ Budget	30 < 55	Pass
	2040 Staging $\leq$ Budget	32 < 55	Pass
	2050 MVRTP $\leq$ Budget	35 < 55	Pass
$NO_x$ associated with $PM_{10}$	2023 Staging $\leq$ Budget	20 < 56	Pass
	2030 Staging $\leq$ Budget	18 < 56	Pass
	2040 Staging $\leq$ Budget	9 < 56	Pass
	2050 MVRTP $\leq$ Budget	9 < 56	Pass

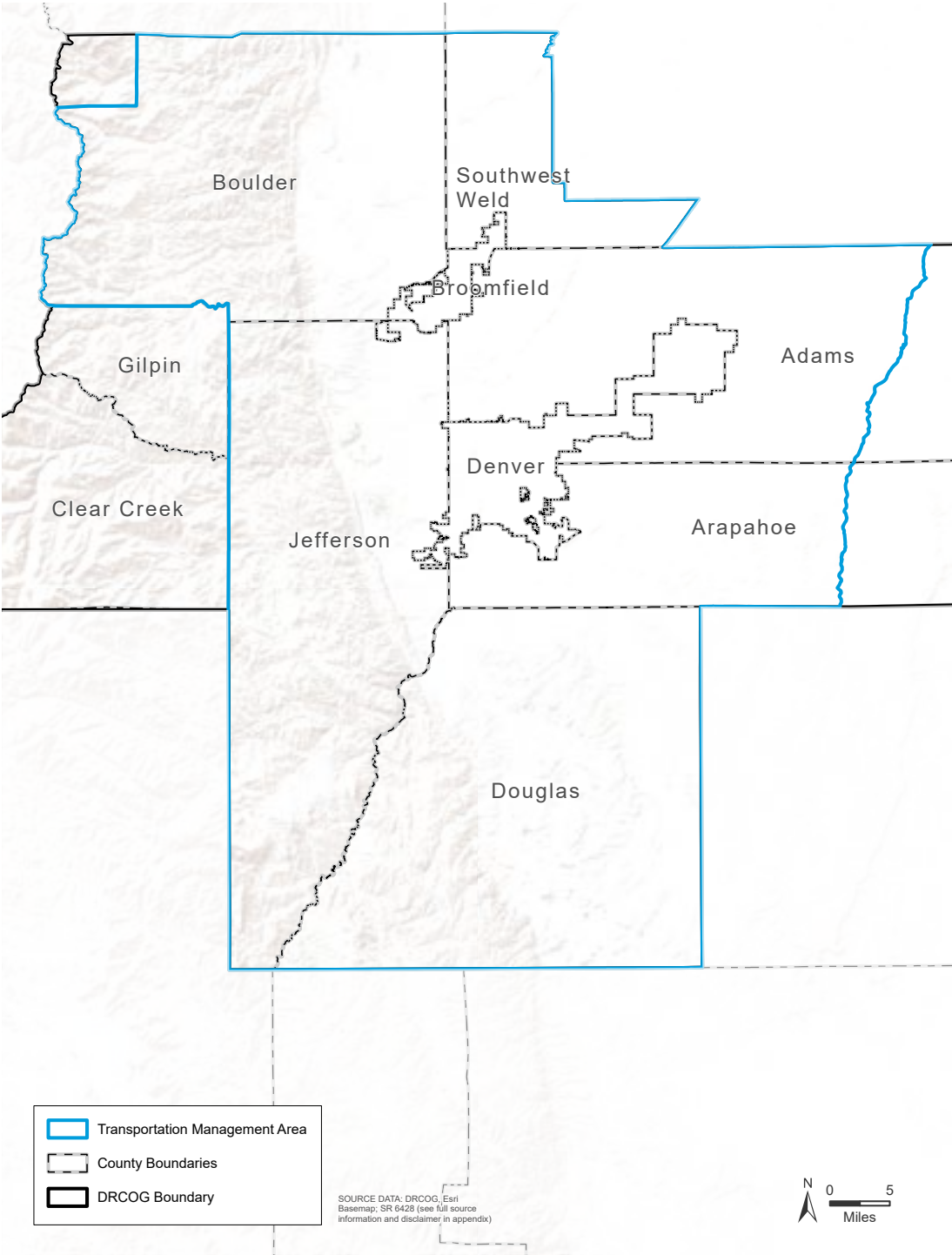
## Chapter 1. What is transportation conformity?

### Background and federal requirements

The Denver Regional Council of Governments is the Metropolitan Planning Organization for the Denver Transportation Management Area shown in Figure 1. The region is an attainment maintenance area for  $PM_{10}$ , a redesignation from the previous designation of nonattainment. The pollutants and their violation status for the Denver region are shown in Table 2. DRCOG is required to show conformity of its fiscally constrained transportation plan and Transportation Improvement Program with the State Implementation Plan for air quality before these transportation plans and programs are adopted. This action is required under Section 176(c) of the Clean Air Act, as amended in 1990. The region has been redesignated as an attainment area for CO, and thus CO emissions are no longer reported for conformity determination processes.

The Clean Air Act defines conformity as compliance to the implementation plan's purpose of eliminating or reducing the severity and number of violations of the National Ambient Air Quality Standards (NAAQS) 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 towards attainment. The U.S. Environmental Protection Agency criteria and procedures vary according to the status of the State Air Quality Implementation Plans for individual pollutants. Transportation plans and programs must satisfy different criteria depending on whether the state has submitted a SIP revision, and whether the EPA has approved the revision. For pollutants for which a region currently meets standards but was formerly in nonattainment, the applicable State Implementation Plan may also be referred to as a maintenance plan, which demonstrates continued attainment of the standards. The EPA final transportation conformity rule is located at 40 CFR Part 93. To address revised standards and changes in conformity requirements, the EPA promulgated several amendments to the final rule as detailed in Table 3.

Figure 1. Transportation Management Area



**Table 2. Pollutant status in the Denver region**

Pollutant	Standard	Status
Carbon Monoxide (CO)	A violation of the carbon monoxide standard occurs when a monitoring station shows more than one exceedance per year of the 8-hour (9 parts per million (ppm)) or 1 hour (35 ppm) standard.	The carbon monoxide standard was last violated in 1995. There has been no violation for CO in the Denver region during the 20-year maintenance period requirement and thus is no longer required to address transportation conformity determination for carbon monoxide (CO).
PM <sub>2.5</sub>	An exceedance of the PM <sub>2.5</sub> standard occurs when a monitoring station exceeds the annual average of 12 µg/m <sup>3</sup> or the 24-hour average of 35 µg/m <sup>3</sup> . A violation of the 24-hour standard occurs only if the 3-year average of the 98th percentile of all 24 hour readings at a monitor exceeds 35 µg/m <sup>3</sup> or the 3-year average of the annual averages exceeds 12 µg/m <sup>3</sup> .	The Denver metropolitan area has never violated either of the two PM <sub>2.5</sub> standards.
PM <sub>10</sub>	An exceedance of the PM <sub>10</sub> standard occurs when a monitoring station exceeds a 24 hour average of 150 µg/m <sup>3</sup> . If the 24-hour standard is exceeded more than three times over a three-year period, it is a violation.	The PM <sub>10</sub> standard was last violated on three days in 1993. There has been no violation for PM <sub>10</sub> in the Denver region since. The maintenance period requirement will end October 16, 2022 and following EPA approval DRCOG will no longer be required to address transportation conformity determination for PM <sub>10</sub> .

**Table 3. Historical summary for National Ambient Air Quality Standards in the Denver region**

Date	Milestone	Comments
July 1, 2004	EPA issued amendments to the final transportation conformity rule.	These addressed conformity regulations for the 8-hour ozone and fine particulate matter (PM <sub>2.5</sub> ) NAAQS, the incorporation of existing federal guidance that is consistent with a U.S. Court of Appeals decision, and streamlining and improving of the rule. <sup>1</sup>
March 10, 2006	EPA issued revisions addressing PM <sub>2.5</sub> and PM <sub>10</sub> Hot-Spot Analyses in Project-Level Transportation Conformity Determinations.	These project-level conformity analyses are the responsibility of project sponsors. This conformity finding covers plan and program level conformity only.
January 24, 2008	The U.S. Department of Transportation and EPA issued the transportation conformity rule.	Titled: "Transportation Conformity Rule Amendments To Implement Provisions Contained in the 2005 Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU)."
March 8, 2012	EPA issued amendments which restructure several sections of the existing transportation conformity rule.	Included restructuring two sections of the conformity rule, 40 CFR 93.109 and 93.119, so that the existing rule requirements clearly apply to areas designated for future new or revised NAAQS, thus reducing the need to amend the transportation conformity rule merely to reference specific new NAAQS. Conformity rules applies to any future new NAAQS.

<sup>1</sup>40 Code of Federal Regulations Part 93

Date	Milestone	Comments
October 17, 2020	EPA submitted a letter that the conformity requirements no longer apply to the Longmont CO maintenance area due to the expiration of the 20-year maintenance plan.	The Longmont CO maintenance area showed continuous maintenance of the CO NAAQS from November 23, 1999 through October 16, 2020, meeting its obligation to demonstrate maintenance of the CO NAAQS for 20 years. Therefore, as of October 17, 2020, DRCOG is no longer required to address transportation conformity determination for the Longmont CO maintenance area.
February 9, 2022	EPA submitted a letter that the conformity requirements no longer apply to the Denver-Boulder CO maintenance area due to the expiration of the 20-year maintenance plan.	The Denver-Boulder maintenance area showed continuous maintenance of the CO NAAQS from January 14, 2002 through January 14, 2022, meeting its obligation to demonstrate maintenance of the CO NAAQS for 20 years. Therefore, as of January 15, 2020, DRCOG is no longer required to address transportation conformity determination for the Denver-Boulder maintenance area.

## Relevant agencies and ongoing 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 2022-2025 Transportation Improvement Program identifies transit, multimodal and roadway projects to be funded from fiscal year 2022 through fiscal year 2025. 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. 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 2022-2025 Transportation Improvement Program, and continue to facilitate youth and civic engagement on a regular basis. DRCOG has provided numerous public participation opportunities, including workshops, county forums, stakeholder meetings, surveys, interactive online forums, a Youth Advisory Panel and a Civic Advisory Group.



## Air quality planning

The status of air quality planning is important as it determines the emissions tests that must be met to show conformity. The State of Colorado submitted the latest Denver particulate matter equal to and less than 10 microns in aerodynamic diameter ( $PM_{10}$ ) maintenance plan to the EPA in December 2005. EPA approved this latest  $PM_{10}$  State Implementation Plan Revision on January 7, 2008. This latest  $PM_{10}$  Maintenance Plan revision contains the  $PM_{10}$  budget of 55 tpd for 2022 and beyond, respectively, as well as the wintertime  $NO_x$  budgets 56 tpd for 2022 and beyond.

On December 14, 2012, EPA strengthened the annual  $PM_{2.5}$  standard from 15 to 12 micrograms per cubic meter ( $\mu g/m^3$ ) and retained the 24-hour  $PM_{2.5}$  standard of 35  $\mu g/m^3$ . The agency also retained the existing standard for  $PM_{10}$ . Based on the existing  $PM_{2.5}$  monitor data, the Denver region does not violate either the new annual  $PM_{2.5}$  standard, or the existing 24-hour  $PM_{2.5}$  standard.

## Agency roles

The Conformity State Implementation Plan was developed by the Air Quality Control Commission and adopted in 1998. It formally defines the process for finding conformity. The EPA approved the Conformity State Implementation Plan on September 21, 2001 (66 FR 48561), making it federally enforceable.

DRCOG, as the Metropolitan Planning Organization, and the Federal Transit Administration and Federal Highway Administration, as representatives of the U.S. Department of Transportation, are charged with determining conformity for the Denver Transportation Management Area. The development of this conformity determination has been a cooperative process between DRCOG and the Regional Air Quality Commission, the Air Pollution Control Division of the Colorado Department of Public Health and Environment, the U.S. Environmental Protection Agency, the and the Federal Transit Administration and Federal Highway Administration, the Colorado Department of Transportation, and the Regional Transportation District. In 2015, a memorandum of agreement was signed by DRCOG, the North Front Range Metropolitan Planning Organization, the Colorado Department of Public Health and Environment, and the Regional Air Quality Commission for the purpose of defining the specific roles and responsibilities in conformity evaluations and findings.

## Chapter 2. Transportation control measures

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For this conformity determination, there are no transportation control measures identified for timely completion or implementation as part of the applicable implementation plan. All transportation control measures associated with the PM<sub>10</sub> State Implementation Plans were completed by 2006.

# Chapter 3. Emissions test process and assumptions

## Background and budgets

The transportation plan and program must pass a series of emissions tests to demonstrate conformity. These emissions tests relate to the pollutants and their precursors for which the Denver region is designated as attainment-maintenance of the NAAQS.

These pollutants and precursors include:

- PM<sub>10</sub>
- Nitrogen oxides (NO<sub>x</sub>) as a precursor for PM<sub>10</sub> (wintertime estimate)

Each pollutant and precursor in specific geographic areas must pass a number of tests. The plan and program must respect the motor vehicle emissions budget in the applicable State Implementation Plan or State Implementation 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 applicable maintenance plan. As required by 40 CFR 93.118, consistency with the motor vehicle emissions budget(s) must be demonstrated for each year for which the applicable implementation plan specifically establishes motor vehicle emissions budget(s), for the attainment year (if it is within the timeframe of the transportation plan), for the last year of the transportation plan's forecast period, and for any intermediate years as necessary so that the years for which consistency is demonstrated by analysis are no more than ten years apart.

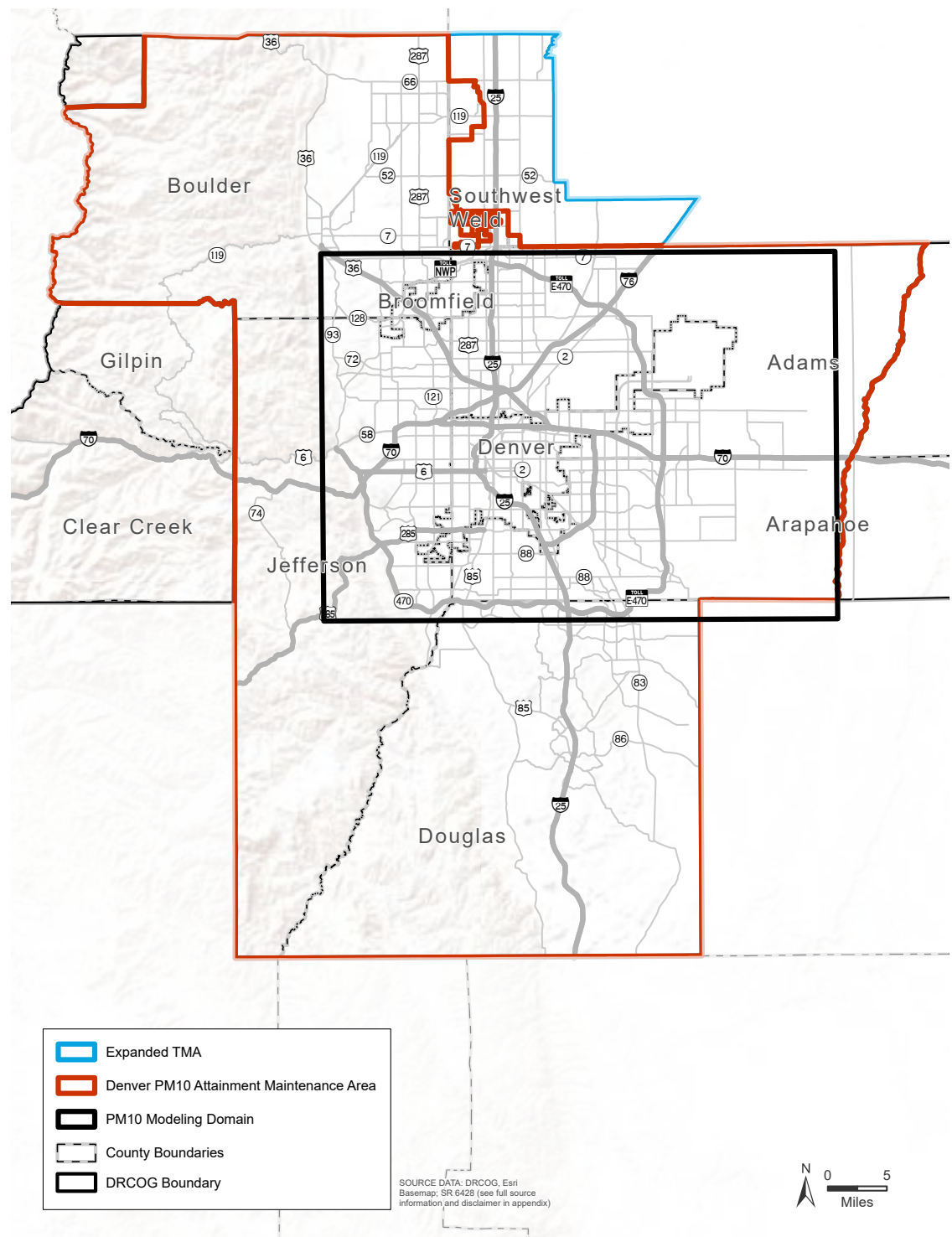
In addition, when a maintenance plan has been submitted, emissions must be less than or equal to the motor vehicle emissions budget(s) established for the last year of the maintenance plan and any year for which the maintenance plan establishes budgets. Applying these tests for the prescribed time periods for each of the pollutants results in 16 emissions tests as listed in Table 4<sup>5</sup>. The analysis areas are shown in Figure 2.

Table 4. Conformity emissions tests

Pollutant	Tests
PM <sub>10</sub>	2023 staging ≤ Budget of 55 tpd 2030 staging ≤ Budget of 55 tpd 2040 staging ≤ Budget of 55 tpd 2050 MVRTP ≤ Budget of 55 tpd
NO <sub>x</sub> associated with PM <sub>10</sub>	2023 staging ≤ Budget of 56 tpd 2030 staging ≤ Budget of 56 tpd 2040 staging ≤ Budget of 56 tpd 2050 MVRTP ≤ Budget of 56 tpd

<sup>5</sup>Transportation model runs represent the beginning of a calendar year. Test dates listed in Table 4 refer to model run dates.

Figure 2. Attainment maintenance area



## Technical process

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 were updated as part of this conformity finding process. Appendix B describes the modeling structure and recent enhancements for the DRCOG travel demand model in more detail. The assumptions are also used in the Motor Vehicle Emission Simulator model (MOVES) to estimate emissions.

## Demographic assumptions

The population forecast for the full DRCOG region in 2050 is 4,382,172. This is a 31 percent increase over the 2020 estimated population of 3,337,670. Employment is forecast to be 2,948,530 in 2050 compared to the 2020 estimate of 2,147,815, an increase of 37 percent. Growth in population and employment will be the principal factor for the increased demand for travel on the region's transportation facilities and services. Table 5 shows the latest forecasts of population and employment for 2020, 2023, 2030, 2040, and 2050 for the DRCOG region. Table 6 lists 2020 and 2050 population and employment estimates by each of the nine counties, as well as the southwest portion of Weld County within the DRCOG region.

## DRCOG transportation assumptions

In order to complete the emissions tests, the 2023, 2030, 2040, and 2050 transportation networks must first be defined. DRCOG's 2022 Updated 2050 Metro Vision Regional Transportation Plan specifies financially constrained highway and transit system improvements and resulting networks to be completed by the year 2050. The 2022-2025 TIP identifies funding to complete regionally significant projects on the designated regional roadway and rapid transit system that are also contained in the amended 2050 Metro Vision Regional Transportation Plan. All roadway and rapid transit network and staging assumptions through 2050 are shown in the figures found in Appendix A.

## Air quality modeling assumptions

The APCD of the CDPHE calculates air pollutant emissions using MOVES. The models and assumptions used by APCD in the conformity analysis were consistent with those used in the development of the PM<sub>10</sub> SIP. The MOVES model accounts for estimates of vehicle types by miles traveled, effects on emissions caused by vehicle regulations, street sweeping commitments, and more.

**Table 5. Population and employment forecasts**

	2020	2023	2030	2040	2050
<b>Population</b>	3,337,670	3,498,995	3,785,201	4,159,665	4,382,172
<b>Employment</b>	2,147,815	2,228,303	2,427,498	2,687,506	2,948,530

Source: State Demography Office, Colorado Department of Local Affairs 2019 Data Pull. Weld County portioning applied by DRCOG staff.  
Counties included in totals: Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, Jefferson and southwestern Weld.

**Table 6. 2020 and 2050 population and employment estimates by county – southern subarea**

County	Population		Employment	
	2020	2050	2020	2050
Adams County	523,778	842,689	267,686	365,949
Arapahoe County	659,564	837,991	426,173	584,069
Boulder County	331,025	420,105	248,111	339,920
City and County of Broomfield	72,773	98,239	48,254	66,192
City and County of Denver	736,531	883,165	646,251	885,225
Douglas County	354,508	464,189	174,176	238,725
Jefferson County	586,965	661,332	313,198	429,177
Southwestern Weld County	72,526	174,462	23,966	39,273
<b>Total carbon monoxide and PM<sub>10</sub> nonattainment area</b>	<b>3,337,670</b>	<b>4,382,172</b>	<b>2,147,815</b>	<b>2,948,530</b>

Source: State Demography Office, Colorado Department of Local Affairs 2019 Data Pull. Weld County portioning applied by DRCOG staff.  
Counties included in totals: Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, Jefferson and southwestern Weld.

## PM<sub>10</sub> Street Maintenance Actions

There are several actions or projects described or assumed in the SIPs that are federally enforceable control measures. PM<sub>10</sub> street maintenance actions are one of the control measures.

DRCOG must demonstrate that future year estimates of PM<sub>10</sub> emissions will be less than or equal to the maintenance PM<sub>10</sub> emissions budgets to show conformity with the PM<sub>10</sub> State Implementation Plan. The mobile source PM<sub>10</sub> budgets are 54 tons per day through 2021, and 55 tons per day for 2022 and beyond.

Air Quality Control Commission Regulation 16 is essential to the control of mobile source emissions. Adopted on August 15, 1991, the regulation has undergone several revisions, with the latest occurring on April 19, 2001. Re-entrained road dust in the Denver metropolitan area from winter street sanding causes between 40 and 60 percent of PM<sub>10</sub> emissions. It is the single largest contributor to PM<sub>10</sub> emissions.<sup>6</sup> Regulation 16 targets street sanding and sweeping practices.

Since October 1, 1991, street sanding material providers have been required to meet set standards for the sanding materials they provide to state, city, and county governments. The regulation applies to both new and recycled sanding materials. All materials must meet requirements regulating their angularity, percent fines, and degree of durability. The burden of material testing to meet these standards falls on the private companies supplying the materials. An independent laboratory must conduct all testing.

Reductions in the applied amount of sanding material are also set for all the local governments and street maintaining agencies (Colorado Department of Transportation, Regional Transportation District, E-470 Authority, Northwest Parkway Authority) within the nonattainment area. A reduction of 30 percent from their established baseline amount is mandated. Baseline amounts are typically based on 1989 practices. In the defined “foothills” area, a 20 percent reduction from the established baseline is mandated. In addition to the above requirements, there are specific requirements to the City and County of Denver and Colorado Department of Transportation:

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<sup>6</sup>In June 1998, the Colorado Department of Transportation, with technical assistance of Midwest Research Institute, concluded a study of the role of sand in PM<sub>10</sub> emissions. Findings from this study demonstrated that the percentage of the total PM<sub>10</sub> emissions from road traffic that consist of road dust increases from about 50 percent to as much as 80 or 90 percent during the high impact 24-hour period following road sanding. Previously, the PM<sub>10</sub> emissions analysis had been using a sand share of 33.8 percent or about half of the recent study findings. Increasing the role of sand in producing PM<sub>10</sub> emission increases the benefits of reduced street sanding. Over the past few years, local governments, CDOT, RTD and the E-470 Public Highway Authority have made major strides to reduce PM<sub>10</sub> emissions from street sand by reducing the amount of sand spread on the streets during snow storms by about 40 percent from 1989 street sanding levels and increasing the sweeping of sanded streets within four days of each snow storm from none to 40 percent.

- The City and County of Denver shall achieve a 72% reduction within the Denver central business district. The central business district is defined as the area bounded by and inclusive of Colfax Avenue, Speer Boulevard, Wynkoop Street, 20th Street, and Broadway.
- Colorado Department of Transportation shall achieve a 54% reduction from Interstate 25 and its entrance/exit ramps between 6th Avenue and University Boulevard.
- The City and County of Denver and Colorado Department of Transportation shall achieve a 50% reduction on roadways within the area bounded by, and including, Federal Boulevard, Downing Street, 38th Avenue, and Louisiana Avenue.

Records and reports of the reductions and practices used must be submitted yearly to the Air Pollution Control Division and the Regional Air Quality Council.

Finally, Regulation 16 sets rules for street sweeping to achieve reductions in  $PM_{10}$  emissions. These rules include time requirements for sweeping after deployments of street sanding materials, definition of the sweeping techniques to be used, and targeted areas for increased sweeping. Record keeping and reporting of dates, equipment use, and areas swept are required under these rules.

Preliminary estimates of emissions for the original 2035 Regional Transportation Plan in 2012 indicated that  $PM_{10}$  emissions would be higher than the 55 tpd emissions budget after accounting for the impacts of Regulation 16. Because of this anticipated exceedance of the  $PM_{10}$  emissions budget, local governments and road agencies were asked to provide commitments to further reduce

emissions as part of the RTP update. These commitments are for additional reductions in sand application and an increase in street sweeping activities, above and beyond Regulation 16, to further reduce mobile source  $PM_{10}$  emissions. In 2020, 44 agencies submitted their commitments to DRCOG. The local governments and agencies have decided on the combination of the above actions to meet their commitments. The street sanding and sweeping commitments made by local governments and road agencies in 2020 are detailed in Appendix D.

Actions that can be employed to achieve  $PM_{10}$  reductions:

- Reducing the total amount of sanding materials used.
- Using anti-icers, deicers, and other sand substitutes in place of sanding materials.
- Street sweeping within four days of each snow event.

The  $PM_{10}$  maintenance plan also identifies a test whereby the region must demonstrate that transportation construction emissions do not exceed those assumed in the emissions budgets. The budgets were established on the assumption that all of the facilities in the amended 2020 Fiscally Constrained Regional Transportation Plan. To pass the test, the rate of lane-mile construction proposed in the 2050 Metro Vision Regional Transportation Plan must be less than or equal to the rate of construction in the 2020 Fiscally Constrained Regional Transportation Plan. The construction emissions of the 2050 Metro Vision Regional Transportation Plan are less than the construction emissions assumed in the budgets and the test is passed.



## Other Mobile Source Reduction Measures

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:

- Travel demand management (TDM) programs such as DRCOG's Regional Way to Go Program, transit pass subsidies, and other TDM actions will help to reduce the amount of single-occupant-vehicle driving by the growing population of the region. TDM 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 (ITS) technological improvements covering a range of communications (vehicle and infrastructure), monitoring, public information, and other projects

## Emission Test Results

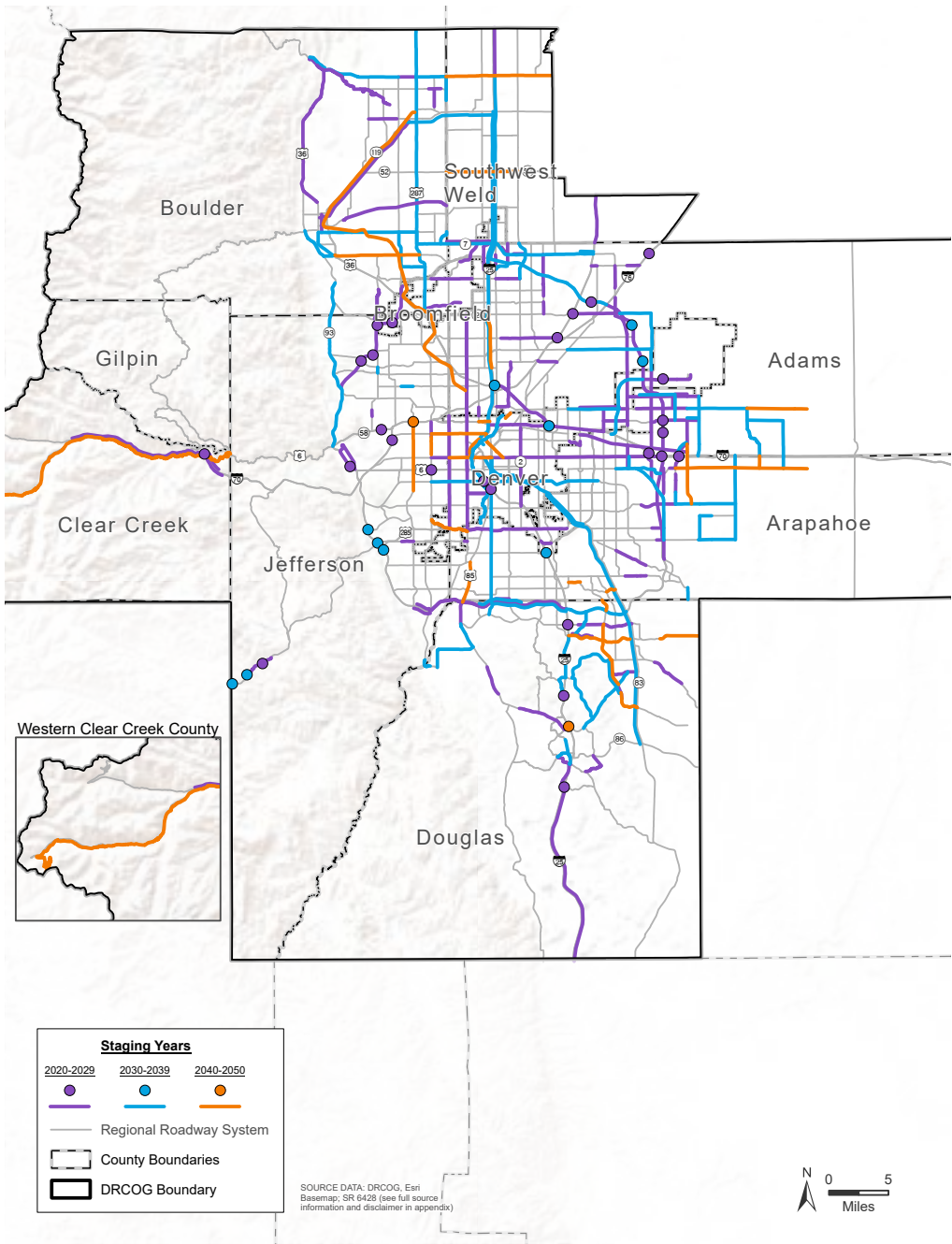
The results of emissions tests are reported in Table 1. All tests are passed as the emissions test results for the Denver region are less than all of the budgets. The emissions estimates were generated by Air Pollution Control Division using transportation inputs and emissions models. The test results do not indicate any failures in the horizon years of the program or plan that would lead to a finding of non-conformity.

**Table 1. Conformity emissions test results**

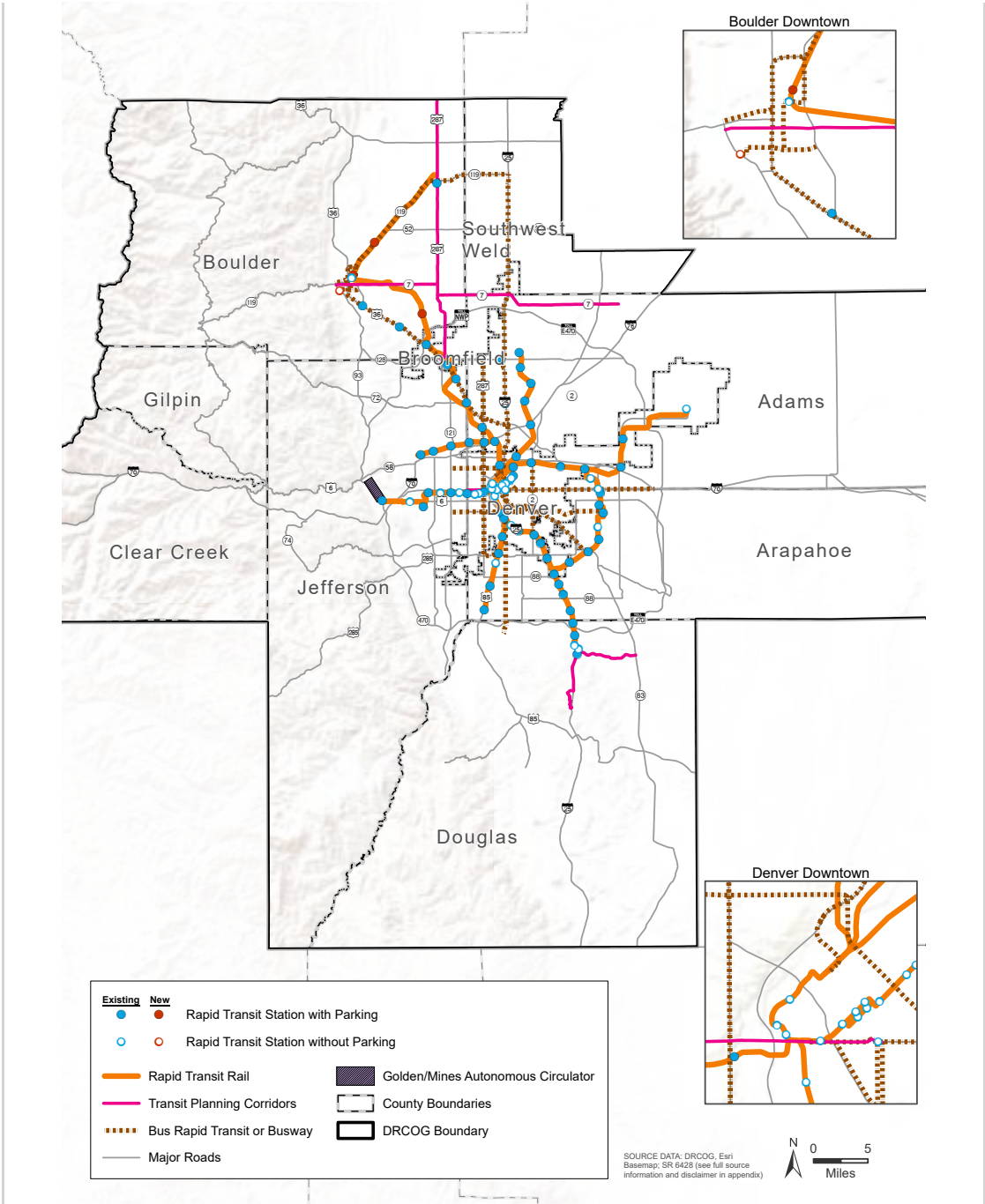
Pollutant	Test	Result<budget (tons per day)	Pass/fail
PM <sub>10</sub>	2023 Staging ≤ Budget	28 < 55	Pass
	2030 Staging ≤ Budget	30 < 55	Pass
	2040 Staging ≤ Budget	32 < 55	Pass
	2050 MVRTP ≤ Budget	35 < 55	Pass
NO <sub>x</sub> associated with PM <sub>10</sub>	2023 Staging ≤ Budget	20 < 56	Pass
	2030 Staging ≤ Budget	18 < 56	Pass
	2040 Staging ≤ Budget	9 < 56	Pass
	2050 MVRTP ≤ Budget	9 < 56	Pass

# Appendix A. DRCOG transportation network and project assumptions

## 2050 Staging of fiscally constrained roadway capacity projects



2050 Fiscally constrained rapid transit system guideway facilities and stations



**Table 3.1: Regionally funded project and program investment priorities**

Project name/ Corridor	Location/Limits	Project description
<b>2050 Metro Vision Regional Transportation Plan: regionally funded projects and programs</b>		
<b>Colorado Department of Transportation administered funds for multimodal capital projects and programs</b>		
C-470	U.S. Route 285/ Morrison/Quincy	Interchange complex reconstruction
Federal Blvd.	6th Ave. to Howard Pl.	Widen from 5 to 6 lanes
I-25 North (Segment 5)	State Hwy. 66 to Weld County Rd. 38 (DRCOG boundary)	Add 1 toll/managed lane each direction
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
I-25 North	E-470 to State Hwy. 7	Managed lanes, State Hwy. 7 interchange reconstruction and State Hwy. 7 mobility hub
I-25 North	84th Ave. to 104th Ave.	Operational improvements, center-loading transit station at 88th Ave. and general purpose lane
I-25 Central Improvements	Santa Fe Blvd. to 20th St.	Safety, operations, multimodal mobility, transit, and community connections
I-25	Speer Blvd./23rd Ave.	Bridge replacements with safety and multimodal mobility improvements
I-25	Santa Fe Dr. (U.S. Route 85) to Alameda Ave.	Bridge replacement, intersection safety, and multimodal mobility improvements
I-25	Bellevue	Interchange reconstruction and pedestrian connections
I-25	El Paso County Line to north of Crystal Valley Pkwy.	Add 1 toll/managed-lane each direction
I-270	I-25/U.S. Route 36 to I-70	New managed lanes

County	Project cost (2020)	Staging period	Multimodal Project Elements			
			Bicycle/pedestrian	Safety	Transit	Freight
Jefferson	\$150,000,000	2030-2039		●		●
Denver	\$23,400,000*	2020-2029	●	●	●	●
Weld	\$175,000,000	2020-2029		●	●	●
Broomfield/ Weld	\$150,000,000	2030-2039	●	●	●	●
Broomfield	\$200,000,000	2030-2039	●	●	●	●
Adams	\$230,000,000	2040-2050	●	●	●	●
Denver	\$645,000,000	2040-2050	●	●	●	●
Denver	\$75,000,000	2020-2029	●	●	●	●
Denver	\$35,000,000	2020-2029	●	●		●
Arapahoe	\$112,000,000	2030-2039	●	●		●
Douglas	\$300,000,000*	2020-2029	●	●	●	●
Adams	\$500,000,000	2020-2029		●	●	●

Continued on next page.

\* This cost is not included in the fiscal constraint analysis because funding was allocated prior to 2020.

**Table 3.1: Regionally funded project and program investment priorities (continued)**

Project name/ Corridor	Location/Limits	Project description
Colorado Department of Transportation administered funds for multimodal capital projects and programs		
I-270	I-25/U.S. Route 36 and I-70	New freeway "direct connects" at each end of I-270
I-70 Floyd Hill eastbound improvements	Floyd Hill to Veterans Memorial Tunnel	TBD
I-70 Floyd Hill westbound improvements	Floyd Hill to Veterans Memorial Tunnel	TBD
I-70	Eisenhower-Johnson Memorial Tunnels	Major rehabilitation of the Eisenhower-Johnson Memorial Tunnels
I-70	Twin Tunnels to Empire Junction (U.S. Route 40)	Add 1 westbound peak period managed lane
I-70	Kipling	Interchange reconstruction and pedestrian connections
I-70	I-25 to Chambers Rd.	Add 2 new managed lanes
State Hwy. 66	Lyons to Hover	Operational/safety improvements from Lyons to Longmont
State Hwy. 66	Hover St. to Main St. (U.S. Route 287)	Widen from 2 to 4 lanes
State Hwy. 83 (Parker Rd.)	State Hwy. 86 to E. Mississippi Ave.	Corridor planning/investment for multimodal mobility, operations and safety
U.S. Route 6	Wadsworth Blvd.	Interchange capacity
U.S. Route 85	120th Ave.	New interchange
U.S. Route 85	104th Ave.	New interchange

County	Project cost (2020)	Staging period	Multimodal Project Elements			
			Bicycle/pedestrian	Safety	Transit	Freight
Adams	\$300,000,000	2030-2039		●	●	●
Clear Creek	\$250,000,000	2020-2029		●	●	●
Clear Creek	\$450,000,000	2020-2029		●	●	●
Clear Creek	\$142,000,000	2020-2050		●	●	●
Clear Creek	\$50,000,000*	2020-2029		●		●
Jefferson	\$80,000,000	2040-2050	●	●		●
Denver/Adams	\$1,175,700,000*	2020-2029	●	●	●	●
Boulder	\$5,000,000	2030-2039	●	●		●
Boulder	\$5,000,000	2020-2029	●	●		●
Arapahoe/ Douglas	\$150,000,000	2030-2039	●	●	●	●
Jefferson	\$80,000,000	2020-2029	●	●		●
Adams	\$100,000,000	2020-2029		●		●
Adams	\$100,000,000	2020-2029		●		●

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\* This cost is not included in the fiscal constraint analysis because funding was allocated prior to 2020.

**Table 3.1: Regionally funded project and program investment priorities (continued)**

Project name/ Corridor	Location/Limits	Project description
Colorado Department of Transportation administered funds for multimodal capital projects and programs		
U.S. Route 85	Louviers to milepost 191.75	Widen from 2 to 4 lanes
U.S. Route 85	Sedalia to Daniels Park	Widen from 2 to 4 lanes
U.S. Route 85	Daniels Park to Meadows	Widen from 2 to 4 lanes
U.S. Route 285	Pine Valley Rd. (County Rd. 126)/Mt. Evans Blvd.	New interchange
U.S. Route 285	Parker Ave.	New interchange
U.S. Route 285	Shaffers Crossing to Kings Valley Dr.	Widen from 3 to 4 lanes (add 1 southbound lane)
U.S. Route 285	Kings Valley Dr.	New interchange
U.S. Route 285	Kings Valley Dr. to Richmond Hill Rd.	Widen from 3 to 4 lanes (add 1 southbound lane)
Vasquez Blvd.	60th Ave.	Intersection improvements
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



County	Project cost (2020)	Staging period	Multimodal Project Elements			
			Bicycle/pedestrian	Safety	Transit	Freight
Douglas	\$59,000,000*	2020-2029		●		●
Douglas	\$35,000,000	2020-2029	●	●		●
Douglas	\$32,000,000	2020-2029	●	●		●
Jefferson	\$40,000,000	2030-2039		●		●
Jefferson	\$25,000,000	2030-2039		●		●
Jefferson	\$60,000,000	2020-2029		●		●
Jefferson	\$15,000,000	2020-2029		●		●
Jefferson	\$25,000,000	2020-2029		●		●
Adams	\$80,000,000	2040-2050		●		●
CDOT projects total	\$4,246,000,000					
Regional	\$11,408,841,041	2020-2050	●	●	●	●
CDOT programs total	\$11,408,841,041					

Continued on next page.

\* This cost is not included in the fiscal constraint analysis because funding was allocated prior to 2020.

**Table 3.1: Regionally funded project and program investment priorities (continued)**

Project name/ Corridor	Location/Limits	Project description
<b>Denver Regional Council of Governments administered funds for multimodal capital projects and programs</b>		
88th Ave.	I-76 northbound ramps to State Hwy. 2	Widen from 2 to 4 lanes
104th Ave.	Colorado Blvd. to McKay Rd.	Widen from 2 to 4 lanes
120th Ave.	U.S. Route 85 to E-470	Widen to 4 lanes
Broncos Pkwy./Easter/Dry Creek corridor improvements	Parker Rd. to Havana	Widen to 4 lanes; bridge, multimodal corridor and intersection improvements
County Line Rd.	Phillips St. to University Blvd.	Widen from 2 to 4 lanes
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 and transit service
Gun Club Rd.	Quincy to Aurora Pkwy.	Widen from 2 to 4 lanes, multimodal corridor improvements, and transit service
I-25 North	104th Ave. to 120th Ave.	Shoulders; general purpose lanes; bridge
I-25	Broadway	Interchange capacity
I-25	Lincoln Ave.	Interchange capacity
I-25	Happy Canyon Rd.	Interchange reconstruction
I-25	Meadows/Founders	Interchange reconstruction
I-25	Crystal Valley Pkwy.	New interchange and south frontage road
I-225/Yosemite	DTC Blvd. to I-25 on-ramp	Interchange and ramp reconstruction

County	Project cost (2020)	Staging period	Multimodal Project Elements			
			Bicycle/pedestrian	Safety	Transit	Freight
Adams	\$21,500,000	2020-2029	●	●		●
Adams	\$8,100,000	2020-2029	●	●		●
Adams	\$24,000,000	2020-2029	●	●		●
Arapahoe	\$35,000,000	2040-2050	●	●		●
Douglas	\$9,500,000	2020-2029	●	●		●
Arapahoe	\$60,000,000	2020-2029	●	●	●	●
Arapahoe	\$30,000,000	2020-2029	●	●	●	●
Adams	\$70,000,000	2040-2050		●	●	●
Denver	\$50,000,000	2020-2029	●	●		●
Douglas	\$49,400,000	2020-2029	●	●		●
Douglas	\$30,000,000	2020-2029	●	●		●
Douglas	\$50,000,000	2040-2050	●	●		●
Douglas	\$80,000,000	2020-2029	●	●		●
Arapahoe	\$60,000,000	2020-2029		●		●

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**Table 3.1: Regionally funded project and program investment priorities (continued)**

Project name/ Corridor	Location/Limits	Project description
<b>Denver Regional Council of Governments administered funds for multimodal capital projects and programs</b>		
Indiana (State Hwy. 72)	W. 80th Ave. to W. 86th Pkwy.	Widen to 4 lanes
Kipling St.	Kentucky Ave. to I-70	Multimodal corridor improvements
Lincoln Ave.	Oswego to Keystone	Multimodal corridor improvements
Martin Luther King Jr. Blvd.	Havana St./Iola St. to Peoria St.	Widen 2 to 4 lanes; new 4-lane road
Peña Blvd.	I-70 to 64th Ave.	Add 1 managed lane in each direction
Peña Blvd.	64th Ave. to E-470	Add 1 managed lane in each direction
RidgeGate Pkwy.	Havana St. to Lone Tree eastern city limit	Widen from 2 to 4 lanes
Smoky Hill Rd.	Buckley Rd. to Picadilly St.	Safety, operational, and multimodal corridor improvements and transit service
State Hwy. 7	164th Ave. to Dahlia St.	Widen from 2 to 4 lanes
State Hwy. 30	Airport Blvd. to Quincy Ave.	Widen from 2 to 4 lanes, multimodal corridor improvements, and transit service
State Hwy. 52	Weld County Rd. 1 to Weld County Rd. 13	Planning and Environment Linkages study outcomes — safety, operational and multimodal improvements
State Hwy. 66	U.S. Route 287/Main Street to E. County Line Rd.(Weld County Rd. 1)	Capacity, operations and bicycle/pedestrian
State Hwy. 66	E. County Line Rd. (Weld County Rd. 1) to Weld County Rd. 19	Widen 2 to 4 lanes, pedestrian improvements

County	Project cost (2020)	Staging period	Multimodal Project Elements			
			Bicycle/pedestrian	Safety	Transit	Freight
Jefferson	\$39,000,000	2030-2039	●	●		●
Jefferson	\$250,000,000	2040-2050	●	●	●	●
Douglas	\$24,000,000	2020-2029	●	●		
Denver	\$15,000,000*	2020-2029	●			●
Denver	\$139,000,000	2030-2039		●	●	●
Denver	\$124,000,000	2030-2039		●	●	●
Douglas	\$8,000,000*	2020-2029	●			●
Arapahoe	\$10,000,000	2020-2029	●	●	●	
Adams	\$24,000,000	2020-2029	●			●
Arapahoe	\$175,000,000	2030-2039	●	●	●	●
Weld	\$20,000,000	2040-2050	●	●	●	●
Boulder	\$15,000,000	2030-2039	●	●	●	●
Weld	\$35,000,000	2040-2050	●			●

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\* This cost is not included in the fiscal constraint analysis because funding was allocated prior to 2020.

**Table 3.1: Regionally funded project and program investment priorities (continued)**

Project name/ Corridor	Location/Limits	Project description
<b>Denver Regional Council of Governments administered funds for multimodal capital projects and programs</b>		
State Hwy. 93	State Hwy. 58 to State Hwy. 170	Widen to 4 lanes and safety/transit improvements
U.S. Route 6	Heritage Rd.	New interchange
U.S. Route 85 (Santa Fe)	C-470 to Bowles	Corridor planning/investment for multimodal mobility, operations and safety
U.S. Route 287/120th Ave.	Midway Blvd. to Lowell Blvd.	Improve circulation, safety, active transportation access, business access, congestion and transit operations
U.S. Route 85	Highlands Ranch Pkwy. to north of County Line Rd.	Widen from 4 to 6 lanes
Wadsworth Blvd.	35th Ave. to 48th Ave.	Widen from 4 to 6 lanes
Wadsworth Blvd.	17th Ave. to 35th Ave.	Multimodal corridor improvements
TIP Set-Asides	Varies	Investment in transportation demand management, air quality, operations and technology and human services transportation

County	Project cost (2020)	Staging period	Multimodal Project Elements			
			Bicycle/pedestrian	Safety	Transit	Freight
Jefferson	\$200,000,000	2030-2039	●	●	●	●
Jefferson	\$30,000,000	2020-2029		●		●
Arapahoe	\$150,000,000	2040-2050	●	●	●	●
Broomfield	\$15,000,000	2020-2029	●	●	●	●
Douglas	\$50,100,000*	2020-2029	●			●
Jefferson	\$31,000,000	2020-2029	●		●	●
Jefferson	\$60,000,000	2040-2050	●	●	●	●
DRCOG projects total	\$1,918,500,000					
Regional	\$375,112,551	2020-2050	●	●	●	●
DRCOG programs total	\$375,112,551					

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\* This cost is not included in the fiscal constraint analysis because funding was allocated prior to 2020.

**Table 3.1: Regionally funded project and program investment priorities (continued)**

Project name/ Corridor	Location/Limits	Project description
<b>Regional Transportation District administered funds for multimodal capital projects and programs</b>		
Northwest Rail	Westminster Station to downtown Longmont	Implement peak period service plan
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.
Base System and FasTracks Debt Service	Varies	Repayment of debt service for the construction of RTD's FasTracks and base system
<b>Regional bus rapid transit projects</b>		
New bus maintenance facility	TBD (RTD northern area)	Construction of a new bus maintenance facility in the RTD's northern area
38th/Park BRT	Wadsworth to Colfax	Bus rapid transit service and supporting safety/ multimodal improvements
Alameda BRT	Wadsworth to R-Line	Bus rapid transit service and supporting safety/ multimodal improvements
Broadway/ Lincoln BRT	Colfax to Highlands Ranch Pkwy.	Bus rapid transit service and supporting safety/ multimodal improvements
Colfax Ave. BRT	Union Station to I-225	Bus rapid transit service and supporting safety/ multimodal improvements
Colfax Ave. Extension BRT	I-225 to E-470	Bus rapid transit service and supporting safety/ multimodal improvements



County	Project cost (2020)	Staging period	Multimodal Project Elements			
			Bicycle/pedestrian	Safety	Transit	Freight
Adams/Boulder/ Broomfield/ Jefferson	\$700,000,000	2040-2050	<div></div>	<div></div>	<div></div>	
RTD projects total	\$700,000,000					
Regional	\$27,287,056,566	2020-2050			<div></div>	
Regional	\$6,423,902,502	2020-2050				
RTD programs total	\$33,710,959,069					

TBD	\$50,000,000	2020-2029			●	
Denver/ Jefferson	\$40,000,000	2040-2050	●	●	●	
Arapahoe/ Denver/ Jefferson	\$61,000,000	2030-2039	●	●	●	
Arapahoe/ Denver/ Douglas	\$61,000,000	2030-2039	●	●	●	
Adams/ Arapahoe/ Denver	\$250,000,000	2020-2029	●	●	●	
Adams/ Arapahoe	\$100,000,000	2020-2029	●	●	●	

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**Table 3.1: Regionally funded project and program investment priorities (continued)**

Project name/ Corridor	Location/Limits	Project description
<b>Regional bus rapid transit projects</b>		
Colorado Blvd. BRT	A Line to I-25	Bus rapid transit service and supporting safety/ multimodal improvements
Federal Blvd. BRT	120th to Santa Fe/ Dartmouth	Bus rapid transit service and supporting safety/ multimodal improvements
North I-25 BRT	Union Station to State Hwy. 119	Bus rapid transit service and supporting safety/ multimodal improvements
Speer/ Leetsdale/ Parker BRT	Colfax to I-225	Bus rapid transit service and supporting safety/ multimodal improvements
State Hwy. 119 BRT	Downtown Boulder to downtown Longmont	Bus rapid transit service and supporting safety/ multimodal improvements, including a separated bikeway
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

County	Project cost (2020)	Staging period	Multimodal Project Elements			
			Bicycle/pedestrian	Safety	Transit	Freight
Denver	\$35,000,000	2020-2029	●	●	●	
Adams/ Denver	\$94,000,000	2020-2029	●	●	●	
Adams/ Broomfield/ Denver/ Weld	\$97,000,000	2040-2050		●	●	
Arapahoe/ Denver	\$95,000,000	2030-2039	●	●	●	
Boulder	\$200,000,000	2020-2029	●	●	●	
Boulder/Weld	\$100,000,000	2030-2039	●	●	●	
Regional bus rapid transit total	\$1,183,000,000					

Continued on next page.

**Table 3.1: Regionally funded project and program investment priorities (continued)**

Project name/ Corridor	Location/Limits	Project description
<b>Corridor transit planning projects and program</b>		
Regional mobility hubs	Varies	Construction of multimodal mobility hubs
Regional strategic transit	Varies	Investment in regional transit services including Bustang, human services transportation, and rural transportation
Castle Pines transit mobility corridor	Castle Pines to RidgeGate RTD Station	Transit corridor
W. Colfax	Sheridan to Broadway/Lincoln	Transit corridor and supporting safety/multimodal improvements
Golden/Mines autonomous circulator	Downtown Golden, School of Mines, RTD W Line	Autonomous circulator
RidgeGate Pkwy. transit mobility corridor	Mainstreet in Parker to Lone Tree City Center RTD Station	Transit corridor
S. Boulder Rd.	Lafayette to Boulder	Multimodal corridor improvements
State Hwy. 7	Boulder to Brighton	Multimodal corridor improvements
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
U.S. Route 287	U.S. Route 36 to Larimer County Line	Safety, operational and multimodal improvements

County	Project cost (2020)	Staging period	Multimodal Project Elements			
			Bicycle/pedestrian	Safety	Transit	Freight
Regional	\$200,137,636	2020-2050	●		●	
Regional	\$200,137,636	2020-2050	●		●	
Douglas	\$20,000,000	2030-2039	●	●	●	
Denver	\$26,573,077	2040-2050	●	●	●	
Jefferson	\$3,500,000	2020-2029		●	●	
Douglas	\$100,000,000	2040-2050	●	●	●	
Boulder	\$75,000,000	2040-2050	●	●	●	
Adams/ Boulder/ Broomfield	\$100,000,000	2030-2039	●	●	●	
Boulder	\$15,200,000	2030-2039	●	●		
Boulder/ Broomfield	\$200,000,000	2030-2039	●	●	●	●
Transit corridor planning total	\$940,548,349					

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**Table 3.1: Regionally funded project and program investment priorities (continued)**

Project name/ Corridor	Location/Limits	Project description
<b>Arterial safety/Regional Vision Zero/Complete Streets retrofits projects and program</b>		
Arterial safety/ Regional Vision Zero/ Complete Streets retrofits set-aside	High-Injury Network and critical corridors identified in the Taking Action on Regional Vision Zero plan	Vision Zero, safety, and Complete Streets improvements
Brighton Blvd.	Race to York	Reconstruction, Vision Zero, safety and freight improvements
Chambers Rd.	E. 56th Ave. to E. 40th Ave.	Vision Zero corridor improvements
Colfax safety improvements	Wadsworth to Sheridan	Multimodal arterial safety
Federal Blvd. multimodal improvements	52nd Ave. to 120th Ave.	Bicycle/pedestrian/transit improvements; Turn lanes; bus/ business access lanes
W. Mississippi Ave.	South Federal Blvd. to S. Broadway	Vision Zero and pedestrian improvements
Sheridan safety improvements	52nd to Hampden	Vision Zero corridor improvements
State Hwy. 42	Louisville and Lafayette	Safety and operational improvements
U.S. Route 36	Boulder to Lyons	Corridor safety improvements
U.S. Route 85 operational and safety improvements	Weld County Rd. 2 to Weld County Rd. 10	Safety and operational improvements
U.S. Route 285 congestion mitigation improvements	Knox Ct./Lowell Blvd. (west) to Havana (east)	Speed and reliability corridor and Vision Zero improvements

County	Project cost (2020)	Staging period	Multimodal Project Elements			
			Bicycle/pedestrian	Safety	Transit	Freight
Regional	\$249,217,902	2020-2050	●	●		
Denver	\$19,762,500	2040-2050	●	●	●	●
Denver	\$16,712,500	2020-2029	●	●	●	
Jefferson	\$12,000,000	2020-2029	●	●	●	●
Adams	\$50,000,000	2020-2029	●	●	●	●
Denver	\$18,600,000	2020-2029	●	●	●	
Denver/ Jefferson	\$17,100,000	2020-2029	●	●	●	
Boulder	\$50,000,000	2030-2039	●	●		
Boulder	\$20,000,000	2020-2029	●	●		
Weld	\$6,100,000	2020-2029		●		
Arapahoe/ Denver	\$88,200,000	2020-2029		●	●	●
Arterial safety/ Regional Vision Zero/Complete Streets retrofits total	\$547,692,902	Continued on next page.				
Appendix S: Air quality conformity determination documents 135						

Continued on next page.

**Table 3.1: Regionally funded project and program investment priorities (continued)**

Project name/ Corridor	Location/Limits	Project description
Active transportation projects and program		
Active transportation set-aside	Short-trip opportunity zones identified in the active transportation plan	Bicycle and pedestrian improvements
Bear Creek Trail	(not specified)	Upgrade trail for safe crossings and consistent cross section. Integrate intelligent transportation systems/ artificial intelligence equipment.
Clear Creek Greenway	Jefferson County Line to Loveland Ski Area	Clear Creek Greenway portion of Peaks to Plains trail system
McCaslin Regional trail	Rock Creeky Pkwy. to State Hwy. 128	Regional trail
Boulder to Erie Regional Trail	Boulder to Erie	Regional trail
S. Platte River Trail	Northern Denver city limits (near 53rd Ave.) to southern Denver city limits (near Harvard Ave.)	Complete missing links and upgrade trail section
S. Platte River Trail	Northern Denver city limits (near 53rd Ave.) to southern Denver city limits (near Harvard Ave.)	Complete missing links and upgrade trail section
Smith Rd. bicycle/ pedestrian facilities	Peoria Street to Powhaton Rd.	New multiuse path
St. Vrain Greenway	Longmont to Lyons	Regional trail



County	Project cost (2020)	Staging period	Multimodal Project Elements			
			Bicycle/pedestrian	Safety	Transit	Freight
Regional	\$822,477,521	2020-2050	●	●		
Denver	\$31,200,000	2040-2050	●	●		
Clear Creek	\$50,000,000	2040-2050	●	●		
Boulder	\$3,000,000	2020-2029	●	●		
Boulder	\$6,000,000	2020-2029	●	●		
Denver	\$25,000,000	2020-2029	●	●		
Denver	\$25,000,000	2030-2039	●	●		
Adams	\$4,000,000	2020-2029	●	●		
Boulder	\$4,000,000	2020-2029	●	●		
Active transportation total	\$970,677,521					

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**Table 3.1: Regionally funded project and program investment priorities (continued)**

Project name/ Corridor	Location/Limits	Project description
Active transportation projects and program		
Freight set-aside	Varies	Freight improvements including but not limited to bridge reconstructions, overpasses/underpasses, new bridges
47th Ave./48th Ave.	I-25 to Pecos	Bridge reconstruction, new multimodal underpass and new bicycle/pedestrian bridge
Alameda Pkwy. Bridge over I-225	Between Potomac St. and Abilene St.	Bridge reconstruction
Peoria St. Bridge	Sand Creek	Bridge reconstruction
Ward Rd./ BNSF	I-70 frontage road north and Ridge Rd.	Multimodal grade separation

County	Project cost (2020)	Staging period	Multimodal Project Elements			
			Bicycle/pedestrian	Safety	Transit	Freight
Regional	\$75,836,451	2020-2050		●		●
Denver	\$45,225,000	2040-2050	●	●	●	●
Arapahoe	\$20,000,000	2020-2029	●	●	●	●
Adams	\$19,000,000	2020-2029	●	●		●
Jefferson	\$60,000,000	2020-2029	●	●	●	●
Freight total	\$220,061,451					

**Table 3.2: Locally funded project and programs**

Project name/ Corridor	Location/Limits	Project description
<b>2050 Metro Vision Regional Transportation Plan: locally funded projects</b>		
<b>Local government funded projects and programs</b>		
6th Ave.	Airport Blvd. to Tower Rd.	Widen from 2 to 6 lanes
6th Ave.	Tower Rd. to 6th Pkwy.	Widen from 2 to 6 lanes
6th Ave.	6th Pkwy. to Harvest Rd.	Widen from 2 to 6 lanes
6th Ave.	Harvest Mile Rd. to Watkins Rd.	New 6-lane road
6th Ave.	Watkins Rd. to Manila Rd.	New 4-lane road
6th Ave.	Manila Rd. to Schumaker Rd.	New 2-lane road
17th Ave.	Alpine St. to Ute Creek Dr.	Widen from 2 to 4 lanes
48th Ave.	Picadilly Rd. to Powhaton Rd.	New 6-lane road
48th Ave.	Powhaton Rd. to Monaghan Rd.	New 2-lane road
48th Ave.	Powhaton Rd. to Monaghan Rd.	Widen from 2 to 4 lanes
48th Ave.	Imboden Rd. to Manila Rd.	Widen from 2 to 4 lanes
56th Ave.	Havana St. to Peña Blvd.	Widen from 4 to 6 lanes
56th Ave.	Peoria St. to Peña Blvd.	Widen from 2 to 4 lanes
56th Ave.	Peña Blvd. to Tower Rd.	Widen from 4 to 6 lanes
56th Ave.	Genoa St. to Picadilly Rd.	Widen from 5 to 6 lanes
56th Ave.	Picadilly Rd. to E-470	Widen from 2 to 6 lanes
56th Ave.	E-470 to Powhaton Rd.	Widen from 2 to 6 lanes
56th Ave.	Powhaton Rd. to Imboden Rd.	Widen from 2 to 4 lanes
56th Ave.	Imboden Rd. to Schumaker Rd.	New 2-lane road
58th Ave.	Washington St. to York St.	Widen from 2 to 4 lanes
64th Ave.	Tower Rd. to Denver/Aurora City Limits	Widen from 2 to 4 lanes

County	Project cost (2020)	Staging period
Arapahoe	\$10,160,000	2020-2029
Arapahoe	\$14,097,000	2020-2029
Arapahoe	\$13,194,030	2020-2029
Adams	\$19,200,000	2040-2050
Adams	\$19,200,000	2040-2050
Adams	\$9,600,000	2040-2050
Boulder	\$2,302,510	2020-2029
Adams	\$40,706,040	2020-2029
Adams	\$7,500,000	2020-2029
Adams	\$7,500,000	2030-2039
Adams	\$4,800,000	2030-2039
Denver	\$15,000,000	2030-2039
Denver	\$40,000,000	2020-2029
Denver	\$17,300,000	2020-2029
Denver	\$5,800,000	2020-2029
Adams	\$9,696,450	2020-2029
Adams	\$19,400,000	2020-2029
Adams	\$24,000,000	2030-2039
Adams	\$19,000,000	2040-2050
Adams	\$10,346,093	2020-2029
Denver	\$700,000	2020-2029

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**Table 3.2: Locally funded project and programs (continued)**

Project name/ Corridor	Location/Limits	Project description
<b>Local government funded projects and programs</b>		
64th Ave.	Denver/Aurora city limit to Himalaya St.	Widen from 2 to 6 lanes
64th Ave.	Himalaya Rd. to Harvest Mile Rd.	Widen from 2 to 4 lanes
64th Ave.	Himalaya Rd. to Harvest Mile Rd.	Widen from 4 to 6 lanes
64th Ave.	Harvest Mile Rd. to Powhaton Rd.	New 2-lane road
64th Ave.	Harvest Mile Rd. to Powhaton Rd.	Widen from 2 to 4 lanes
64th Ave.	Powhaton Rd. to Monaghan Rd.	New 4-lane road
72nd Ave.	Simms St. to Kipling St.	Widen from 2 to 4 lanes
96th Ave.	State Hwy. 2 to Tower Rd.	Widen from 2 to 4 lanes
96th Ave.	Tower Rd. to Picadilly Rd.	Widen from 2 to 6 lanes
96th Ave.	96th St. west of Northwest Pwky. to State Hwy. 128	Add 2 toll lanes
104th Ave.	Marion St. to Colorado Blvd.	Widen from 4 to 6 lanes
104th Ave.	McKay Rd. to U.S. Route 85	Widen from 2 to 4 lanes
120th Ave.	Sable Blvd. to E-470	Widen from 2 to 6 lanes
120th Ave.	E-470 to Picadilly Rd.	Widen from 2 to 6 lanes
144th Ave.	U.S. Route 287 to Zuni St.	Widen from 2 to 4 lanes
144th Ave.	Washington St. to York St.	Widen from 2 to 4 lanes
144th Ave.	York St. to Colorado Blvd.	Widen from 2 to 4 lanes
152nd Ave.	Washington St. to York St.	Widen from 2 to 4 lanes
Arapahoe Rd.	Waco St. to Himalaya St.	Widen from 2 to 6 lanes
Arapahoe Rd.	Himalaya Way to Liverpool St.	Widen from 4 to 6 lanes
E. Bromley Ln.	U.S. Route 85 to Sable Blvd.	Widen from 4 to 6 lanes
E. Bromley Ln.	Tower Rd. to I-76	Widen from 4 to 6 lanes

County	Project cost (2020)	Staging period
Adams	\$6,452,362	2020-2029
Adams	\$39,000,000	2030-2039
Adams	\$39,000,000	2030-2039
Adams	\$6,452,362	2020-2029
Adams	\$10,934,700	2020-2029
Adams	\$6,709,410	2020-2029
Jefferson	\$20,000	2030-2039
Adams	\$46,672,500	2030-2039
Adams	\$14,668,500	2030-2039
Broomfield	\$39,370,000	2020-2029
Adams	\$6,276,340	2020-2029
Adams	\$40,600,000	2020-2029
Adams	\$29,718,000	2030-2039
Adams	\$15,500,000	2030-2039
Broomfield	\$21,200,000	2020-2029
Adams	\$12,795,250	2020-2029
Adams	\$10,433,050	2020-2029
Adams	\$13,074,650	2030-2039
Arapahoe	\$20,400,000	2020-2029
Arapahoe	\$6,176,772	2020-2029
Adams	\$1,333,500	2020-2029
Adams	\$1,853,032	2020-2029

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**Table 3.2: Locally funded project and programs (continued)**

Project name/ Corridor	Location/Limits	Project description
<b>Local government funded projects and programs</b>		
Broncos Pkwy.	Havana St. to Peoria St.	Widen from 4 to 6 lanes
Broncos Pkwy.	Jordan Rd. to Parker Rd.	Widen from 4 to 6 lanes
Buckley Rd.	136th Ave. to Bromley Rd.	Widen from 2 to 4 lanes
Buckley Rd.	118th Ave. to Cameron Dr.	Widen from 2 to 6 lanes
C-470 eastbound: S. Kipling Pkwy. to I-25	S. Kipling Pkwy. to Wadsworth Blvd.	Add 1 high-occupancy toll lane
C-470 westbound: S. Kipling Pkwy. to I-25	Wadsworth Blvd. to S. Kipling Pkwy.	Add 1 high-occupancy toll lane
C-470 westbound: S. Kipling Pkwy. to I-25	Colorado Blvd. to Lucent Blvd.	Add 1 high-occupancy toll lane
C-470 eastbound: S. Kipling Pkwy. to I-25	Broadway to I-25	Add 1 high-occupancy toll lane
Canyonside Blvd.	Crowfoot Valley Rd. to Hess Rd.	New 4-lane road
Chambers Rd.	E-470 to Arapahoe/Douglas County Line	Widen from 4 to 6 lanes
Chambers Rd.	Mainstreet to Lincoln Ave.	Widen from 4 to 6 lanes
Chambers Rd.	Hess Rd. to Mainstreet	Widen from 4 to 6 lanes
Chambers Rd.	Crowfoot Valley Rd. to Hess Rd.	New 2-lane road
Chambers Rd.	Crowfoot Valley Rd. to Hess Rd.	Widen from 2 to 4 lanes
Chambers Rd.	Crowfoot Valley Rd. to Hess Rd.	Widen from 4 to 6 lanes



County	Project cost (2020)	Staging period
Arapahoe	\$8,134,350	2020-2029
Arapahoe	\$6,934,200	2020-2029
Adams	\$7,747,000	2020-2029
Adams	\$13,897,737	2020-2029
Douglas/ Jefferson	\$45,000,000	2020-2029
Douglas/ Jefferson	\$45,000,000	2020-2029
Douglas	\$80,000,000	2030-2039
Douglas	\$80,000,000	2030-2039
Douglas	\$16,000,000	2030-2039
Douglas	\$12,500,000	2040-2050
Douglas	\$16,000,000	2040-2050
Douglas	\$10,000,000	2040-2050
Douglas	\$19,500,000	2020-2029
Douglas	\$17,500,000	2030-2039
Douglas	\$12,000,000	2040-2050

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**Table 3.2: Locally funded project and programs (continued)**

Project name/ Corridor	Location/Limits	Project description
<b>Local government funded projects and programs</b>		
Chambers Rd./ Bayou Gulch Rd.	Parker Rd. to Vistancia Dr.	Widen from 2 to 4 lanes
Chambers Rd./ Bayou Gulch Rd.	Vistancia Dr. to southern boundary	New 2-lane road
Chambers Rd./ Bayou Gulch Rd.	Vistancia Dr. to southern boundary	Widen from 2 to 4 lanes
Chambers Rd./ Bayou Gulch Rd.	Crowfoot Valley Rd. to Parker south town limit, new road	New 2-lane road
Chambers Rd./ Bayou Gulch Rd.	Crowfoot Valley Rd. to Parker south town limit, widening	Widen from 2 to 4 lanes
Colorado Blvd.	south of 168th Ave. to 168th Ave.	New 4-lane road
Colorado Blvd.	156th Ave. to south of 168th Ave.	New 4-lane road
Colorado Blvd.	144th Ave. to 156th Ave.	Widen from 2 to 4 lanes
E. County Line Rd.	9th Ave. to State Hwy. 66	Widen from 2 to 4 lanes
Crowfoot Valley Rd.	Chambers Rd. to Stroh Rd.	Widen from 2 to 4 lanes
Crowfoot Valley Rd.	Macanta Rd./Canyonside Blvd. to Chambers Rd.	Widen from 2 to 4 lanes
Crowfoot Valley Rd.	Founders Pkwy. to Macanta Rd./ Canyonside Blvd.	Widen from 2 to 4 lanes
Green Valley Ranch Blvd.	Chambers Rd. to Peña Blvd.	Widen from 4 to 6 lanes
Green Valley Ranch Blvd.	Peña Blvd. to Tower Rd.	Widen from 4 to 6 lanes

County	Project cost (2020)	Staging period
Douglas	\$18,000,000	2040-2050
Douglas	\$6,000,000	2020-2029
Douglas	\$6,000,000	2040-2050
Douglas	\$5,000,000	2020-2029
Douglas	\$4,500,000	2030-2039
Adams	\$23,500,000	2030-2039
Adams	\$23,500,000	2030-2039
Adams	\$23,500,000	2030-2039
Boulder	\$9,779,000	2030-2039
Douglas	\$11,500,000	2030-2039
Douglas	\$38,000,000	2030-2039
Douglas	\$10,000,000	2030-2039
Denver	\$9,900,000	2020-2029
Denver	\$1,700,000	2020-2029

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**Table 3.2: Locally funded project and programs (continued)**

Project name/ Corridor	Location/Limits	Project description
<b>Local government funded projects and programs</b>		
Gun Club Rd.	Yale Ave. to Mississippi Ave.	Widen from 2 to 4 lanes
Gun Club Rd.	Yale Ave. to Mississippi Ave.	Widen from 4 to 6 lanes
Gun Club Rd.	Quincy Ave. to 1.5 miles south of Quincy Ave.	Widen from 2 to 6 lanes
Hampden Ave.	Picadilly Rd. to Gun Club Rd.	Widen from 2 to 4 lanes
Harvest Mile Rd.	56th Ave. to 64th Ave.	New 3-lane road
Harvest Mile Rd.	56th Ave. to 64th Ave.	Widen from 3 to 6 lanes
Harvest Mile Rd.	I-70 to 56th Ave.	New 6-lane road
Harvest Rd.	6th Ave. to I-70	New 6-lane road
Harvest Rd.	Alameda Ave. to 1st Ave.	Widen from 4 to 6 lanes
Harvest Rd.	Mississippi Ave. to Alameda Ave.	Add new 6-lane road
Harvest Mile Rd.	Jewell Ave. to Mississippi Ave.	Widen from 2 to 6 lanes
Hess Rd.	Canyonside Blvd. to Chamber Rd.	Widen from 2 to 4 lanes
Hilltop Rd.	Canterberry Pkwy. to Singing Hills Rd.	Widen from 2 to 4 lanes
Huron St.	160th Ave. to State Hwy. 7	Widen from 2 to 4 lanes
Huron St.	150th Ave. to 160th Ave.	Widen from 2 to 4 lanes
I-70	Picadilly Rd.	Add new interchange
I-70	Harvest Mile Rd.	Add new interchange
I-70	Harvest Mile Rd.	Add new interchange
I-76	Bridge St.	Add new interchange

County	Project cost (2020)	Staging period
Arapahoe	\$10,899,140	2030-2039
Arapahoe	\$10,899,140	2030-2039
Arapahoe	\$26,670,000	2020-2029
Arapahoe	\$12,353,544	2020-2029
Adams	\$6,452,235	2020-2029
Adams	\$7,760,970	2030-2039
Adams	\$15,900,000	2030-2039
Adams	\$13,313,410	2020-2029
Arapahoe	\$6,657,340	2020-2029
Arapahoe	\$13,313,410	2020-2029
Arapahoe	\$13,313,410	2030-2039
Douglas	\$17,000,000	2030-2039
Douglas	\$20,000,000	2020-2029
Broomfield	\$5,080,000	2020-2029
Broomfield	\$8,572,500	2020-2029
Adams	\$27,490,547	2020-2029
Adams	\$39,566,215	2020-2029
Arapahoe	\$39,566,215	2020-2029
Adams	\$25,400,000	2020-2029

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**Table 3.2: Locally funded project and programs (continued)**

Project name/ Corridor	Location/Limits	Project description
<b>Local government funded projects and programs</b>		
Imboden Rd.	48th Ave. to 56th Ave.	Widen from 2 to 4 lanes
Imboden Mile Rd.	40th Ave. to 48th Ave.	Widen from 2 to 4 lanes
Imboden Mile Rd./Quail Run Rd.	North of Quail Run Rd. to Imboden Rd./40th Ave.	New 4-lane road
Jefferson Pkwy.	State Hwy. 128/96th St. to State Hwy. 93 north of 64th Ave.	New 4-lane road
Jefferson Pkwy.	Indiana St./State Hwy. 128	Add new interchange
Jefferson Pkwy.	Candelas Pkwy.	Add new interchange
Jefferson Pkwy.	State Hwy. 72	Add new interchange
Jefferson Pkwy.	State Hwy. 93 to 0.5 miles north of 64th Ave.	Widen from 2 to 4 lanes
Jewell Ave.	Himalaya St. to E-470	Widen from 3 to 6 lanes
Jewell Ave.	E-470 to Gun Club Rd.	Widen from 2 to 6 lanes
Jewell Ave.	Gun Club Rd. to Harvest Mile Rd.	Widen from 2 to 6 lanes
Jewell Ave.	Harvest Rd. to Monaghan Rd.	Widen from 2 to 6 lanes
Jewell Ave.	Monaghan Rd. to Watkins Rd.	Widen from 2 to 4 lanes
Lincoln Ave.	Peoria St. to 1st Ave.	Widen from 4 to 6 lanes
Lincoln Ave.	1st St. to Keystone Blvd.	Widen from 4 to 6 lanes
Lincoln Ave.	Keystone Blvd. to Parker Rd.	Widen from 4 to 6 lanes
Mainstreet	Canterberry Pkwy. to Delbert Rd.	Widen from 2 to 4 lanes
Manila Rd.	Alameda Ave. to I-70	New 4-lane road
Manila Rd.	I-70 to 48th Ave.	Widen from 2 to 4 lanes
McIntyre St.	52nd Ave. to 60th Ave.	Widen from 2 to 4 lanes

County	Project cost (2020)	Staging period
Adams	\$24,000,000	2030-2039
Adams	\$4,000,000	2030-2039
Adams	\$24,000,000	2030-2039
Jefferson	\$259,080,000	2020-2029
Jefferson		2020-2029
Jefferson		2020-2029
Jefferson		2020-2029
Jefferson		2020-2029
Arapahoe	\$13,194,030	2020-2029
Arapahoe	\$4,848,860	2020-2029
Arapahoe	\$9,950,450	2020-2029
Adams	\$9,700,000	2030-2039
Adams	\$14,400,000	2030-2039
Douglas	\$4,000,000	2030-2039
Douglas	\$18,000,000	2030-2039
Douglas	\$20,250,000	2020-2029
Douglas	\$28,000,000	2040-2050
Adams	\$5,000,000	2030-2039
Adams	\$15,000,000	2030-2039
Jefferson	\$6,500,000	2020-2029

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**Table 3.2: Locally funded project and programs (continued)**

Project name/ Corridor	Location/Limits	Project description
<b>Local government funded projects and programs</b>		
Monaghan Rd.	56th Ave. to 64th Ave.	New 4-lane road
Monaghan Rd.	26th Ave. to 56th Ave.	Widen from 2 to 4 lanes
Monaghan Rd.	I-70 to 26th Ave.	New 4-lane road
Monaghan Rd.	Quincy Ave. to Yale Ave.	New 6-lane road
Nelson Rd.	75th St. to Affolter Dr.	Widen from 2 to 4 lanes
Pace St.	5th Ave. to 17th Ave.	Widen from 2 to 4 lanes
Pecos St.	52nd Ave. to 0.72 miles north of 52nd Ave.	Widen from 2 to 4 lanes
Peña Blvd.	E-470 to Jackson Gap St.	Widen from 6 to 8 lanes
Peña Blvd.	Gun Club Rd.	Interchange capacity
Peña Blvd.	Jackson Gap St. west ramps to DEN terminal	Widen from 6 to 8 lanes
Peoria St.	E-470 to 0.75 mile south of Lincoln Ave.	Widen from 2 to 4 lanes
Peoria St.	0.75 miles south of Lincoln Ave. to Mainstreet/ RidgeGate Pkwy.	Widen from 2 to 4 lanes
Picadilly Rd.	96th Ave. to 120th Ave.	New 6-lane road
Picadilly Rd.	82nd Ave. to 96th Ave.	New 6-lane road
Picadilly Rd.	70th Ave. to 82nd Ave.	New 6-lane road
Picadilly Rd.	56th Ave. to 70th Ave./Aurora city limits	New 6-lane road
Picadilly Rd.	48th Ave. to 56th Ave.	Widen from 2 to 6 lanes
Picadilly Rd.	Smith Rd. to 48th Ave.	Widen from 2 to 6 lanes
Picadilly Rd.	I-70 to Smith Rd.	Widen from 2 to 6 lanes
Picadilly Rd.	Colfax Ave. to I-70	New 6-lane road



County	Project cost (2020)	Staging period
Arapahoe	\$25,000,000	2030-2039
Arapahoe	\$26,000,000	2030-2039
Arapahoe	\$25,000,000	2030-2039
Arapahoe	\$22,860,000	2030-2039
Boulder	\$5,198,110	2020-2029
Boulder	\$3,827,780	2020-2029
Adams	\$8,647,748	2020-2029
Denver	\$33,000,000	2020-2029
Denver	\$15,000,000	2020-2029
Denver	\$10,200,000	2020-2029
Douglas	\$7,000,000	2030-2039
Douglas	\$5,000,000	2030-2039
Adams	\$49,022,000	2030-2039
Adams	\$21,590,000	2030-2039
Denver	\$11,400,000	2020-2029
Adams	\$20,353,020	2020-2029
Adams	\$13,568,680	2020-2029
Adams	\$22,496,780	2020-2029
Adams	\$5,332,730	2020-2029
Adams	\$12,904,724	2020-2029

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**Table 3.2: Locally funded project and programs (continued)**

Project name/ Corridor	Location/Limits	Project description
<b>Local government funded projects and programs</b>		
Picadilly Rd.	6th Pkwy. to Colfax Ave.	Widen from 2 to 6 lanes
Picadilly Rd.	State Hwy. 30 to 6th Pkwy.	New 4-lane road
Plum Creek Pkwy.	Wolfensberger Rd. to I-25	Widen from 2 to 4 lanes
Plum Creek Pkwy.	Gilbert St. to Ridge Rd.	Widen from 2 to 4 lanes
Powhaton Rd.	26th Ave. to 48th Ave.	Widen from 2 to 6 lanes
Powhaton Rd.	Jewell Ave. to 26th Ave.	Widen from 2 to 4 lanes
Powhaton Rd./ Harvest Mile Rd.	I-70 to 26th Ave.	New 4-lane road
Powhaton Rd./ Harvest Mile Rd.	I-70 to 26th Ave.	Widen from 4 to 6 lanes
Powhaton Rd.	Smoky Hill Rd. to County Line Rd.	Widen from 2 to 6 lanes
Quail Run Rd.	I-70 to 29th Ave./Quail Run Rd.	New 4-lane road
Quail Run Rd.	6th Ave. to I-70	New 4-lane road
Quebec St.	132nd Ave. to 160th Ave.	Widen from 2 to 4 lanes
Quebec St.	120th Ave. to 128th Ave.	Widen from 2 to 4 lanes
Quincy Ave.	Simms St. to Kipling Pkwy.	Widen from 2 to 4 lanes
Quincy Ave.	Irving St. to Federal Blvd.	New 2-lane road
Quincy Ave.	Plains Pkwy. to Gun Club Rd.	Widen from 2 to 6 lanes
Quincy Ave.	Monaghan Rd. to Hayesmount Rd.	Widen from 2 to 6 lanes
Quincy Ave.	Hayesmount Rd. to Watkins Rd.	Widen from 2 to 6 lanes

County	Project cost (2020)	Staging period
Arapahoe	\$5,000,000	2020-2029
Arapahoe	\$7,000,000	2020-2029
Douglas	\$5,080,000	2020-2029
Douglas	\$5,080,000	2020-2029
Adams	\$40,000,000	2020-2029
Adams	\$24,500,000	2040-2050
Adams	\$12,000,000	2020-2029
Adams	\$8,000,000	2030-2039
Arapahoe	\$3,491,230	2030-2039
Adams	\$36,391,342	2030-2039
Adams	\$5,000,000	2040-2050
Adams	\$21,010,880	2020-2029
Adams	\$8,432,800	2020-2029
Jefferson	\$12,001,500	2020-2029
Arapahoe	\$3,810,000	2020-2029
Arapahoe	\$13,335,000	2020-2029
Arapahoe	\$18,935,700	2030-2039
Arapahoe	\$16,002,000	2030-2039

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**Table 3.2: Locally funded project and programs (continued)**

Project name/ Corridor	Location/Limits	Project description
<b>Local government funded projects and programs</b>		
Rampart Range Rd.	Waterton Rd. to Titan Rd.	Widen from 2 to 4 lanes
Ridge Rd.	Plum Creek Pkwy. To State Hwy. 86	Widen from 2 to 4 lanes
Sheridan Pkwy.	Northwest Pkwy. to Preble Creek	Widen from 2 to 4 lanes
Sheridan Pkwy.	Lowell Blvd. to Northwest Pkwy.	Widen from 2 to 4 lanes
Smoky Hill Rd.	Pheasant Run Pkwy. to Versailles Pkwy.	Widen from 4 to 6 lanes
State Hwy. 7	Boulder County Line to Sheridan Pkwy.	Widen from 2 to 4 lanes
State Hwy. 7	Sheridan Pkwy. to I-25	Widen from 2 to 6 lanes
State Hwy. 7	Riverdale Rd. to U.S. Route 85	Widen from 2 to 4 lanes
State Hwy. 30	Stephen D. Hogan Pkwy. (6th Pkwy.) to Mississippi Ave.	Widen from 2 to 4 lanes
State Hwy. 58	Cabela St.	Add new interchange
Stephen D. Hogan Pkwy. (6th Pkwy.)	State Hwy. 30 to E-470	Widen from 2 to 6 lanes
Stephen D. Hogan Pkwy. (6th Pkwy.)	E-470 to Gun Club Rd.	Widen from 2 to 6 lanes
Stroh Rd.	Chambers Rd. to Crowfoot Valley Rd.	New 4-lane road
Stroh Rd.	Crowfoot Valley Rd. to J. Morgan Blvd.	Widen from 2 to 4 lanes
Titan Rd.	Rampart Range Rd. to Santa Fe Dr.	Widen from 2 to 4 lanes
Tower Rd./ Buckley Rd.	105th Ave. to 118th Ave.	New 4-lane road

County	Project cost (2020)	Staging period
Douglas	\$10,000,000	2030-2039
Douglas	\$3,810,000	2020-2029
Broomfield	\$5,715,000	2020-2029
Broomfield	\$7,620,000	2020-2029
Arapahoe	\$33,909,000	2030-2039
Broomfield	\$6,604,000	2020-2029
Broomfield	\$10,172,700	2020-2029
Adams	\$16,319,500	2030-2039
Arapahoe	\$18,000,000	2020-2029
Jefferson	\$19,558,000	2020-2029
Arapahoe	\$34,904,680	2030-2039
Arapahoe	\$4,848,860	2020-2029
Douglas	\$14,000,000	2020-2029
Douglas	\$9,250,000	2020-2029
Douglas	\$25,000,000	2030-2039
Adams	\$8,801,100	2020-2029

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**Table 3.2: Locally funded project and programs (continued)**

Project name/ Corridor	Location/Limits	Project description
<b>Local government funded projects and programs</b>		
Tower Rd.	Peña Blvd. to 105th Ave.	Widen from 4 to 6 lanes
Tower Rd.	56th Ave. to Peña Blvd.	Widen from 4 to 6 lanes
Tower Rd.	48th Ave. to 56th Ave.	Widen from 4 to 6 lanes
Tower Rd.	45th Ave. to Green Valley Ranch Blvd.	Widen from 4 to 6 lanes
Tower Rd.	Colfax Ave. to Smith Rd.	Widen from 2 to 6 lanes
Tower Rd.	6th Ave. to Colfax Ave.	New 2-lane road
Tower Rd.	6th Ave. to Colfax Ave.	Widen from 2 to 6 lanes
U.S. Route 85	Titan Rd. to Highlands Ranch Pkwy.	Widen from 4 to 6 lanes
Washington St.	152nd Ave. to 160th Ave.	Widen from 2 to 6 lanes
Waterton Rd.	State Hwy. 121 to Campfire St.	Widen from 2 to 4 lanes
Watkins Rd.	Quincy Ave. to I-70	Widen from 2 to 6 lanes
Wolfensberger Rd.	Coachline Rd. to Prairie Hawk Dr.	Widen from 2 to 4 lanes
Yale Ave.	Monaghan Rd. to Hayesmount Rd.	Widen from 2 to 6 lanes
York St.	160th Ave. (State Hwy. 7) to 168th Ave.	Widen from 2 to 4 lanes
York St.	E-470 to State Hwy. 7	Widen from 2 to 4 lanes
York St.	152nd Ave. to E-470	Widen from 2 to 4 lanes
York St.	88th Ave. to 78th Ave.	Widen from 2 to 4 lanes
York St.	78th Ave. to State Hwy. 224	Widen from 2 to 4 lanes
York St.	State Hwy. 224 to 58th Ave.	Widen from 2 to 4 lanes

County	Project cost (2020)	Staging period
Adams	\$20,000,000	2020-2029
Denver	\$16,000,000	2020-2029
Denver	\$5,300,000	2020-2029
Denver	\$2,500,000	2020-2029
Adams	\$8,727,440	2020-2029
Arapahoe	\$25,820,370	2020-2029
Arapahoe	\$25,820,370	2030-2039
Douglas	\$5,000,000	2030-2039
Adams	\$37,300,000	2020-2029
Douglas	\$16,000,000	2030-2039
Arapahoe	\$54,673,500	2030-2039
Douglas	\$7,500,000	2030-2039
Arapahoe	\$17,335,500	2030-2039
Adams	\$7,493,000	2020-2029
Adams	\$10,668,000	2020-2029
Adams	\$13,074,650	2030-2039
Adams	\$13,500,000	2020-2029
Adams	\$12,800,000	2020-2029
Adams	\$20,000,000	2020-2029
<b>Local government projects total</b>	<b>\$3,195,863,948</b>	

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**Table 3.2: Locally funded project and programs (continued)**

Project name/ Corridor	Location/Limits	Project description
<b>Local government funded projects and programs</b>		
System preservation, enhancement, and operations	Varies	Road resurfacing; traffic signals, optimization, communication, variable message signs; and other systematic repairs and preventative maintenance
Bridges & culverts	Varies	Bridge replacement, rehabilitation, preservation, and systematic repairs
New non-regional roadway system	Varies	Construction of new arterials, collectors, and local roads
Toll authority debt service	Varies	Repayment of debt service for the construction of toll facilities

<b>E-470 Public Highway Authority projects and programs</b>		
E-470	U.S. Route 85 to I-25 North	Widen 4 to 6 lanes
E-470	I-76 to U.S. Route 85	Widen 4 to 6 lanes
E-470	Peoria	Widen to 6 through-lanes plus turn lanes
E-470	Sable	New interchange
E-470	104th to I-76	Widen 4 to 6 lanes
E-470	Peña to I-76	Widen 6 to 8 lanes
E-470	I-76	Add ramps for fully directional interchange
E-470	I-76	Add ramps for fully directional interchange
E-470	112th Ave.	New interchange
E-470	Peña	Add separated auxillary lanes
E-470	I-70 to 104th	Widen 4 to 6 lanes
E-470	88th Ave.	New interchange



County	Project cost (2020)	Staging period
Regional	\$17,025,350,550	2020-2050
Regional	\$3,367,673,315	2020-2050
Regional	\$48,275,895,000	2020-2050
Regional	\$1,850,678,088	2020-2050
<b>Local government programs total</b>	<b>\$70,519,596,954</b>	

Adams	\$28,000,000	2030-2039
Adams	\$21,096,000	2030-2039
Adams	\$21,096,000	2030-2039
Adams	\$16,000,000	2020-2029
Adams	\$106,500,000	2020-2029
Adams	\$27,700,000	2030-2039
Adams	\$18,000,000	2020-2029
Adams	\$15,822,000	2030-2039
Adams	\$15,822,000	2020-2029
Denver	\$23,000,000	2020-2029
Adams	\$30,589,000	2020-2029
Adams	\$102,000,000	2020-2029

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**Table 3.2: Locally funded project and programs (continued)**

Project name/ Corridor	Location/Limits	Project description
<b>E-470 Public Highway Authority projects and programs</b>		
E-470	48th Ave.	New interchange
E-470	38th Ave.	New interchange
E-470/I-70 interchange Complex	I-70	Directional I-70 interchanges
E-470	Quincy to I-70	Widen 4 to 6 lanes
E-470	Smoky Hill to I-70	Widen 6 to 8 lanes
E-470	Parker Rd. to Smoky Hill	Widen 6 to 8 lanes
E-470	I-25 South to Parker Rd.	Widen 6 to 8 lanes

<b>E-470 Public Highway Authority projects and programs</b>		
E-470 renewal and replacement program	Varies	Infrastructure renewal, replacement and maintenance items
E-470 ramp signalization and geometric improvements	Varies	Signalize ramp terminal intersections and geometric interchange improvements
E-470 pavement overlays	Varies	Pavement overlays needed before reconstruction associated with anticipated widening
E-470 multiuse trails	Varies	Trail projects anticipated to be linked with E-470 widening

County	Project cost (2020)	Staging period
Adams	\$19,885,000	2020-2029
Adams	\$56,950,000	2020-2029
Adams	\$74,000,000	2020-2029
Arapahoe	\$83,100,000	2020-2029
Arapahoe	\$41,000,000	2020-2029
Arapahoe/ Douglas	\$109,000,000	2020-2029
Douglas	\$1,750,000	2020-2029
<b>E-470 Public Highway Authority projects total</b>	<b>\$811,310,000</b>	

Adams/ Arapahoe/ Douglas	\$679,022,419	2020-2050
Adams/ Arapahoe/ Douglas	\$62,444,000	2020-2050
Adams/ Arapahoe/ Douglas	\$25,618,000	2020-2050
Adams/ Arapahoe/ Douglas	\$28,600,000	2020-2050
<b>E-470 Public Highway Authority programs total</b>	<b>\$795,684,419</b>	
<b>Projects total</b>	<b>\$13,185,847,025</b>	
<b>Programs total</b>	<b>\$119,429,696,602</b>	
<b>Investment total</b>	<b>\$131,543,848,204</b>	

## 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 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, about 15 million trips made by individuals are made every weekday. The Focus Model sums all travel to forecast how many vehicles will be driven on major roads: travel speed and delay, 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 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.
- 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.

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. (See the Calibration Report at <https://drcog.org/sites/default/files/resources/Focus%202.3.1%20Calibration%20Report.pdf>)

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. (See the Validation Report at <https://drcog.org/sites/default/files/resources/Focus%202.3.1%20Validation%20Report.pdf>.)

## Regional socioeconomic 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 1 shows the population, household and employment forecasts by model staging years for the DRCOG full region and the metropolitan planning organization area.

**Table 1: Population, household, and employment 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

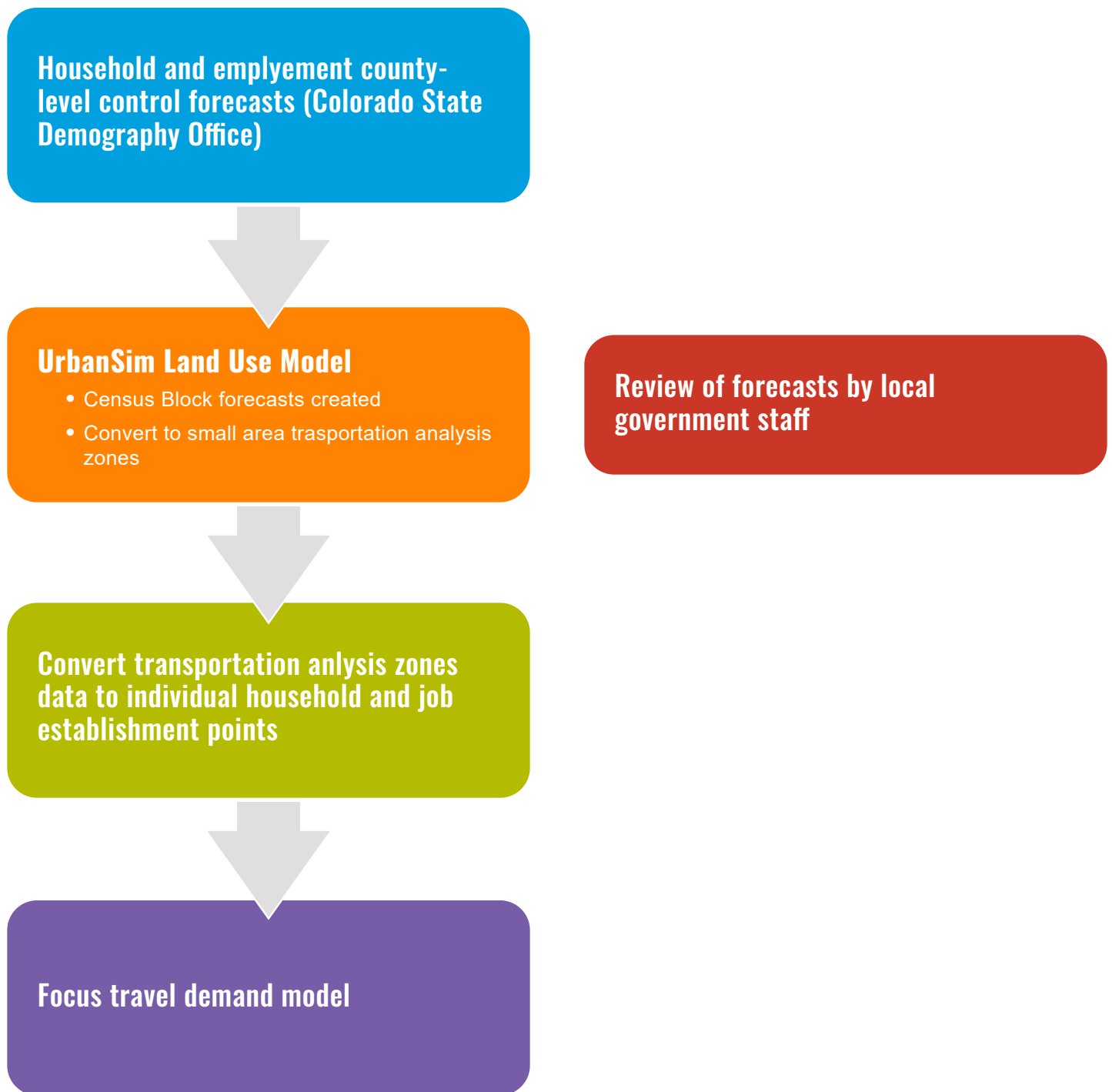
## Small area development forecasts

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, as shown in Figure 1. 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 2 shows a flowchart for the process of socioeconomic forecasting in the Denver region.

**Figure 2: Socioeconomic model elements and flow**





## Focus Model process overview

Figure 3 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 3: Focus activity-based model elements**

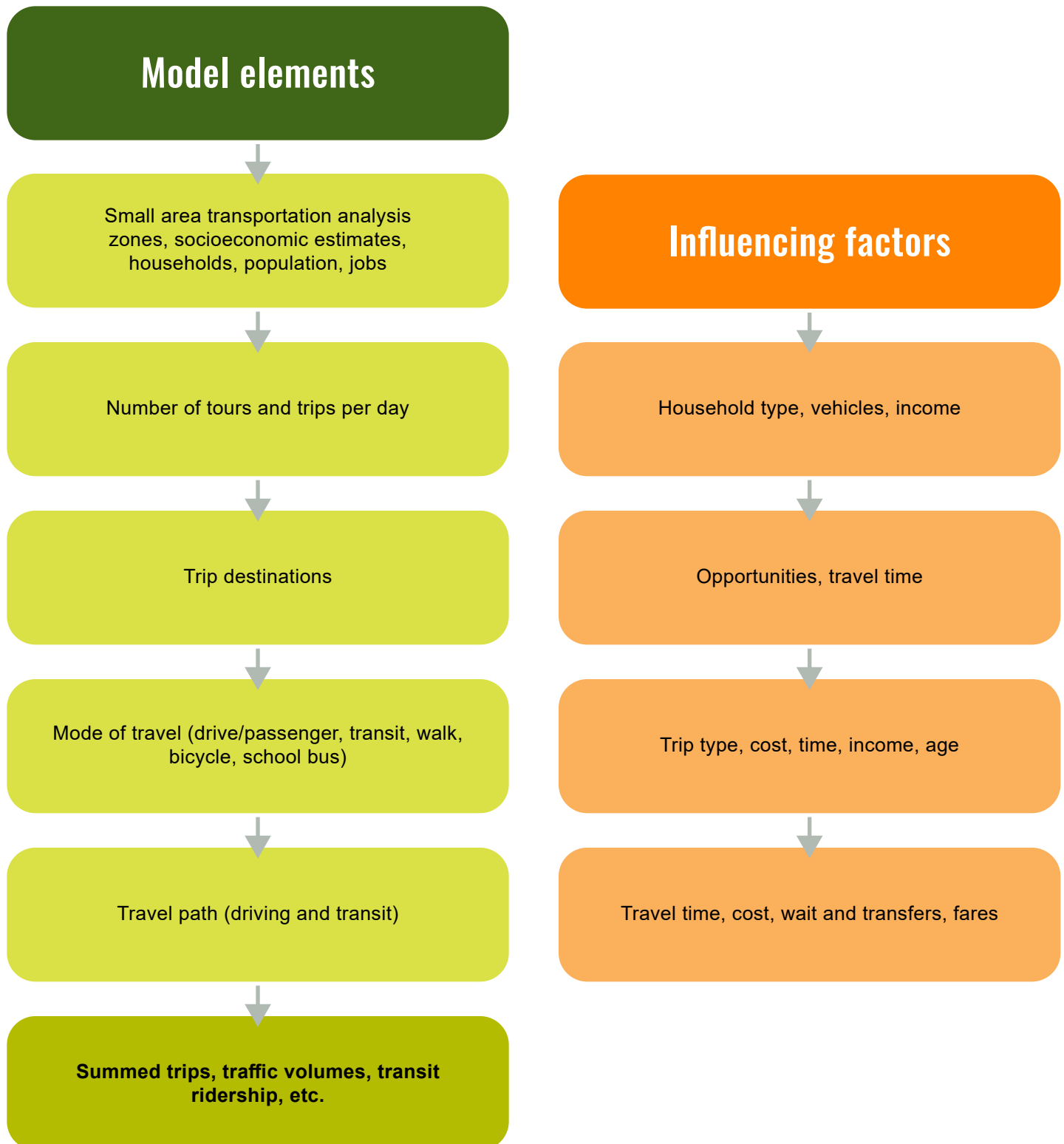
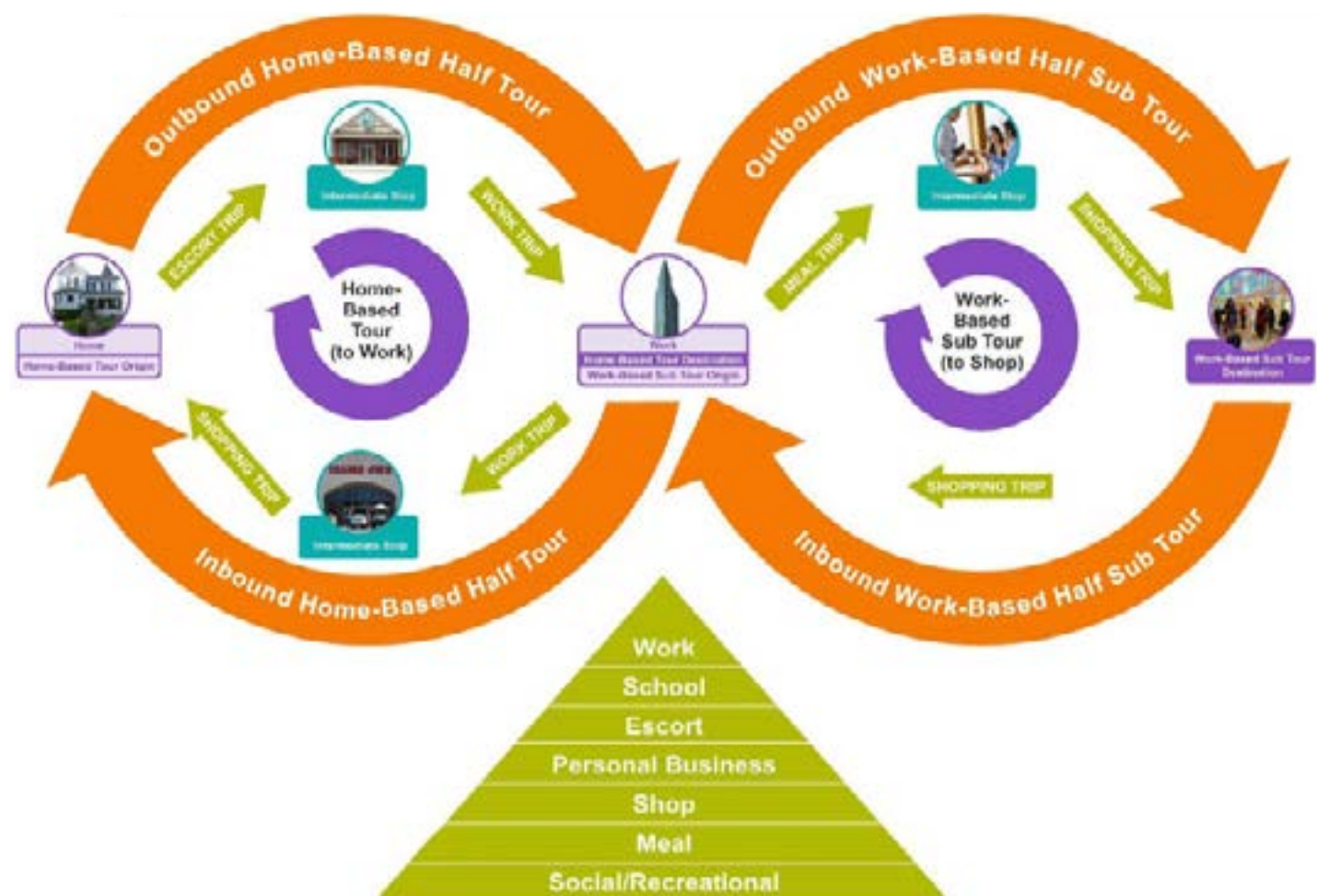


Figure 4: Sample tour diagram



## Roadway and transit system

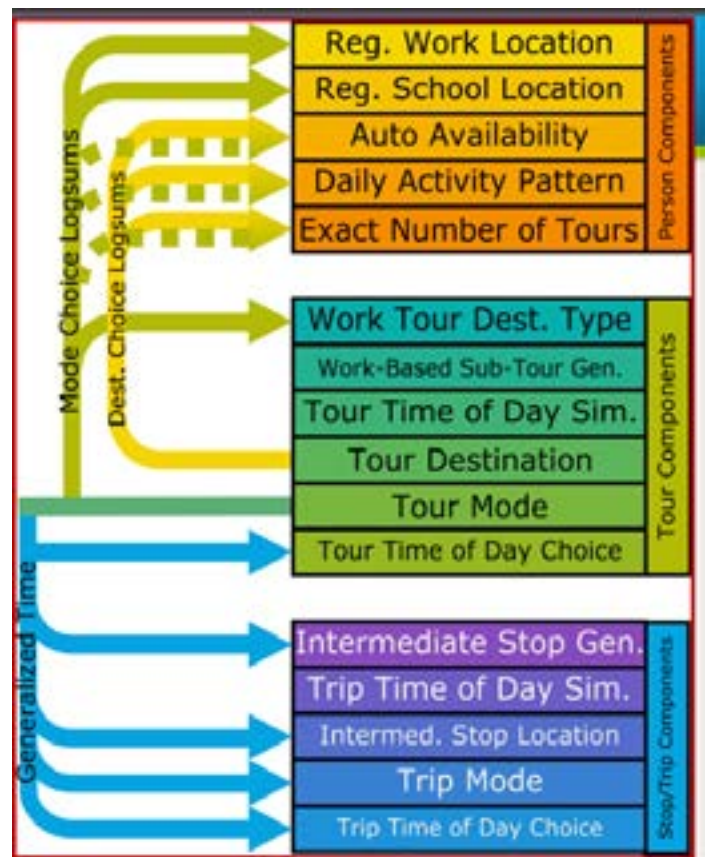
The most critical feature of the model is the representation of the transportation system. The roadway network is represented by over 25,000 directional road segments, described by location, length, number of lanes, functional classification and area type. High-occupancy vehicle and managed lanes also 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 5 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 5: Key focus model components (Activity Based Model components in red italics)**

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



## Roadway and transit skims (path selection)

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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

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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

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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 and information such as 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

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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 his or her 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 his or her 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 3 and Table 4.

***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 3: 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 4: Observed estimates and modeled 2020 transit weekday boardings**

	2019 observed (est.)	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 Table

	2020	2050
<b>Total population</b>	3,408,152	4,478,343
<b>Employment</b>	2,180,587	3,000,647
<b>Dwelling Units (Households)</b>	1,361,781	1,882,031
<b>Persons/Dwelling Unit (Household)</b>		
<b>VMT by Roadway Type</b>	2.5	2.38
-Freeway	34,056,247	47,659,781
-Expressway	5,254,677	7,116,310
-Principal	25,437,909	36,283,234
-Minor	8,604,440	12,042,677
-Other (Collectors, Centroid Connectors, Ramps)	17,202,507	26,046,738
<b>Total</b>	<b>90,555,780</b>	<b>129,148,740</b>
<b>Speed by Roadway Type (miles per hour)</b>		
-Freeway	58.8	54.2
-Expressway	43.2	39.9
-Principal	32.8	31.1
-Minor	29.3	28
-Other (Collectors, Centroid Connectors, Ramps)	27.1	27.1
<b>Total (Average Speed)</b>	<b>37.7</b>	<b>35.7</b>
<b>Lane Miles by Roadway Type</b>		
-Freeway	2,157	2,435
-Expressway	540	559
-Principal	4,293	5,098
-Minor	2,893	3,126
-Other (Collectors, Ramps)	10,823	10,890
<b>Total</b>	<b>20,706</b>	<b>22,108</b>

## Appendix D: PM<sub>10</sub> Street Emissions Reduction Commitments

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See companion document for commitments.

## Appendix E: U.S. Department of Transportation Conformity Finding

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Forthcoming.