2015 CYCLE 2

CO AND PM10 CONFORMITY REDETERMINATION

for the
DRCOG 2040 Fiscally Constrained
Regional Transportation Plan

and the
Amended 2016-2021 Transportation Improvement Program

Public Hearing Draft

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ABSTRACT

TITLE:	**2015 Cycle 2 CO and PM_{10} Conformity Redetermination for the DRCOG 2040 Fiscally Constrained Regional Transportation Plan and the Amended 2016-2021 Transportation Improvement Program**
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ABSTRACT:	Demonstration of the Denver region's timely implementation of adopted Transportation Control Measures and meeting of federally prescribed air pollution emissions tests.

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CHAPTER 1. INTRODUCTION

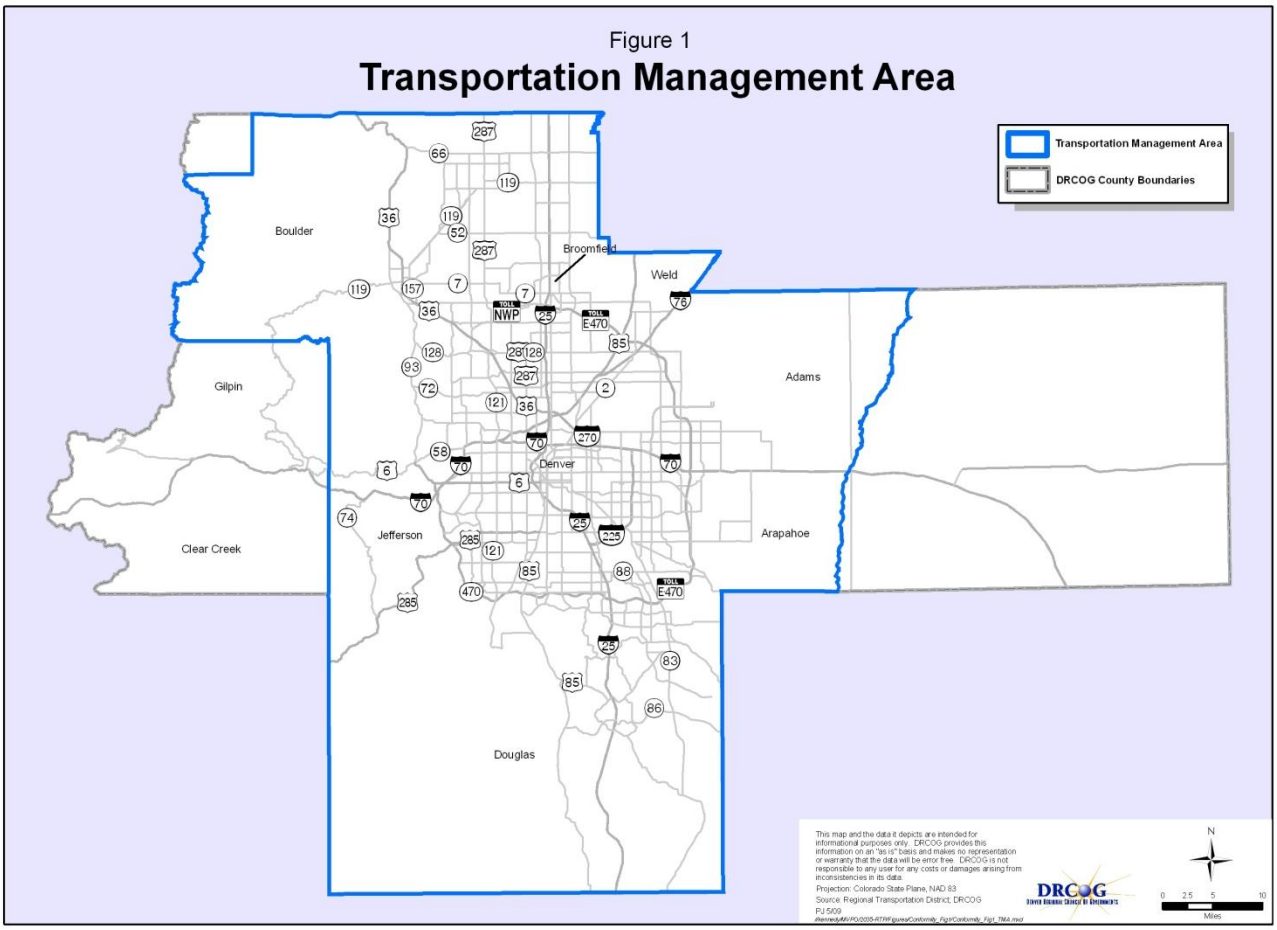
Federal Requirements

The Denver Regional Council of Governments (DRCOG) is the Metropolitan Planning Organization (MPO) for the Denver Transportation Management Area (TMA) shown in Figure 1. The MPO is required to show conformity of its fiscally constrained transportation plan and Transportation Improvement Program (TIP) with the State Implementation Plan (SIP) 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. Conformity to an air quality implementation plan is defined in the Clean Air Act as conformity 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. 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.

The U.S. Environmental Protection Agency (EPA) final transportation conformity rule is located at 40 CFR Part 93. To address revised standards and changes in conformity requirements, EPA promulgated several amendments to the final rule. On July 1, 2004, EPA issued amendments which addressed:

- Conformity regulations for the 8-hour ozone and fine particulate matter ($PM_{2.5}$) NAAQS.
- The incorporation of existing federal guidance that is consistent with a U.S. Court of Appeals decision.
- The streamlining and improving of EPA's existing transportation conformity rule[1].

[1] 40 CFR Part 93



On March 10, 2006, EPA issued revisions addressing $PM_{2.5}$ and PM_{10} 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.

On January 24, 2008, the U.S. Department of Transportation and EPA issued the transportation conformity rule, "Transportation Conformity Rule Amendments To Implement Provisions Contained in the 2005 Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU)."

On March 8, 2012, EPA issued amendments which restructure several sections of the existing transportation conformity rule. Key elements of the amendments include:

- 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.

- As a result of these changes, the conformity rule will apply to any new NAAQS that EPA establishes in the future.

The EPA 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 such a submittal.

In addition to the emissions tests, the region must demonstrate timely implementation of adopted Transportation Control Measures (TCMs). The transportation community is held responsible for implementing TCMs to which the state committed in the various pollutant SIPs.

Current Situation

Transportation Planning

DRCOG Region

The 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, a regional roadway system network, bicycle and pedestrian facilities, and improvements to the existing roadway system.

The Metro Vision Regional Transportation Plan (MVRTP) is the transportation plan that implements the transportation element of Metro Vision. The MVRTP contains an unconstrained vision plan, outlining the region's total transportation needs, as well as the Fiscally Constrained RTP, which includes those projects that can be implemented given reasonably anticipated revenues through 2040. The 2040 Fiscally Constrained RTP was adopted in February 2015. DRCOG is in the process of preparing a new MVRTP with anticipated adoption in 2016.

The 2016-2021 Transportation Improvement Program (TIP), adopted in March 2015, identifies transit, multimodal, and roadway projects to be funded from FY 2016 through FY 2019. The regionally significant projects are described in Chapter 3. The TIP will implement projects and strategies identified in the 2040 Fiscally Constrained RTP.

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 latest revision to the carbon monoxide (CO) maintenance plan for Longmont established the emissions budget at 43 tons per day (tpd) for 2010 and beyond. On May 3, 2007, EPA found the revised CO budget of 43 tpd "adequate" for use in conformity determinations. EPA's approval of this latest Longmont CO Maintenance Plan revision became effective on October 16, 2007.

The most recent revised CO maintenance plan for Denver, approved by the Colorado Air Quality Control Commission (AQCC) on December 15, 2005, established the emission budget at 1,625 tpd through 2020, and 1,600 tpd for 2021 and beyond. On May 3, 2007, EPA found the revised CO budget of 1,600 tpd adequate for use in conformity determinations for 2021 and beyond. EPA's approval of the revised Denver CO Maintenance Plans became effective on October 16, 2007.

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} SIP Revision on January 7, 2008. This latest PM_{10} Maintenance Plan revision contains the PM_{10} budgets of 54 tpd for the years 2015 through 2021, and 55 tpd for 2022 and beyond, respectively, as well as the wintertime NOx budgets of 70 tpd and 56 tpd for the years 2015 through 2021, and 2022 and beyond, respectively.

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.

Air Quality Situation

The region has been redesignated as attainment maintenance for CO and PM_{10}. The pollutants and their violation status for the Denver region include:

Carbon Monoxide – 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 since.

$PM_{2.5}$ – An exceedance of the $PM_{2.5}$ standard occurs when a monitoring station exceeds the annual average of 12 µg/m^3 or the 24-hour average of 35 µg/m^3. 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^3 or the 3-year average of the annual averages exceeds 12 µg/m^3. The Denver metropolitan area has never violated either of the two standards.

PM_{10} – An exceedance of the PM_{10} standard occurs when a monitoring station exceeds a 24-hour average of 150 µg/m^3. If the 24-hour standard is exceeded more than three times over a three-year period, it is a violation. The PM_{10} standard was last violated on three days in 1993. There has been no violation for PM_{10} in the Denver region since.

1-Hour Ozone – EPA made an adequacy determination of the proposed 8-hour ozone motor vehicle emissions budgets for conformity and the new budgets became effective on March 19, 2010. The 1-hour ozone budgets are no longer used for transportation conformity purposes.

Process

Agency Roles

The Conformity SIP was developed by the AQCC and adopted in 1998. It formally defines the process for finding conformity. The EPA approved the Conformity SIP on September 21, 2001 (66FR48561). This makes the Conformity SIP federally enforceable.

DRCOG, as the MPO, and the Federal Transit Administration (FTA) and Federal Highway Administration (FHWA), as representatives of the U.S. Department of Transportation, are charged with determining conformity for the Denver TMA. The development of the Fiscally Constrained RTP and TIP conformity determination has been a cooperative process between DRCOG and the RAQC, the Air Pollution Control Division (APCD) of CDPHE, the EPA, the FHWA, the FTA, CDOT, and the Regional Transportation District (RTD). In 2015, a memorandum of agreement was signed including CDPHE, DRCOG, the North Front Range MPO, and the RAQC for the purpose of defining the specific roles and responsibilities in conformity evaluations and findings.

Public Participation

Public participation was encouraged throughout the development of DRCOG's 2040 Fiscally Constrained RTP and associated Metro Vision Plan, and the TIPs. DRCOG has held numerous workshops, stakeholder meetings, interactive online forums, and other public participation events, as well as gathering public input through the Sustainable Communities Initiative, DRCOG Listening Tour, CDOT Town Halls, and other related efforts.

CHAPTER 2. IMPLEMENTATION OF CONTROL MEASURES

Transportation Control Measures

The transportation plan and program must provide for the timely implementation of adopted Transportation Control Measures (TCM) from the applicable implementation plan. The state air quality implementation plan identified a number of TCMs that were funded and completed in past TIPs. The implementation of rail transit was a substantial TCM, first defined in the 1979 Carbon Monoxide SIP and the 1982 Ozone SIP.

The region's first segment of light rail, which opened in October 1994, provides service from the downtown area south to Broadway and I-25. The first extension of this service, the southwest corridor, from Broadway and I-25 to Mineral Avenue along South Santa Fe Drive, opened in July 2000.

An extension of light rail service into the Central Platte Valley opened in April 2002. Funding came from a private-public partnership that included DRCOG, RTD, the City and County of Denver, and the private sector.

The southeast corridor light rail transit line was completed in November 2006. It was the last remaining partially completed TCM. It includes light rail service along I-25 from Broadway south to Lincoln Avenue, as well as a light rail spur along I-225 from I-25 to Parker Road.

Beyond the SIP measures, the 2040 Fiscally Constrained RTP and the 2016-2021 TIP continue funding for transportation demand management (TDM) actions through:

- The Regional TDM Program.
- A separate TDM pool program that supports localized efforts, including projects implemented by transportation management organizations (TMOs).

The TIPs also provide funding for the RTD FasTracks program, local bus service initiatives, bicycle/pedestrian projects, and transit station area master plans and urban center studies.

Timely Implementation Criteria

The transportation plan must meet two conditions to demonstrate timely implementation of TCMs:

- The transportation plan, in describing the envisioned future transportation system, provides for the timely completion or implementation of all TCMs in the applicable implementation plan which are eligible for funding under Title 23 USC of the Federal Transit Act, consistent with the schedule included in the applicable implementation plan.

  The 2040 Fiscally Constrained RTP identifies the metropolitan transportation system of freeways, managed lanes (HOV/HOT lanes) transit facilities, travel demand actions, and operational improvements. It also contains direction to guide the implementation of the plan. There are no remaining TCM's to be implemented. The Denver Regional Element of the State Air Quality Implementation Plan and the 2040 Fiscally Constrained RTP are consistent documents.

- Nothing in the transportation plan interferes with the implementation of any TCM in the applicable implementation plan.

  The DRCOG committees and Board review the recommendations, improvements, and direction identified in the 2040 Fiscally Constrained RTP. No conflicts exist with any specific requirements in commitments of the adopted SIP. The Fiscally Constrained RTP does not prohibit implementation of any SIP TCM, nor does it make it impossible to implement any SIP TCM.

  TCMs contained in the SIP, but not directly related to the Fiscally Constrained RTP, given their non-facility planning nature, include the federal Motor Vehicle Emissions Control Program, Inspection and Maintenance Program, stationary source controls, display signs instructing motorists to turn off engines, warranty enforcement, and gasoline high altitude emissions research. The 2040 Fiscally Constrained RTP contains no policies that inhibit the implementation of these measures.

For a TIP to provide for the timely implementation of TCMs, three criteria must be satisfied:

- TCMs, which are eligible for funding under Title 23 USC of the Federal Transit Act, are on or ahead of the schedule established in the applicable implementation plan, or, if such TCMs

are behind schedule, the MPO and DOT have determined the past obstacles to implementation have been identified and overcome.

There are no TCMs remaining from the CO or PM_{10} SIPs.

- If TCMs have previously been programmed, but funds have not been obligated and the TCMs are behind schedule, then the TIP cannot be found to conform if the funds intended for these TCMs are reallocated to projects in the TIP other than TCMs.

  This situation has not occurred. Programmed funds for TCMs have been obligated.

- Nothing in the TIP may interfere with implementation of any TCM in the applicable implementation plan.

  The DRCOG committees and Board review the projects identified in the 2016-2021 TIP. No conflicts exist with any specific requirements or commitments of the adopted SIP. The TIP does not prohibit implementation of any SIP TCM, nor does it make it impossible to implement any SIP TCM.

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CHAPTER 3. EMISSIONS TESTS

General Description

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:

- Carbon monoxide (CO)
- PM_{10}
- Nitrogen oxides (NO_x) as a precursor for PM_{10} (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 SIP or SIP 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 20 emissions tests as listed in Table 1[2]. The analysis areas are shown in Figure 2.

[2] Transportation model runs represent the beginning of a calendar year. Test dates listed in Table 1 refer to model run dates.

Table 1
Conformity Emissions Tests

Pollutant and Area	Tests
Carbon Monoxide in Denver Attainment Maintenance Area[1]	2015 staging ≤ Budget of 1,625 tpd 2021 ≤ Budget of 1,600 tpd 2025 staging ≤ Budget of 1,600 tpd 2035 staging ≤ Budget of 1,600 tpd 2040 Fiscally Constrained RTP ≤ Budget of 1,600 tpd
Carbon Monoxide in Longmont Attainment Maintenance Area[2]	2015 staging ≤ Budget of 43 tpd 2020 ≤ Budget of 43 tpd 2025 staging ≤ Budget of 43 tpd 2035 staging ≤ Budget of 43 tpd 2040 Fiscally Constrained RTP ≤ Budget of 43 tpd
PM_{10}	2015 staging ≤ Budget of 54 tpd 2022 ≤ Budget of 55 tpd 2025 staging ≤ Budget of 55 tpd 2035 staging ≤ Budget of 55 tpd Fiscally Constrained 2040 RTP ≤ Budget of 55 tpd
NO_x associated with PM_{10}	2015 staging ≤ Budget of 70 tpd 2022 ≤ Budget of 56 tpd 2025 staging ≤ Budget of 56 tpd 2035 staging ≤ Budget of 56 tpd Fiscally Constrained 2040 RTP ≤ Budget of 56 tpd

[1] EPA approval is effective October 16, 2007.

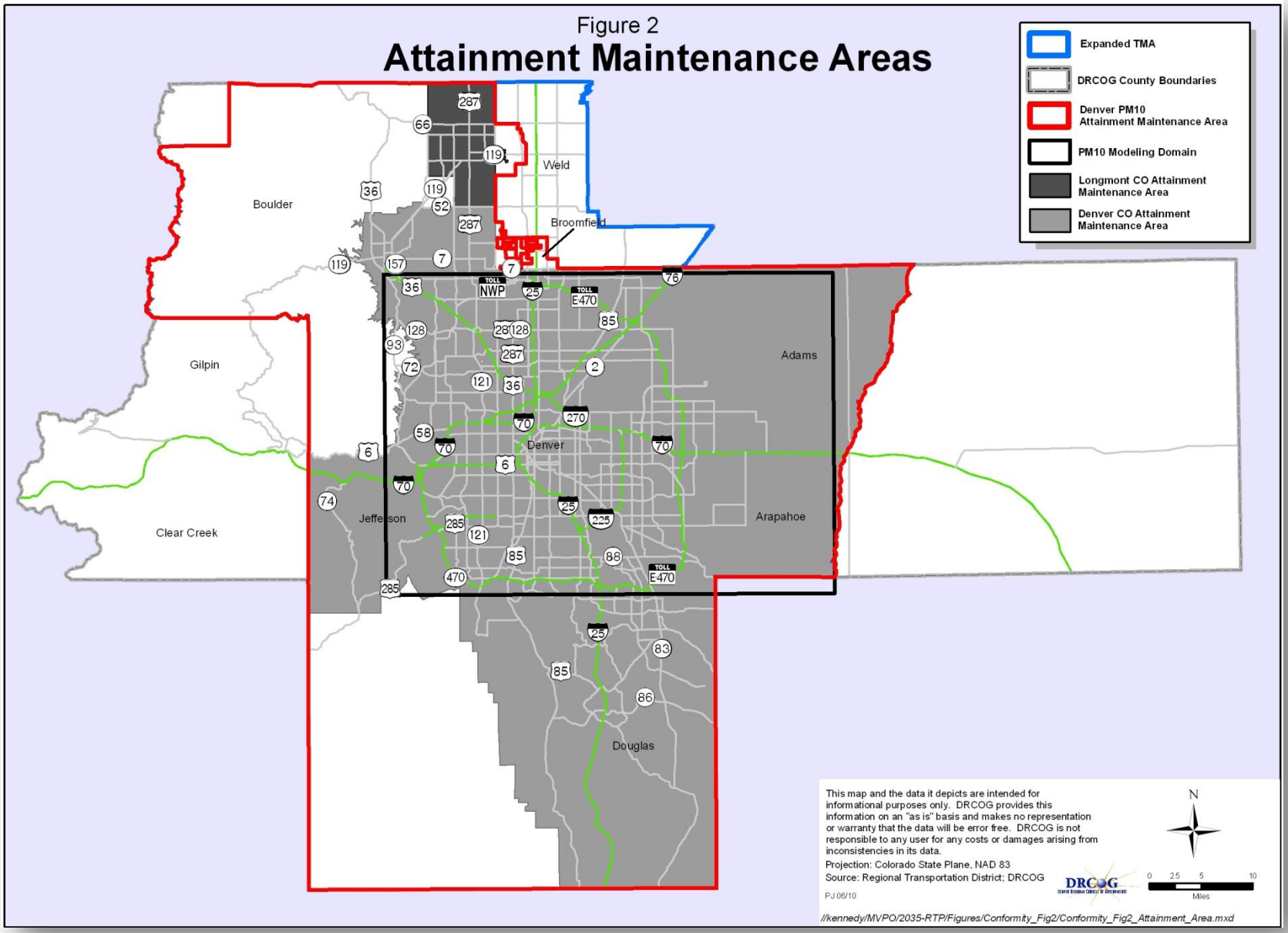
Figure 2
Attainment Maintenance Areas
Expanded TMA
DRCOG County Boundaries
Denver PM10 Attainment Maintenance Area
PM10 Modeling Domain
Longmont CO Attainment Maintenance Area
Denver CO Attainment Maintenance Area
Boulder
Weld
Broomfield
Gilpin
Clear Creek
Jefferson
Adams
Denver
Arapahoe
Douglas
This map and the data it depicts are intended for informational purposes only. DRCOG provides this information on an "as is" basis and makes no representation or warranty that the data will be error free. DRCOG is not responsible to any user for any costs or damages arising from inconsistencies in its data.
Projection: Colorado State Plane, NAD 83
Source: Regional Transportation District; DRCOG
PJ 06/10
N
0 2.5 5 10
Miles
//kennedy/MVPO/2035-RTP/Figures/Conformity_Fig2/Conformity_Fig2_Attainment_Area.mxd

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 above-mentioned factors were used with the EPA emission model (MOVES) to estimate emissions.

Demographic Assumptions

The population forecast for the full DRCOG region in 2040 is 4,218,686. This is a 37 percent increase over the 2015 estimated population of 3,082,555. Employment is forecast to be 2,334,304 in 2040 compared to the 2015 estimate of 1,781,527, an increase of 31 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 2 shows the latest forecasts of population and employment for 2015, 2025, 2035 and 2040 for the DRCOG region. Table 3 lists 2015 and 2040 population and employment estimates by each of the nine counties, as well as the southwest portion of Weld County within the DRCOG region.

Table 2
Population and Employment Forecasts – DRCOG Region

DRCOG Region	2015	2025	2035	2040
Population	3,082,555	3,698,247	4,149,334	4,218,686
Employment	1,781,527	2,062,972	2,260,796	2,334,304

Source: DRCOG. UrbanSim Modeling Run, Fall 2015

Table 3
2040 Population and Employment
Estimates by County – DRCOG Region

County	Population		Employment	
	2015	2040	2015	2040
Adams County	512,147	768,918	219,707	351,927
Arapahoe County	623,986	891,224	356,819	447,956
Boulder County	314,342	411,257	195,303	224,221
Broomfield County	53,515	102,459	46,019	85,061
Clear Creek County	11,401	15,642	3,294	3,455
Denver County	603,444	815,372	522,539	659,645
Douglas County	326,706	460,229	147,980	236,200
Gilpin County	7,262	8,579	7,483	7,630
Jefferson County	565,879	670,113	264,285	295,351
SW Weld in DRCOG	63,373	74,893	18,098	22,858
Full DRCOG Region	**3,018,682**	**4,218,686**	**1,781,527**	**2,334,304**

Source: DRCOG. UrbanSim Modeling Run. Fall 2015

DRCOG Transportation Assumptions

In order to complete the emissions tests, the 2015, 2025, 2035, and 2040 transportation networks must first be defined. DRCOG's 2040 Fiscally Constrained RTP specifies financially constrained highway and transit system improvements and resulting networks to be completed by the year 2040. The 2016-2021 TIP identifies funding to complete a number of regionally significant projects on the designated regional roadway and rapid transit system that are also contained in the 2040 Fiscally Constrained RTP, listed below:

- US-85 from Cook Ranch Road to Meadows Parkway: widen roadway to four lanes.
- I-25 from US-36 to 120th Avenue: add two HOT lanes.
- I-25 from RidgeGate Pkwy to County Line Road South Ramps: widen roadway to 8 lanes.
- Gold Line, Denver Union Station to Ward Road: new rail, stations, park-n-Rides.
- I-225 Corridor, Parker Road to Smith Road: new rail, stations, parking.

- Northwest Rail, Denver Union Station to Westminster (71st Ave Station): new rail, stations, parking.
- East Corridor, Denver Union Station to Denver International Airport: new rail, stations, and park-n-Rides.
- 120th Avenue Connection over US-36: build new six lane road.
- I-25 from Santa Fe to Alameda: interchange reconstruction.
- US-36 from the Table Mesa Park-n-Ride to the I-25 Express Lanes: add two HOT lanes, enhancements for bus rapid transit (BRT).
- I-225 from Parker Road to Mississippi Avenue: widen roadway to six lanes.

The 2016-2021 TIP also include many other projects that will help to reduce emissions associated with ozone:

- Transit operating funds and bus purchases
- Bicycle and pedestrian facilities
- Travel Demand Management (TDM) programs
- Intelligent Transportation Systems (ITS) infrastructure
- Traffic signal systems and coordination
- Master plans for areas around transit stations and urban centers

Other representative regionally significant projects in the 2040 Fiscally Constrained RTP (not yet funded in the TIP) using federal and state resources include:

- Pena Boulevard from I-70 to E-470: widen roadway to eight lanes.
- Wadsworth Parkway (SH-121) from 92nd Avenue to SH-128/120th Avenue: widen roadway to six lanes.
- 104th Avenue from Grandview Ponds to McKay Road: widen roadway to four lanes.
- I-270 from I-25 to I-70: widen roadway to six lanes and reconstruct Vasquez Boulevard interchange.
- US-6 at Wadsworth Boulevard: interchange reconstruction.
- I-25 from 120th Avenue to SH-7 and from SH-66 to WCR 38: add two toll/managed lanes.
- C-470 from Wadsworth Boulevard to I-25: add toll/managed lanes.

- Colfax Avenue from 7th Street to Potomac Street: new Bus Rapid Transit.
- SH-119 from Boulder to Longmont: new Bus Rapid Transit.
- North Metro Rail Line, Denver Union Station to 124th Avenue Station: new rail, stations, parking.
- Southeast Rail Extension, Lincoln Avenue to RidgeGate Parkway: new rail, stations, parking.

Regional highway projects in the Fiscally Constrained RTP using locally-derived funds include:

- C-470 from South Kipling Parkway to I-25: add toll/managed lanes.
- E-470 from I-25/C-470 to I-25/Northwest Parkway: widen to eight/six lanes, build five new interchanges.
- New interchange at I-70/Harvest Mile Road.
- Jefferson Parkway from SH-93 to SH-128: new four-lane toll road, plus 3 partial interchanges.

The 2015 rapid transit network includes the existing Central, Southwest, Southeast, West, and Central Platte Valley rail lines. It also includes the I-25 HOV/Tolled Express Lanes; HOV lanes on Santa Fe Drive and US 36 (to Pecos Street); and bus lanes on Broadway and Lincoln. The remaining rapid transit system to be completed by 2040 is shown in Figure 3.

All roadway and rapid transit network and staging assumptions through 2040 are shown in Figures 3 and 4, respectively, in Appendix A.

Air Quality Modeling Assumptions

The APCD of the CDPHE calculates air pollutant emissions using MOVES. The conformity analysis began in October 2015. The models and assumptions used by APCD in the conformity analysis were consistent with those used in the development of the CO and PM_{10} SIPs. The MOVES model accounts for estimates of vehicle types by miles traveled, effects on emissions caused by vehicle regulations, street sweeping commitments, and more. The technical support documentation for each of these SIPs is available at http://apcd.state.co.us/tech.aspx.

Control Measures

There are several actions or projects described or assumed in the SIPs that are federally enforceable control measures. PM_{10} street maintenance actions are one of the control measures.

PM_{10} Street Maintenance Actions

DRCOG must demonstrate that future year estimates of PM_{10} emissions will be less than or equal to the maintenance PM_{10} emissions budgets to show conformity with the PM_{10} SIP. The mobile source PM_{10} budgets are 54 tons per day (tpd) through 2021, and 55 tpd for 2022 and beyond.

AQCC 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_{10} emissions. It is the single largest contributor to PM_{10} emissions[3]. 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

[3] 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_{10} emissions. Findings from this study demonstrated that the percentage of the total PM_{10} 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_{10} 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_{10} 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_{10} 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.

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 of the local governments and street maintaining agencies (CDOT, RTD, 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 CDOT:

- The City and County of Denver shall achieve a 72% reduction within the Denver central business district (CBD). The CBD is defined as the area bounded by and inclusive of Colfax Avenue, Speer Boulevard, Wynkoop Street, 20th Street, and Broadway.
- CDOT 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 CDOT 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 APCD and the RAQC.

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 RTP 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 2014, 40 agencies submitted their commitments to DRCOG.

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

- 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 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 2014 are detailed in Appendix C.

The 2040 Fiscally Constrained RTP identifies approximately $90 million over a 26-year period in CMAQ and local match funds for air quality programs and purchases. Some of this $90 million may fund additional sweeper and deicer equipment.

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 2020 Fiscally Constrained RTP, the RTP in effect at the time the PM_{10} SIP was adopted, would be constructed at rates of 11.4 lane-miles per year for freeways and 62.7 lane-miles per year for major regional and principal arterials. To pass the test, the rate of lane-mile construction proposed in the 2040 Fiscally Constrained RTP must be less than or equal to the rate of construction in the 2020 Fiscally Constrained RTP. The rate of construction for the 2040 Fiscally Constrained RTP is about 7.9 lane-miles per year for freeways/tollways and 31.1 lane-miles per year for major regional arterials and principal arterials. Thus, the construction emissions of the 2040 Fiscally Constrained RTP are less than the construction emissions assumed in the budgets and the test is passed.

Other Mobile Source Reduction Measures

Two categories of measures to reduce regional emissions are funded and will be conducted across the region, but are not specifically reflected or 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 regional Transportation Operations Program will implement projects that allow the roadway system to operate much more efficiently through:
    - Traffic Signal System Improvement Program (TSSIP), which ensures the region's traffic signals make the most efficient use of arterial street capacity by minimizing vehicle stops, idling, and disruptions caused by malfunctioning equipment.
    - The Regional Intelligent Transportation Systems (ITS) Program will implement technological improvements that improve safety and operations, reduce crashes and incidents, and enhance the provision of real time traffic information to the traveling public.

Emission Test Results

The results of emissions tests are reported in Table 4. The emissions estimates were generated by APCD 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.

The emissions test results for the Denver region are less than all of the budgets listed in Table 4.

Table 4

Conformity Emissions Test Results

Pollutant and Area	Test	Result<Budget (tons per day)	Pass/Fail
Carbon Monoxide in Denver Attainment Maintenance Area	2015 Staging ≤ Budget	539 < 1,625	Pass
	2021 Staging ≤ Budget[4]	415 < 1,600	Pass
	2025 Staging ≤ Budget	332 < 1,600	Pass
	2035 Staging ≤ Budget	201 < 1,600	Pass
	Fiscally Constrained 2040 RTP ≤ Budget	200 < 1,600	Pass
Carbon Monoxide in Longmont Attainment Maintenance Area	2015 Staging ≤ Budget	12.5 < 43	Pass
	2020 Staging ≤ Budget[5]	10.1 < 43	Pass
	2025 Staging ≤ Budget	7.6 < 43	Pass
	2035 Staging ≤ Budget	4.6 < 43	Pass
	Fiscally Constrained 2040 RTP ≤ Budget	4.8 < 43	Pass
PM_{10}	2015 Staging ≤ Budget	32.1 < 54	Pass
	2022 Staging ≤ Budget[6]	34.1 < 55	Pass
	2025 Staging ≤ Budget	34.9 < 55	Pass
	2035 Staging ≤ Budget	38.8 < 55	Pass
	Fiscally Constrained 2040 RTP ≤ Budget	39.0 < 55	Pass
NO_x associated with PM_{10}	2015 Staging ≤ Budget	67.1 < 70	Pass
	2022 Staging ≤ Budget[7]	40.7 < 56	Pass
	2025 Staging ≤ Budget	29.4 < 56	Pass
	2035 Staging ≤ Budget	17.2 < 56	Pass
	Fiscally Constrained 2040 RTP ≤ Budget	16.0 < 56	Pass

[4] 2021 derived from interpolation of 2015 estimate of 539.5 tpd and 2025 estimate of 298.9 tpd.
[5] 2020 derived from interpolation of 2015 estimate of 12.5 tpd and 2025 estimate of 6.0 tpd.
[6] 2022 derived from interpolation of 2015 estimate of 32.1 tpd and 2025 estimate of 34.8 tpd.
[7] 2022 derived from interpolation of 2015 estimate of 67.1 tpd and 2025 estimate of 30.0 tpd.

APPENDIX A

TRANSPORTATION NETWORK ASSUMPTIONS

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Appendix A - 2040 Fiscally Constrained Regional Transportation Plan
Fiscally Constrained Roadway & Rapid Transit Capacity Improvements
Remaining Project Cost Allocations (FY 2016 - 2040)

Roadway	CDOT Road	Project Location (Limits)	Improvement Type	Length (Miles)	Air Quality Network Staging	Remaining Project Cost (FY '15 $millions)	County
A. Regional Roadway System Projects							
1. Regionally Funded with DRCOG-Controlled Funds							
6th Pkwy.		SH-30/Liverpool St. to E-470	New 2 Lane Road	1.3	2015-2024	$19.9	Arapahoe
56th Ave.		Havana St. to Pena Blvd.	Widen from 2 to 6 Lanes	4.3	2015-2024	$45.0	Denver
88th Ave.		I-76 NB Ramps to SH-2	Widen from 2 to 4 Lanes	1.7	2015-2024	$21.5	Adams
104th Ave.	SH-44	Grandview Ponds to McKay Rd.	Widen from 2 to 4 Lanes	0.7	2015-2024	$8.1	Adams
120th Ave.		Allison St. to Emerald St.	New 6 Lanes	0.4	2015-2024	$0.0	Broomfield
Arapahoe Rd.	SH-88	Havana St. (or Jordan Rd.)	New Grade Separation		2025-2034	$16.0	Arapahoe
County Line Rd.		Phillips St. to University Blvd.	Widen from 2 to 4 Lanes	1.2	2015-2024	$9.5	Douglas
Hampden Ave./ S. Havana St.	SH-30	Florence St. to s/o Yale Ave.	Widen from 5 to 6 Lanes	1.4	2025-2034	$14.0	Denver
I-25	I-25	Lincoln Ave.	Interchange Capacity		2015-2024	$49.4	Douglas
I-25	I-25	Broadway	Interchange Capacity		2015-2024	$50.0	Denver
I-25	I-25	Ridgegate Pkwy. to County Line Rd. S. Ramps	Widen from 6 to 8 Lanes	2.7	2015-2024	$0.0	Douglas
I-70	I-70	I-25 to Chambers Rd.	Add 2 New Managed Lanes	3.8	2015-2024	$1,175.7	Denver/Adams
Kipling St.	SH-391	Colfax Ave. to I-70	Widen from 4 to 6 Lanes	3.0	2025-2034	$18.0	Jefferson
Martin Luther King Jr. Blvd.		Havana St./Iola St. to Peoria St.	Widen 2 to 4 Lanes; New 4 Lane Road	1.0	2015-2024	$15.0	Denver
Parker Rd.	SH-83	Quincy Ave. to Hampden Ave.	Widen from 6 to 8 Lanes	1.0	2025-2034	$18.5	Arapahoe
Pena Blvd.		I-70 to E-470	Widen from 4 to 8 Lanes	6.4	2015-2024	$55.0	Denver
Quebec St.	SH-35	35th Ave. to Sand Creek Dr. S.	Widen from 4 to 6 Lanes	1.2	2015-2024	$11.0	Denver
Ridgegate Pkwy.		Havana St. to Lone Tree E. City Limit	Widen from 2 to 4 Lanes	1.8	2015-2024	$8.0	Douglas
SH-7	SH-7	164th Ave. to Dahlia St.	Widen from 2 to 4 Lanes	2.2	2025-2034	$32.7	Adams
Sheridan Blvd.	SH-95	I-76 to US-36	Widen from 4 to 6 Lanes	4.5	2015-2024	$23.0	Adams/Jefferson
US-6	US-6	Federal Blvd. to Bryant St.	Interchange Capacity		2015-2024	$0.0	Denver
US-36	US-36	I-25 Express Lanes to Table Mesa Dr.	Add HOT Lanes	17.2	2015-2024	$0.0	Regional
US-36	US-36	Sheridan Blvd.	Interchange Capacity		2015-2024	$0.0	Jefferson
US-85	US-85	Blakeland Dr. to County Line Rd.	Widen from 4 to 6 Lanes	0.5	2025-2034	$26.0	Douglas
US-85	US-85	Highlands Ranch Pkwy. to Blakeland Dr.	Widen from 4 to 6 Lanes	1.6	2015-2024	$24.1	Douglas
Wadsworth Blvd.	SH-121	35th Ave. to 48th Ave.	Widen from 4 to 6 Lanes	1.2	2015-2024	$31.0	Jefferson
Wadsworth Pkwy.	SH-121	92nd Ave. to SH-128	Widen from 4 to 6 Lanes	3.7	2025-2034	$31.6	Jefferson
					Subtotal:	**$1,703.0**	

Notes

(1) Project funds have been fully obligated prior to FY '15; project is under construction.

(2) Includes DRCOG contribution of $50 million. CDOT-derived funds make up $1,125.7 billion.

2. Regionally Funded with CDOT-Controlled Funds							
C-470	C-470	Wadsworth Blvd. to I-25	Add Toll Managed Lanes			$220.0	Douglas/Jefferson
		EB: Wadsworth Blvd. to I-25	*Add 1 New Toll Managed Lane*	*10.8*	*2015-2024*		*Douglas/Jefferson*
		WB: I-25 to Colorado Blvd.	*Add 2 New Toll Managed Lanes*	*4.1*	*2015-2024*		*Douglas*
		WB: Colorado Blvd. to Wadsworth Blvd.	*Add 1 New Toll Managed Lane*	*8.2*	*2015-2024*		*Douglas/Jefferson*
Federal Blvd.	SH-88	6th Ave. to Howard Pl.	Widen from 5 to 6 Lanes	0.8	2015-2024	$23.4	Denver
I-25	I-25	Arapahoe Rd.	Interchange Capacity		2015-2024	$50.4	Arapahoe
I-25	I-25	Santa Fe Dr. (US-85) to Alameda Ave.	Interchange Capacity		2015-2024	$27.0	Denver
I-25	I-25	Alameda Ave. to Walnut St. (Bronco Arch)	Add 1 New Lane in each direction	2.6	2025-2034	$30.0	Denver
I-25	I-25	US-36 to Thornton Pkwy.	Add 1 New SB Lane	2.8	2015-2024	$30.0	Adams
I-25	I-25	US-36 to 120th Ave.	Add 1 Toll/Managed Lane each direction	5.9	2015-2024	$68.5	Adams
I-25	I-25	120th Ave. to SH-7	Add 1 Toll/Managed Lane each direction	6.0	2015-2024	$55.0	Adams/Broomfield
I-25	I-25	SH-66 to WCR 38 (DRCOG Boundary)	Add 1 Toll/Managed Lane each direction	4.1	2035-2040	$92.0	Weld
I-225	I-225	I-25 to Yosemite St.	Interchange Capacity		2025-2034	$43.0	Denver
I-70	I-70	Empire Junction (US-40) to Twin Tunnels	Add/Convert 1 new EB Peak Period Managed Lane	9.6	2015-2024	$24.0	Clear Creek
I-70	I-70	Twin Tunnels to Empire Junction (US-40)	Add 1 WB Peak Period Managed Lane	9.6	2025-2034	$50.0	Clear Creek
I-70	I-70	Vicinity of US-6 and Floyd Hill	TBD		2015-2024	$100.0	Clear Creek
I-270	I-270	I-25 to I-70	Widen from 4 to 6 Lanes	6.3	2035-2040	$160.0	Adams
I-270	I-270	Vasquez Blvd. (US 6/85)	Interchange Capacity		2015-2024	$60.0	Adams
SH-2	SH-2	72nd Ave. to I-76	Widen from 2 to 4 Lanes	7.5	2015-2024	$13.6	Adams
SH-66	SH-66	Hover St. to Main St. (US-287)	Widen from 2 to 4 Lanes	1.5	2035-2040	$19.0	Boulder
SH-119	SH-119	SH-52	New Interchange		2025-2034	$30.0	Boulder
US-6	US-6	19th St.	New Interchange		2015-2024	$20.0	Jefferson
US-6	US-6	Wadsworth Blvd.	Interchange Capacity		2025-2034	$60.0	Jefferson

Appendix A - 2040 Fiscally Constrained Regional Transportation Plan
Fiscally Constrained Roadway & Rapid Transit Capacity Improvements
Remaining Project Cost Allocations (FY 2016 - 2040)

Roadway	CDOT Road	Project Location (Limits)	Improvement Type	Length (Miles)	Air Quality Network Staging	Remaining Project Cost (FY '15 $millions)	County
2. Regionally Funded with CDOT-Controlled Funds (cont'd.)							
US-85	US-85	Meadows Pkwy. to Louviers Ave.	Widen from 2 to 4 Lanes	5.7		$59.0	Douglas
		Meadows Pkwy. to Castlegate			*2015-2024*		
		Castlegate to Daniels Park Rd.			*2025-2034*		
		Daniels Park Rd. to SH-67 (Sedalia)			*2015-2024*		
		MP 191.75 to Louviers Ave.			*2025-2034*		
US-285	US-285	Pine Junction to Richmond Hill					
		Pine Valley Rd. (CR 126)/Mt Evans Blvd.	*New Interchange*		*2015-2024*	$14.0	Jefferson
		Kings Valley Dr.	*New Interchange*		*2015-2024*	$11.0	Jefferson
		Kings Valley Dr. to Richmond Hill Rd.	*Widen 3 to 4 Lanes (Add 1 SB Lane)*	0.9	*2015-2024*	$10.0	Jefferson
		Shaffers Crossing to Kings Valley Dr.	*Widen 3 to 4 Lanes (Add 1 SB Lane)*	1.4	*2015-2024*	$12.0	Jefferson
		Parker Ave.	*New Interchange*		*2015-2024*	$9.0	Jefferson
					Subtotal:	**$1,290.9**	
3. 100% Locally Derived Funding							
6th Ave.		Airport Blvd. to Tower Rd.	Widen from 2 to 6 Lanes	1.0	2015-2024	$10.2	Arapahoe
6th Ave.	SH-30	Tower Rd. to 6th Pkwy.	Widen from 2 to 6 Lanes	1.6	2015-2024	$14.1	Arapahoe
6th Pkwy.		SH-30 to E-470	Widen from 2 to 6 Lanes	1.3	2025-2034	$34.9	Arapahoe
6th Pkwy.		E-470 to Gun Club Rd.	Widen from 2 to 6 Lanes	0.3	2015-2024	$4.9	Arapahoe
6th Ave.		6th Pkwy. to Harvest Mile Rd.	Widen from 2 to 6 Lanes	0.4	2015-2024	$13.2	Arapahoe
17th Ave.		Alpine St. to Ute Creek Dr.	Widen from 2 to 4 Lanes	1.0	2015-2024	$2.3	Boulder
35th Ave.		Brighton Blvd. to Walnut St.	Widen from 2 to 4 Lanes	0.3	2025-2034	$2.5	Denver
48th Ave.		Imboden Rd. to Quail Run Rd.	Widen from 2 to 6 Lanes	1.0	2025-2034	$9.7	Adams
48th Ave.		Picadilly Rd. to Powhaton Rd.	New 6 Lanes	3.0	2015-2024	$40.7	Adams
48th Ave.		Powhaton Rd. to Monaghan Rd.	New 6 Lanes	1.0	2025-2034	$13.6	Adams
56th Ave.		E-470 to Imboden Rd.	Widen from 2 to 6 Lanes	7.0	2015-2024	$67.9	Adams
56th Ave.		Picadilly Rd. to E-470	Widen from 2 to 6 Lanes	1.0	2015-2024	$9.7	Adams
56th Ave.		Dunkirk St. to Himalaya St.	Widen from 4 to 6 Lanes	0.5	2015-2024	$11.5	Denver
56th Ave.		Himalaya St. to Picadilly Rd.	Widen from 2 to 6 Lanes	1.0	2015-2024	$5.8	Denver
56th Ave.		Pena Blvd. to Tower Rd.	Widen from 4 to 6 Lanes	0.7	2015-2024	$17.3	Denver
58th Ave.		Washington St. to York St.	Widen from 2 to 4 Lanes	1.0	2015-2024	$10.4	Adams
64th Ave.		Denver/Aurora City Limit to Himalaya St.	Widen from 2 to 6 Lanes	0.5	2015-2024	$6.5	Adams
64th Ave.		Harvest Mile Rd. to Powhaton Rd.	New 2 Lanes	1.0	2015-2024	$6.5	Adams
64th Ave.		Harvest Mile Rd. to Powhaton Rd.	Widen from 2 to 4 Lanes	1.0	2025-2034	$10.9	Adams
64th Ave.		Himalaya Rd. to Harvest Mile Rd.	Widen from 2 to 4 Lanes	3.0	2015-2024	$12.3	Adams
64th Ave.		Powhaton Rd. to Monaghan Rd.	New 4 Lanes	1.0	2015-2024	$6.7	Adams
64th Ave.		Tower Rd. to Denver/Aurora City Limits	Widen from 2 to 4 Lanes	0.5	2015-2024	$0.7	Denver
64th Ave.		Terry St. to Kendrick Dr.	Widen from 2 to 4 Lanes	1.2	2015-2024	$6.4	Jefferson
96th Ave.		SH-2 to Tower Road	Widen from 2 to 4 Lanes	5.0	2025-2034	$46.7	Adams
96th Ave.		Tower Rd. to Picadilly Rd.	Widen from 2 to 6 Lanes	2.0	2025-2034	$14.7	Adams
96th St.		96th St. at Northwest Pkwy. to SH-128	Add Toll Lanes	2.3	2015-2024	$39.4	Broomfield
104th Ave.		Marion St to Colorado Blvd	Widen from 4 to 6 Lanes	1.6	2025-2034	$6.3	Adams
104th Ave.		US-85 to SH-2	Widen from 2 to 4 Lanes	1.8	2015-2024	$41.2	Adams
104th Ave.	SH-44	McKay Road to US-85	Widen from 2 to 4 Lanes	1.9	2025-2034	$40.6	Adams
120th Ave.		Sable Blvd. to E-470	Widen from 2 to 6 Lanes	2.0	2025-2034	$29.7	Adams
120th Ave.		E-470 to Picadilly Rd.	Widen from 2 to 6 Lanes	2.6	2025-2034	$15.5	Adams
144th Ave.		Washington St. to York St.	Widen from 2 to 4 Lanes	1.0	2015-2024	$12.8	Adams
144th Ave.		York St. to Colorado Blvd.	Widen from 2 to 4 Lanes	1.0	2015-2024	$10.4	Adams
144th Ave.		US-287 to Zuni St.	Widen from 2 to 4 Lanes	3.5	2015-2024	$21.2	Broomfield
152nd Ave.		Washington St. to York St.	Widen from 2 to 4 Lanes	1.2	2025-2034	$11.1	Adams
3. 100% Locally Derived Funding (cont'd.)							
160th Ave.		Lowell Blvd. to Sheridan Pkwy.	New 2 Lanes	1.0	2015-2024	$3.8	Broomfield
Alameda Ave.		McIntyre St. to Rooney Rd.	Widen from 2 to 6 Lanes	0.3	2015-2024	$2.6	Jefferson
Alameda Ave.		Bear Creek Blvd. to McIntyre St.	Widen from 2 to 4 Lanes	1.3	2015-2024	$7.6	Jefferson
Arapahoe Rd.		Himalaya Way to Liverpool St.	Widen from 4 to 6 Lanes	0.5	2025-2034	$6.2	Arapahoe
Arapahoe Rd.		Waco St. to Himalaya St.	Widen from 2 to 6 Lanes	1.3	2015-2024	$20.4	Arapahoe
Bayou Gulch Rd. /Chambers Rd.		Parker Road to Parker S. Town Limit	Widen from 0/2 to 4 Lanes	2.4	2025-2034	$18.4	Douglas
Broadway		Arizona Ave. to Mississippi Ave.	Widen from 4 to 6 Lanes	0.1	2015-2024	$2.5	Denver
Broadway		Kentucky Ave. to Exposition Ave.	Widen from 4 to 6 Lanes	0.3	2015-2024	$4.8	Denver
Broadway		Mississippi Ave. to Kentucky Ave.	Widen from 6 to 8 Lanes	0.3	2015-2024	$5.0	Denver
Broncos Pkwy.		Jordan Rd. to Parker Rd.	Widen from 4 to 6 Lanes	0.8	2015-2024	$6.9	Arapahoe
Broncos Pkwy.		Havana St. to Peoria St.	Widen from 4 to 6 Lanes	1.0	2015-2024	$8.1	Arapahoe
Buckley Rd.		118th Ave. to Cameron Dr.	Widen from 2 to 6 Lanes	1.3	2015-2024	$13.9	Adams
Buckley Rd.		136th Ave. to Bromley Ln.	Widen from 2 to 4 Lanes	2.0	2015-2024	$7.8	Adams

Roadway	CDOT Road	Project Location (Limits)	Improvement Type	Length (Miles)	Air Quality Network Staging	Remaining Project Cost (FY '15 $millions)	County
3. 100% Locally Derived Funding (cont'd.)							
C-470	C-470	S. Kipling Pkwy. to I-25	Add New Toll/Managed Lanes				
		WB: Wadsworth Blvd. to S. Kipling Pkwy.	*Add 1 Toll/Managed Lane*	*1.4*	*2025-2034*	*$45.0*	*Jefferson*
		EB: S. Kipling Pkwy. to Wadsworth Blvd.	*Add 1 Toll/Managed Lane*	*3.0*	*2025-2034*		*Jefferson*
		WB: Colorado Blvd. to Lucent Blvd.	*Add 1 Toll/Managed Lane*	*3.7*	*2025-2034*	*$120.0*	*Douglas*
		EB: Broadway to I-25	*Add 1 Toll/Managed Lane*	*6.6*	*2025-2034*		*Douglas*
Canyons Pkwy.		Crowfoot Valley Rd. to Hess Rd.	New 4 Lanes	4.1	2015-2024	$19.1	Douglas
Central Park Blvd.		47th Ave. (Northfield Blvd.) to 56th Ave.	New 4 Lanes	0.9	2015-2024	$4.3	Denver
Chambers Rd.		Crowfoot Valley Road to Parker S. Town Limit	New 2 Lanes	0.7	2025-2034	$3.1	Douglas
Chambers Rd.		Crowfoot Valley Road to Parker S. Town Limit	Widen from 2 to 4 Lanes	0.7	2015-2024	$3.1	Douglas
Chambers Rd.		Crowfoot Valley Rd. to Hess Rd.	New 4 Lanes	2.3	2015-2024	$15.4	Douglas
Chambers Rd.		Hess Rd. to Mainstreet	Widen from 2 to 4 Lanes	1.9	2015-2024	$12.6	Douglas
Chambers Rd.		Mainstreet to Lincoln Ave.	Widen from 2 to 4 Lanes	1.4	2015-2024	$4.4	Douglas
Colorado Blvd.		144th Ave. to 168th Ave.	Widen from 0/2 to 4 Lanes	3.7	2025-2034	$23.5	Adams
Crowfoot Valley Rd.		Stroh Rd. to Chambers Rd.	Widen from 2 to 4 Lanes	1.4	2015-2024	$6.4	Douglas
Crowfoot Valley Rd.		Macanta Rd. to Chambers Rd.	Widen from 2 to 4 Lanes	3.6	2025-2034	$22.9	Douglas
Crowfoot Valley Rd.		Founders Pkwy. to Macanta Rd.	Widen from 2 to 4 Lanes	1.1	2025-2034	$5.1	Douglas
E. Bromley Ln.		Hwy 85 to Sable Blvd.	Widen from 4 to 6 Lanes	0.5	2015-2024	$1.3	Adams
E. Bromley Ln.		Tower Rd. to I-76	Widen from 4 to 6 Lanes	1.1	2015-2024	$1.9	Adams
E-470		48th Ave.	Add New Interchange		2015-2024	$26.9	Adams
E-470		88th Ave.	Add New Interchange		2025-2034	$17.6	Adams
E-470		I-25 North to I-76	Widen from 4 to 6 Lanes	11.0	2025-2034	$100.0	Adams
E-470		Potomac	Add New Interchange		2015-2024	$15.0	Adams
E-470		112th Ave.	Add New Interchange		2025-2034	$17.6	Adams
E-470		I-70 to Pena Blvd.	Widen from 4 to 6 Lanes	7.4	2025-2034	$29.3	Adams/Denver
E-470		Pena Blvd. to I-76	Widen from 4 to 6 Lanes	7.6	2025-2034	$60.0	Adams/Denver
E-470		I-25 to Parker Rd.	Widen from 6 to 8 Lanes	5.5	2025-2034	$45.0	Arapahoe
E-470		Parker Rd. to Quincy Ave.	Widen from 4 to 6 Lanes	8.1	2015-2024	$80.0	Arapahoe/Douglas
E-470		Quincy Ave. to I-70	Widen from 4 to 6 Lanes	7.0	2025-2034	$60.0	Arapahoe
East County Line Rd.		9th Ave. to SH-66	Widen from 2 to 4 Lanes	2.0	2025-2034	$9.8	Boulder
Erie Pkwy.		US-287 to 119th St.	Widen from 2 to 4 Lanes	1.5	2015-2024	$14.6	Boulder
Green Valley Ranch Blvd.		Chambers Rd. to Telluride St.	Widen from 4 to 6 Lanes	1.5	2015-2024	$9.9	Denver
Green Valley Ranch Blvd.		Chambers Rd. to Pena Blvd.	Widen from 2 to 4 Lanes	1.0	2015-2024	$2.4	Denver
Green Valley Ranch Blvd.		Telluride St. to Tower Rd.	Widen from 4 to 6 Lanes	0.5	2015-2024	$1.7	Denver
Gun Club Rd.		1.5 Miles s/of Quincy Ave. to Quincy Ave.	Widen from 2 to 6 Lanes	1.6	2015-2024	$26.7	Arapahoe
Gun Club Rd.	SH-30	Yale Ave. to Mississippi Ave.	Widen from 2/4 to 6 Lanes	2.1	2025-2034	$10.9	Arapahoe
Hampden Ave.		Picadilly Rd. to Gun Club Rd.	Widen from 2 to 4 Lanes	1.1	2015-2024	$12.4	Arapahoe
Harvest Mile Rd.		56th Ave. to 64th Ave.	New 3 Lanes	1.0	2015-2024	$6.5	Adams
Harvest Mile Rd.		56th Ave. to 64th Ave.	Widen from 3 to 6 Lanes	1.0	2025-2034	$7.8	Adams
Harvest Mile Rd.		I-70 to 56th Ave.	New 6 Lanes	4.1	2015-2024	$54.3	Adams
Harvest Mile Rd.		Jewell Ave. to Mississippi Ave.	Widen from 2 to 6 Lanes	1.0	2025-2034	$13.3	Arapahoe
Harvest Rd.		6th Ave. to I-70	New 6 Lanes	1.1	2015-2024	$13.3	Adams
Harvest Rd.		Alameda Ave. to 6th Ave.	Widen from 3 to 6 Lanes	1.0	2015-2024	$6.7	Arapahoe
Harvest Rd.		Mississippi Ave. to Alameda Ave.	New 6 Lanes	1.0	2015-2024	$13.3	Arapahoe
Hess Rd.		I-25 to Chambers Rd.	Widen from 2 to 4 Lanes	5.1	2025-2034	$44.5	Douglas
Hess Rd.		Motsenbocker Rd. to Nate Dr.	Widen from 2 to 4 Lanes	0.5	2015-2024	$3.5	Douglas
Hilltop Rd.		Canterberry Pkwy. to Singing Hills Rd.	Widen from 2 to 4 Lanes	2.7	2025-2034	$17.8	Douglas
Huron St.		150th Ave. to 160th Ave.	Widen from 2 to 4 Lanes	1.3	2015-2024	$8.6	Broomfield
Huron St.		160th Ave. to SH-7	Widen from 2 to 4 Lanes	1.2	2015-2024	$5.1	Broomfield
I-25	I-25	Castlegate Dr.	Add New Interchange		2015-2024	$15.3	Douglas
I-25	I-25	Crystal Valley Pkwy.	Add New Interchange		2025-2034	$44.5	Douglas
I-70	I-70	E-470	Interchange Capacity		2025-2034	$100.0	Adams/Arapahoe
I-70	I-70	Harvest Mile Rd.	Add New Interchange		2015-2024	$39.6	Adams/Arapahoe
I-70	I-70	32nd Ave.	Interchange Capacity		2015-2024	$22.4	Jefferson
I-70	I-70	Picadilly Rd.	Add New Interchange		2015-2024	$27.5	Adams
I-76	I-76	Bridge St.	Add New Interchange		2015-2024	$25.4	Adams
Imboden Rd.		48th Ave. to 56th Ave.	Widen from 2 to 6 Lanes	1.0	2025-2034	$10.3	Adams
Jefferson Pkwy.		Initial Phase: SH-93 to SH-128	New 4 Lane Toll Road; 3 Partial Interchanges	10.2	2015-2024	$259.1	Jefferson
		Candelas Pkwy.	*New Partial Interchange*		*2015-2024*		
		Indiana St. s/o SH-128	*New Partial Interchange*		*2015-2024*		
		SH-72	*New Partial Interchange*		*2015-2024*		
Jewell Ave.		E-470 to Gun Club Rd.	Widen from 2 to 6 Lanes	0.5	2015-2024	$4.9	Arapahoe
Jewell Ave.		Gun Club Rd. to Harvest Rd.	Widen from 2 to 6 Lanes	1.0	2015-2024	$10.0	Arapahoe

Roadway	CDOT Road	Project Location (Limits)	Improvement Type	Length (Miles)	Air Quality Network Staging	Remaining Project Cost (FY '15 $millions)	County
3. 100% Locally Derived Funding (cont'd.)							
Jewell Ave.		Himalaya Rd. to E-470	Widen from 3 to 6 Lanes	1.4	2015-2024	$13.2	Arapahoe
Jordan Rd.		Bradbury Pkwy. to Hess Rd.	Widen from 2 to 4 Lanes	0.6	2015-2024	$3.0	Douglas
Lincoln Ave.		1st St. to Keystone Blvd.	Widen from 4 to 6 Lanes	1.8	2025-2034	$8.3	Douglas
Lincoln Ave.		Keystone Blvd. to Parker Rd.	Widen from 4 to 6 Lanes	1.6	2015-2024	$8.0	Douglas
Lincoln Ave.		Peoria St. to 1st Ave.	Widen from 4 to 6 Lanes	0.7	2015-2024	$3.2	Douglas
Mainstreet		Canterberry Pkwy. to Tomahawk Rd.	Widen from 2 to 4 Lanes	1.4	2025-2034	$7.6	Douglas
Mainstreet		Lone Tree E. City Limit to Chambers Rd.	Widen from 2 to 4 Lanes	0.9	2025-2034	$7.6	Douglas
McIntyre St.		44th Ave. to 52nd Ave.	Widen from 2 to 4 Lanes	1.0	2015-2024	$3.5	Jefferson
McIntyre St.		52nd Ave. to 60th Ave.	Widen from 2 to 4 Lanes	1.0	2015-2024	$6.5	Jefferson
Monaghan Rd.		Quincy Ave. to Yale Ave.	New 6 Lanes	2.0	2025-2034	$22.9	Arapahoe
Nelson Rd.		75th St. to Affolter Dr.	Widen from 2 to 4 Lanes	2.3	2015-2024	$5.2	Boulder
Pace St.		5th Ave. to Ute Rd.	Widen from 2 to 4 Lanes	2.5	2015-2024	$3.8	Boulder
Pecos St.		52nd Ave. to I-76	Widen from 2 to 4 Lanes	1.3	2015-2024	$8.7	Adams
Pena Blvd.		Tower Rd.	Add on-ramp to WB Pena		2015-2024	$3.8	Denver
Pena Blvd.		Jackson Gap St. West Ramps to DIA Terminal	Widen from 6 to 8 Lanes	1.7	2015-2024	$10.2	Denver
Peoria St.		E-470 to .75 miles s/o Lincoln Ave.	Widen from 2 to 4 Lanes	1.9	2015-2024	$4.4	Douglas
Peoria St.		.75 miles s/o Lincoln Ave. to Mainstreet	Widen from 2 to 4 Lanes	0.5	2025-2034	$4.4	Douglas
Picadilly Rd.		48th Ave. to 56th Ave.	Widen from 2 to 6 Lanes	1.2	2015-2024	$13.6	Adams
Picadilly Rd.		56th Ave. to 70th Ave./Aurora City Limits	New 6 Lanes	1.7	2015-2024	$20.4	Adams
Picadilly Rd.		82nd Ave. to 96th Ave.	New 6 Lanes	1.8	2025-2034	$21.6	Adams
Picadilly Rd.		Colfax Ave. to I-70	New 6 Lanes	0.3	2015-2024	$12.9	Adams
Picadilly Rd.		I-70 to Smith Rd.	Widen from 2 to 6 Lanes	0.5	2015-2024	$5.3	Adams
Picadilly Rd.		Smith Rd. to 48th Ave.	Widen from 2 to 6 Lanes	2.2	2015-2024	$22.5	Adams
Picadilly Rd.		96th Ave. to 120th Ave.	New 6 Lanes	3.0	2025-2034	$49.0	Adams
Picadilly Rd.		6th Ave. to Colfax Ave.	Widen from 2 to 6 Lanes	1.6	2015-2024	$10.0	Arapahoe
Picadilly Rd.		Jewell Ave. to 6th Pkwy.	New 4 Lanes	2.7	2015-2024	$18.1	Arapahoe
Picadilly Rd.		70th Ave. to 82nd Ave.	New 6 Lanes	1.5	2015-2024	$11.4	Denver
Plum Creek Pkwy.		Gilbert St. to Ridge Rd.	Widen from 2 to 4 Lanes	1.5	2015-2024	$5.1	Douglas
Powhaton Rd.		Smoky Hill Rd. to County Line Rd.	Widen from 2 to 6 Lanes	1.0	2025-2034	$3.5	Arapahoe
Quail Run Rd.		I-70 to 48th Ave.	New 6 Lanes	3.0	2025-2034	$36.4	Adams
Quebec St.		120th Ave. to 128th Ave.	Widen from 2 to 4 Lanes	1.0	2015-2024	$8.4	Adams
Quebec St.		132nd Ave. to 160th Ave.	Widen from 2 to 4 Lanes	3.5	2015-2024	$21.0	Adams
Quincy Ave.		Plains Pkwy. to Gun Club Rd.	Widen from 2 to 6 Lanes	0.6	2015-2024	$13.3	Arapahoe
Quincy Ave.		Hayesmount Rd. to Watkins Rd.	Widen from 2 to 6 Lanes	2.0	2025-2034	$16.0	Arapahoe
Quincy Ave.		Monaghan Rd. to Hayesmount Rd.	Widen from 2 to 6 Lanes	1.1	2025-2034	$18.9	Arapahoe
Quincy Ave.		C-470 to Simms St.	Widen from 2 to 4 Lanes	1.9	2015-2024	$8.0	Jefferson
Quincy Ave.		Simms St. to Kipling Pkwy.	Widen from 2 to 4 Lanes	1.0	2015-2024	$12.0	Jefferson
Quincy Ave.		Irving St. to Federal Blvd.	New 2 Lanes	0.3	2015-2024	$3.8	Arapahoe
Rampart Range Rd.		Waterton Rd. to Titan Rd.	Widen from 2 to 4 Lanes	1.5	2025-2034	$10.2	Douglas
Ridge Rd.		Plum Creek Pkwy. to SH-86	Widen from 2 to 4 Lanes	1.1	2015-2024	$3.8	Douglas
S. Boulder Rd./160th Ave.		120th St. to Boulder/Broomfield County Line	New 2 Lanes	1.2	2025-2034	$10.2	Boulder
SH-7	SH-7	Riverdale Rd. to US-85	Widen from 2 to 4 Lanes	1.1	2025-2034	$16.3	Adams
SH-7	SH-7	Boulder County Line to Sheridan Pkwy.	Widen from 2 to 4 Lanes	2.5	2015-2024	$6.6	Broomfield
SH-7	SH-7	Sheridan Pkwy. to I-25	Widen from 2 to 6 Lanes	1.5	2015-2024	$10.2	Broomfield
SH-58	SH-58	Cabela St.	Add New Interchange		2015-2024	$19.6	Jefferson
Sheridan Blvd.		Lowell Blvd. to NW Pkwy.	Widen from 2 to 4 Lanes	1.1	2015-2024	$7.6	Broomfield
Sheridan Pkwy.		NW Pkwy. to SH-7	Widen from 2 to 4 Lanes	1.3	2015-2024	$5.7	Broomfield
Smoky Hill Rd.		Pheasant Run Pkwy. to Versailles Pkwy.	Widen from 4 to 6 Lanes	4.4	2025-2034	$33.9	Arapahoe
Southwest Ring Rd.		Wolfensberger Rd. to I-25	Widen from 2 to 4 Lanes	1.4	2015-2024	$5.1	Douglas
Stroh Rd.		Crowfoot Valley Rd. to J. Morgan Blvd.	Widen from 2 to 4 Lanes	0.5	2015-2024	$6.4	Douglas
Stroh Rd.		Chambers Rd. to Crowfoot Valley Rd.	New 4 Lanes	1.4	2015-2024	$10.6	Douglas
Thornton Pkwy.		Colorado Blvd. to Riverdale Rd.	Widen from 2 to 4 Lanes	0.5	2025-2034	$14.0	Adams
Titan Rd.		Rampart Range Rd. to Santa Fe Dr.	Widen from 2 to 4 Lanes	3.0	2025-2034	$38.1	Douglas
Tower Rd.		Colfax Ave. to Smith Rd.	Widen from 2 to 6 Lanes	1.0	2015-2024	$8.7	Adams
Tower Rd.		Pena Blvd. to 104th Ave.	Widen from 2 to 6 Lanes	3.8	2015-2024	$40.5	Adams
Tower Rd.		Pena Blvd. to 104th Ave.	Widen from 4 to 6 Lanes	3.8	2025-2034	$20.0	Adams
Tower Rd.		6th Ave. to Colfax Ave.	New 2 Lanes	1.0	2015-2024	$9.5	Arapahoe
Tower Rd.		6th Ave. to Colfax Ave.	Widen from 2 to 6 Lanes	1.0	2025-2034	$16.3	Arapahoe
Tower Rd.		38th/40th Ave. to Green Valley Ranch Blvd.	Widen from 2/4 to 6 Lanes	1.0	2015-2024	$26.7	Denver
Tower Rd.		56th Ave. to Pena Blvd.	Widen from 4 to 6 Lanes	2.4	2015-2024	$16.0	Denver
Tower Rd.		48th Ave. to 56th Ave.	Widen from 4 to 6 Lanes	1.0	2015-2024	$5.3	Denver
Tower/Buckley Rd.		105th Ave. to 118th Ave.	New 4 Lanes	2.0	2015-2024	$8.8	Adams
US-85	US-85	Titan Rd. to Highland Ranch Pkwy.	Widen from 4 to 6 Lanes	2.2	2025-2034	$5.9	Douglas

Appendix A - 2040 Fiscally Constrained Regional Transportation Plan
Fiscally Constrained Roadway & Rapid Transit Capacity Improvements
Remaining Project Cost Allocations (FY 2016 - 2040)

Roadway	CDOT Road	Project Location (Limits)	Improvement Type	Length (Miles)	Air Quality Network Staging	Remaining Project Cost (FY '15 $millions)	County
US-85	US-85	Castlegate Dr.	Add New Interchange		2015-2024	$31.8	Douglas
Washington St.		144th Ave. to 152nd Ave.	Widen from 2 to 4 Lanes	0.7	2015-2024	$12.0	Adams
Washington St.		52nd Ave. to 58th Ave.	Widen from 2 to 4 Lanes	0.8	2015-2024	$4.4	Adams
Washington St.		152nd Ave. to 160th Ave.	Widen from 2 to 4 Lanes	1.4	2015-2024	$24.8	Adams
Washington St.		Elk Pl. to 52nd Ave.	Widen from 2 to 4 Lanes	0.6	2015-2024	$13.3	Denver
Waterton Rd.		Dante Dr. to Campfire St.	Widen from 2 to 4 Lanes	1.0	2025-2034	$3.8	Douglas
Watkins Rd.		Quincy Ave. to I-70	Widen from 2 to 6 Lanes	7.1	2025-2034	$54.7	Arapahoe
Wolfensberger Rd.		Coachline Rd. to Prairie Hawk Dr.	Widen from 2 to 4 Lanes	1.0	2025-2034	$7.5	Douglas
Yale Ave.		Monaghan Rd. to Hayesmount Rd.	Widen from 2 to 6 Lanes	1.1	2025-2034	$17.3	Arapahoe
York St.		152nd Ave. to E-470	Widen from 2 to 4 Lanes	0.2	2025-2034	$2.0	Adams
York St.		160th Ave. (SH-7) to 168th Ave.	Widen from 2 to 4 Lanes	1.0	2015-2024	$7.5	Adams
York St.		E-470 to SH-7	Widen from 2 to 4 Lanes	0.7	2015-2024	$10.7	Adams
					Subtotal:	**$3,298.0**	
					Grand Total for Regional Roadway System Projects:	**$6,291.9**	

B. Regional Transit Projects

FasTracks Components							
Eagle Project						$1,033.2	
East Rail Line		DUS to DIA	Commuter Rail	22.8	2015-2024		Adams/Denver
Gold Line		DUS to Ward Rd.	Commuter Rail	11.2	2015-2024		Multiple
Northwest Rail Phase 1		DUS to 71st/Lowell Blvd.	Commuter Rail	6.2	2015-2024		Adams/Denver
I-225 Rail Line		Parker Rd. to East Rail Line	Light Rail	10.5	2015-2024	$476.9	Adams/Arapahoe
North Metro Commuter Rail		DUS to 124th Ave.	Commuter Rail	13.0	2015-2024	$606.8	Adams/Denver
Southeast Rail Extension		Lincoln Ave. to Ridgegate Pkwy.	Light Rail	2.3	2015-2024	$205.9	Douglas
US-36 Bus Rapid Transit		DUS to Table Mesa	Bus Rapid Transit	18.0	2015-2024	$78.9	Multiple
Other FasTracks Projects						$99.4	
Other Regional Transit							
Colfax Ave.	US-40	7th St. to Potomac St.	Bus Rapid Transit	10.5	2015-2024	$115.0	Adams/Denver
SH-119	SH-119	Foothills Pkwy to US-287	Bus Rapid Transit	11.0	2015-2024	$57.0	Boulder
					Total of Regional Transit Projects	**$2,673.1**	

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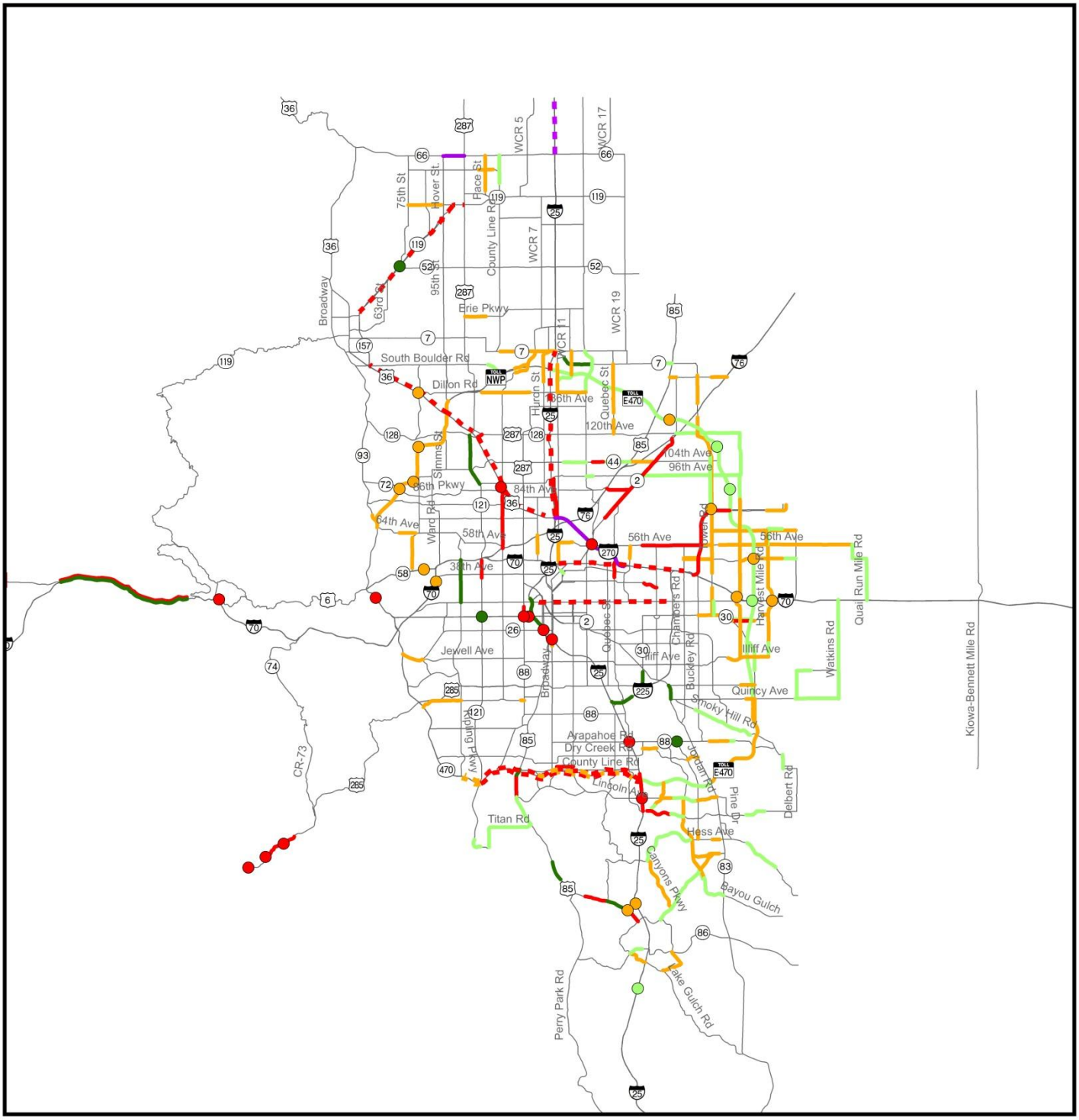
Figure 3
Staging of Fiscally Constrained Roadway Projects

2040 Regional Transportation Plan



LEGEND

	2015-2024		2025-2034		2035-2040	
	Local $	Regional $	Local $	Regional $	Local $	Regional $
Roadway Segment						
Managed Lanes (HOT)						
New or Improved Interchange						

Regional Roadway System
Roads Outside Region

N

0 6 12
Miles

SOURCE DATA:
Enter all data sources here, included base map information

This data is intended for informational purposes only. DRCOG provides this information on an "as is" basis and makes no guarantee, representation or warranty, either express or implied, that the data will be error free. DRCOG further makes no guarantees, representations or warranties, either express or implied, as to the completeness, accuracy or correctness of the data, or as to merchantability or fitness of the data for a particular use or purpose. DRCOG is not responsible to any user for any costs, expenses, liabilities or damages arising from inconsistencies in its data or from any use of the information.

Projection: State Plane Colorado Central, NAD 83 (feet)

PJ 10/28/2015

\Transportation\RTP\2040 MVRTP\Figures\03_Appendix_FigA_Fiscally_Constrained_2040.mxd

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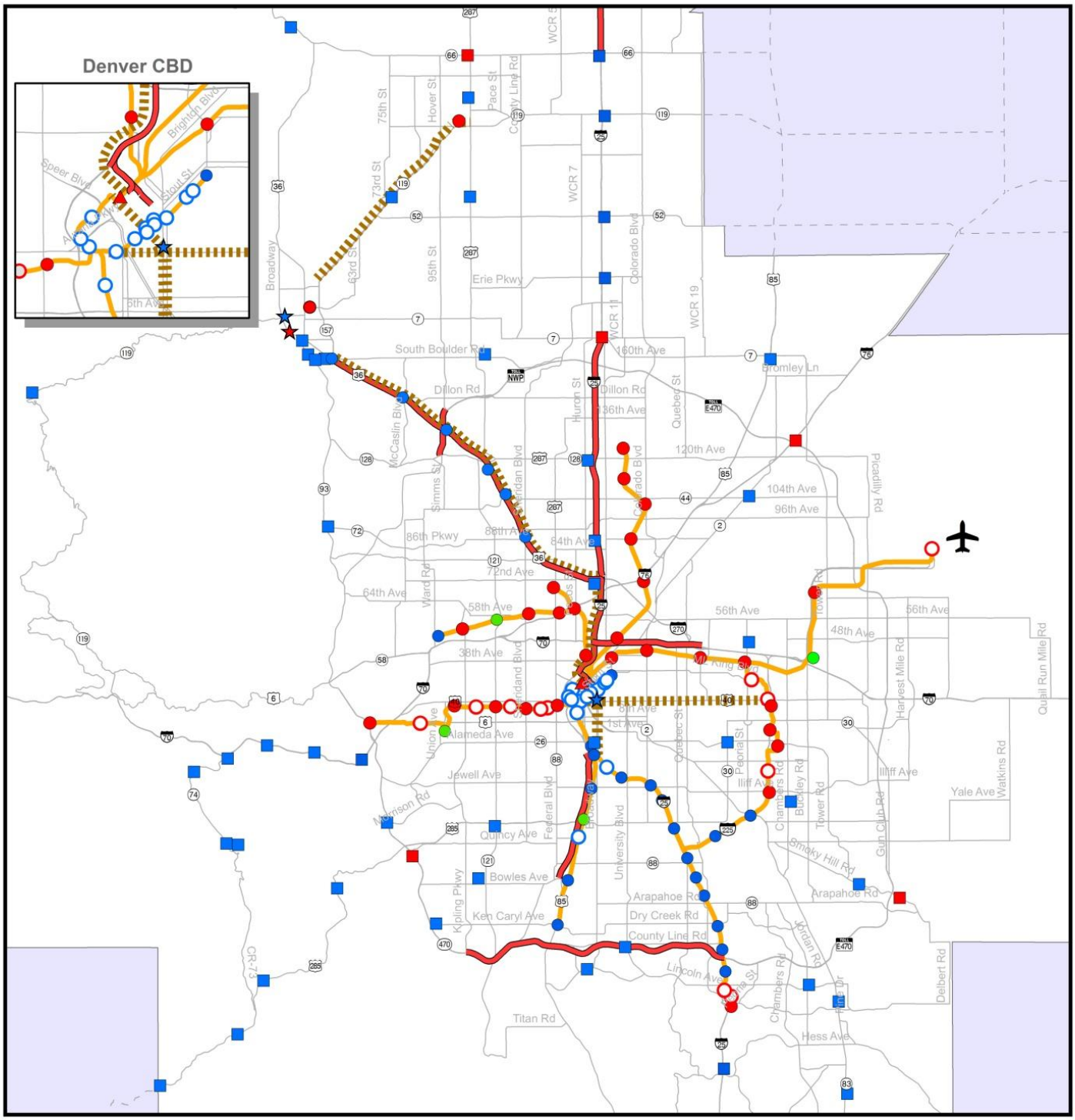
Figure 4
2040 Regional Transportation Plan
Fiscally Constrained Rapid Transit Park-n-Ride & Station Locations



LEGEND

existing	expand	new	
●	●	●	Rapid Transit Station with Parking
○		○	Rapid Transit Station without Parking
■	■	■	Park-n-Ride Lot
		▲	Denver Union Station
★		★	Other Stations/Transit Centers.

Fiscally Constrained Rapid Transit Rail
BRT or Busway
Managed Lanes
Regional Roadway System

N
0 2 4
Miles

SOURCE DATA:
Enter all data sources here, included base map information

This data is intended for informational purposes only. DRCOG provides this information on an "as is" basis and makes no guarantee, representation or warranty, either express or implied, that the data will be error free. DRCOG further makes no guarantees, representations or warranties, either express or implied, as to the completeness, accuracy or correctness of the data, or as to merchantability or fitness of the data for a particular use or purpose. DRCOG is not responsible to any user for any costs, expenses, liabilities or damages arising from inconsistencies in its data or from any use of the information.

Projection: State Plane Colorado Central, NAD 83 (feet)

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APPENDIX B

TRANSPORTATION MODEL CALIBRATION DESCRIPTION

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Introduction

In support of the conformity determination for the 2040 Regional Transportation Plan (RTP), the Denver Regional Council of Governments' (DRCOG) Regional Planning and Operations Division used the Regional UrbanSim Socio-economic Model together with *Focus*, the updated regional travel modeling system. Travel modeling uses mathematical formulations in computer software programs to show how regional development impacts road and transit usage.

The *Focus* model simulates the travel of millions of individual people in the region throughout a typical weekday. The *Focus* model sums all travel to forecast how many vehicles will be driven on major roads; how much congestion there will be; and how many people will walk, bike or use transit. To realistically simulate each person's daily travel, *Focus* and UrbanSim model the many choices each person makes, including:

(1) where to work
(2) where to go to school
(3) how many automobiles are owned by the person's household
(4) how many trips each person makes in a day, and for what reasons
(5) which trips are chained together into home-to-home tours
(6) the address where each trip starts from and goes to
(7) the travel mode for each trip, with choices including walk and biking
(8) which major streets or bus routes were chosen to reach each destination

The models take into account many characteristics of people, such as their age, gender, employment status, and income; and how the region will change demographically over time. It also takes into account characteristics of the built environment such as congestion, density, and walkability.

The *Focus* travel model was initially estimated based on detailed data from a survey called the Travel Behavior Inventory (TBI). The TBI project involved multiple surveys of travel in the Denver metropolitan area, including:

- The Household Survey – a travel diary survey that gathered complete travel information for an assigned day for approximately 5,000 households;
- The Front Range Travel Survey – a survey of vehicles entering and leaving the metropolitan area;

- The Commercial Vehicle Survey – a survey that gathered complete travel information from more than 800 commercial vehicles on an assigned day; and
- The Non-Respondent Populations Project - an effort to evaluate whether those who did not respond to the survey exhibited different travel behavior than people who did respond to the survey.

The bulk of this survey work was conducted in 1997-1998, with data “cleaning” and summary conducted through 2001.

Focus was calibrated using 2005 data sources including roadway counts, transit boardings, American Community Survey data, and Census data.

Since this original work, additional surveys of travel behavior have been conducted, including:

- RTD's 2008 Regional On-Board Transit Survey – a questionnaire handed out to light rail and bus travelers to understand how transit travel patterns have changed since the opening of the Southeast Corridor Light Rail in November 2006. The survey contains information on almost 24,000 transit trips.
- The 2010 Front Range Travel Counts Household Survey – A survey of over 12,000 households along the Colorado Front Range, including 7,000 in the DRCOG region, using a format similar to the 1997 TBI Household Survey described above.

In developing the 2040 RTP this year, the mathematical relationships within the *Focus* model were adjusted to better reflect the travel behavior recorded in these two surveys, including:

- Where people live and work within the region
- Where students attend school
- How many trips of each type different kinds of people make on a typical day
- How far people travel for various kinds of trips
- Preferences about traveling by auto, carpool, transit, biking and walking
- How different types of transit riders trade off different elements of their trip, such as the fare, in-vehicle time, access and egress times, and waiting time

The final outputs of *Focus* were also checked against traffic counts and RTD ridership data to make sure the overall regional travel patterns being forecasted were reasonable.

Demographic Forecasts

DRCOG works with a panel of economists and planners from both the private and public sectors to review current growth trends and evaluate the output of a regional forecasting model. This model relates the regional economy to national economic forecasts. The forecasts are reviewed annually with major revisions expected every five years.

Small Area Development Estimates

To provide development data at a level of detail necessary for the travel model, the regional urban activity forecasts are dis-aggregated into 2,800 transportation analysis zones (TAZs), as shown in Figure 1. The allocation to TAZs 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?
- Where should a firm locate to conduct its business in accordance with zoning regulations, and with suitable access to workers, supplies, and finished product markets?
- Does a family's current house continue to meet its needs and be convenient to jobs, schools, and other activities, or should the family move to a better house?
- What size and types of house does a family need based on the number and ages of its members and its household income?
- What neighborhoods are convenient to work and offer the amenities the family values?

The UrbanSim model includes a population synthesizer that creates a descriptive database record for each household in the region (about one million records in 2010) and each person (about 2.8 million records in 2010). The effects of several regional planning policies also are taken into account in the model: open space plans affect the amount of developable land in the relevant parcels; the regional Urban Growth Boundary/Area affects expected densities, and the development totals in parcels outside that boundary. Figure 2 shows a flowchart for the process of socioeconomic forecasting in the Denver region.

Figure 1
DRCOG Travel Analysis Zones

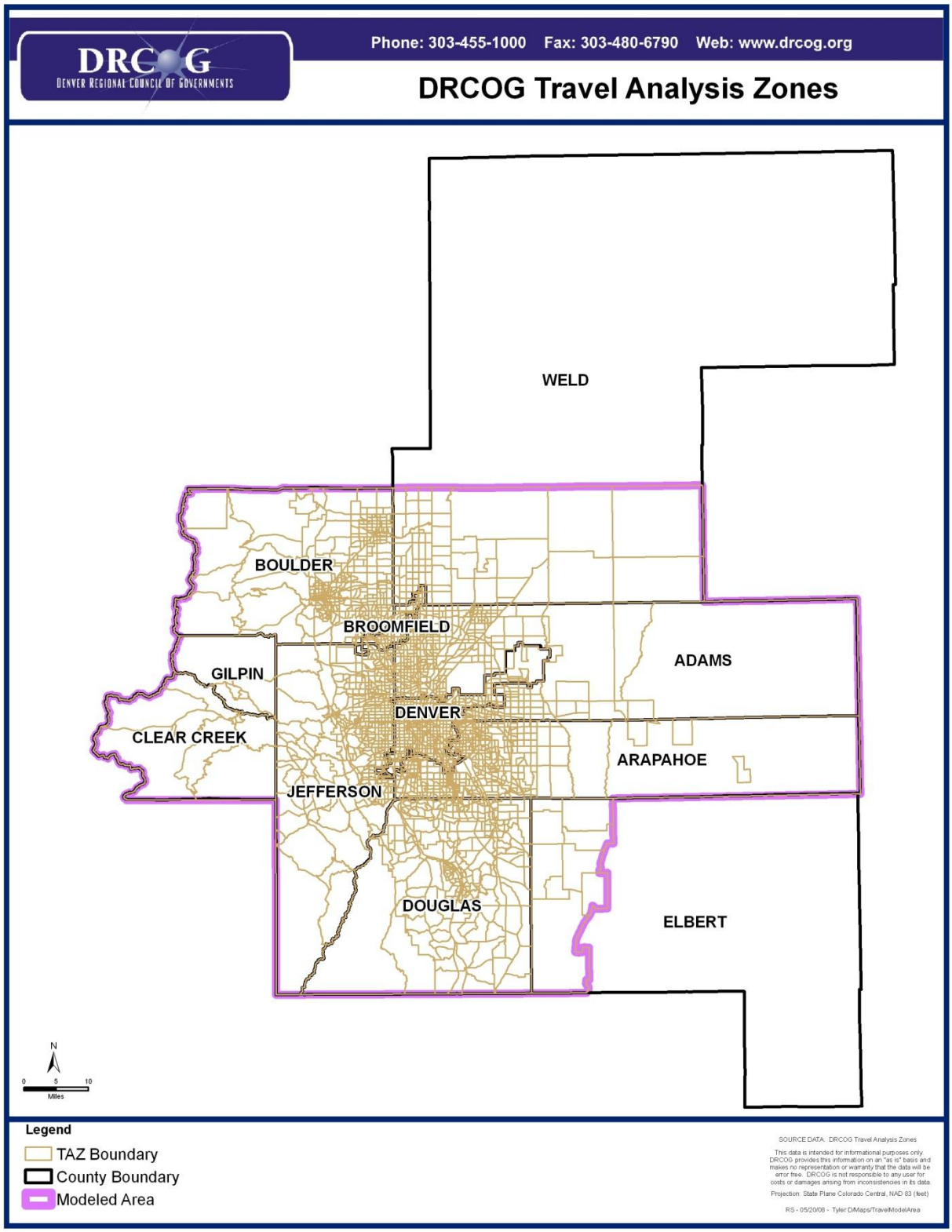


Figure 2
Socioeconomic Model Elements and Flow

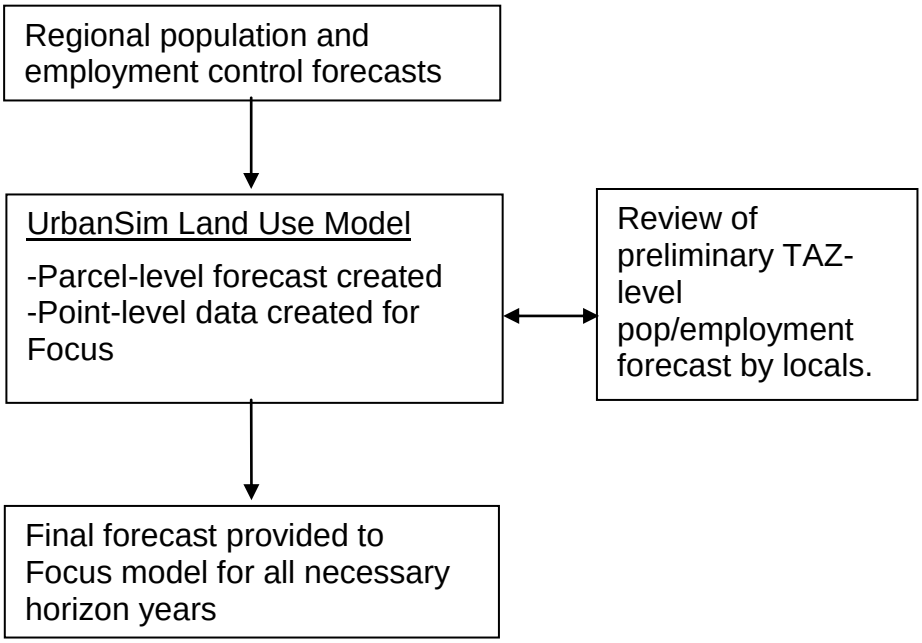
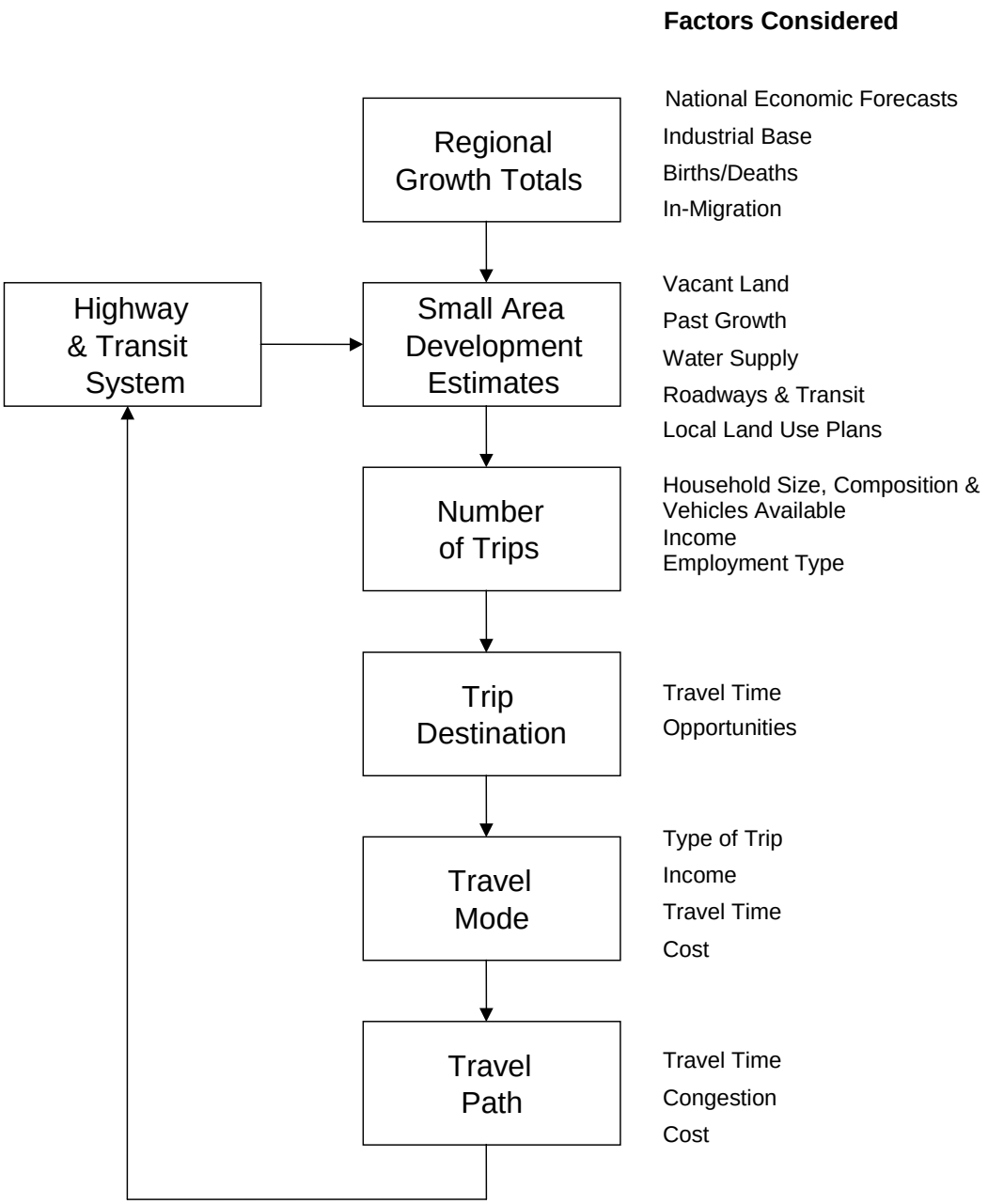


Figure 3
Travel Model Elements and Flow



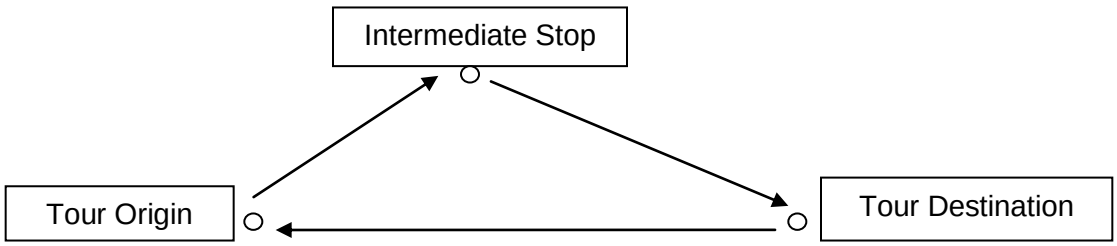
Focus Model Process Overview

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 mode and time of day. Tours are the first travel elements to be created, considering the travel times and costs. Figure 4 shows a diagram to explain how tours are related to trips. This example diagram has one tour composed of three trips (shown as individual arrows), and one intermediate stop.

The model then 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.

Figure 4
Tour Diagram



Highway and Transit System

One of the most significant inputs to all travel model components is the transportation network representation. The highway 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 (HOV) lanes also are represented as special links. Tollway links are assessed an additional 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, and walk access/egress routes. Bus routes follow the same highway network as auto trips, and bus speeds are based on auto speeds. 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 highway and transit use, minimum impedance paths are

calculated using time, distance and toll cost over the highway and HOV system, and time and cost over the transit system.

Model Components

The most important model components are briefly described in the sections below, and Table 1 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.

Table 1. Focus Model Components

1. TransCAD Initialization	14. Tour Time of Day Simulation
2. Size Sum Variable Calculator	15. Tour Primary Destination Choice
3. TransCAD Trip Generation	16. Tour Priority Assignment
4. TransCAD Skimming (Path Selection)	17. Tour Main Mode Choice
5. TransCAD Airport, Commercial Vehicle, and External Travel Distribution and Mode Choice	18. Tour Time of Day Choice
6. Regular Workplace Location	19. Intermediate Stop Generation Choice
7. Regular School Location	20. Trip Time of Day Simulation
8. Auto Availability	21. Intermediate Stop Location Choice
9. Aggregate Destination Choice Logsum Generation	22. Trip Mode Choice
10. Daily Activity Pattern	23. Trip Time of Day
11. Exact Number of Tours	24. Write Trips To TransCAD
12. Work Tour Destination Type	25. TransCAD Highway and Transit Assignment
13. Work-Based Subtour Generation	

Highway and Transit Skims (Path Selection)

The highway and transit paths are chosen for all origin-destination zone pairs and times-of-day by finding the most convenient paths that balance the travel time, travel cost, and other considerations. 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 Trips

After optimal paths are identified, the Compass 4.0 model components must be run for airport trips, internal-external trips, commercial vehicle trips, and external-external trips. The entire Compass model must be run to generate and assign these trips.

Regular Workplace and School Location

The work location choice model takes all regional workers and assigns them a regular work location zone and point. Characteristics of the worker and their home zone are used in combination with zonal characteristics to determine the desirability of any zone.

Similarly to the regular work location choice model, the regular school location choice model assigns each student a regular school location zone and school. The model uses information about the student, such as income and age, and information on school enrollment and distance from home to school to determine which schools will be attractive for which 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 that the decision-making of school location for different grade ranges has significantly different characteristics. The models are all multinomial logit with the choice being the location of the school zone.

Auto Availability Choice

The auto availability choice model is a multinomial logit model that selects number of automobiles available for each household in the region. The choices range from no cars to 4+ cars. The model uses information about households and their accessibility to work and school to determine how many autos are available to households.

Tour Models

After *Focus* has projected the long-term decisions about work and school location and auto ownership, it forecasts daily activities on a tour-level.

The ***day 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 exactly 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 model outputs this number of tours by purpose into the tours table in the database.

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. Such a person may be eating out or running errands during his or her lunch break. She or he might also be attending meetings with colleagues in related firms, or with government regulators, for example. 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, 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 biking 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 trip mode on all trips. The tour mode has already been found by the tour mode choice model, and this knowledge is used in combination with skim data, zonal data, and person data to find the trip modes 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 (drive alone, shared ride 2, shared ride 3+, walk to transit, drive to transit, walk, bike, school bus)
- Trip Time of Day (one of 24 hours)
- Which tour the trip is part of
- What person made the trip
- What household the person who made the trip belongs

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

Network Assignment

Automobile trips are assigned to the highway network via a “user equilibrium” algorithm, after commercial trips have been loaded first using an “all-or-nothing process.” The all-or-nothing process simply assigns trips to the shortest path between origin and destination, ignoring possible congestion effects that might cause trips to take different paths. The user equilibrium process assigns the trips between each origin and each destination TAZ in such a way that, at the end of the process, no trip can reduce its travel time by changing its path. In other words, taking into account the congestion produced by all other trips in the region, each trip is following its minimum path. High-occupancy vehicles (HOV) are loaded simultaneously with single-occupant vehicles (SOV). During this process, TransCAD keeps track of which vehicles are eligible to use HOV facilities, and which might need to pay a toll to use High-Occupancy/Toll (HOT) lanes, such as the reversible I-25 Express Lanes north of downtown Denver. The model also takes into account 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 take into account the possibility that high demand on some transit routes may motivate some riders to shift routes, or that other riders may not be able to board when a train or bus is full. RTD has

special modeling tools that allow them to use *Focus* model forecasts for more detailed operational planning.

Finally, the model is run several times, feeding back the output speeds from highway 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.

Model Calibration

In developing the 2040 RTP, each *Focus* model component was calibrated using 2010 inputs and comparing the resulting "forecast" to 2010 external data sources such as roadway counts and RTD transit boardings, both individually and from a region-wide perspective.

When the *Focus* model was initially developed, external data from 2005 was used wherever possible to ensure that the model was correctly capturing observed 2005 Denver travel behavior when 2005 inputs were used in the model. The following 2005 datasets were used to calibrate against:

- 2005 American Community Survey (ACS)
- 2005 Colorado state demographer data
- 2005 Colorado Department of Transportation (CDOT) highway counts
- 2005 HPMS estimated regional VMT
- 2005 Regional Transportation District (RTD) transit boardings and 2005 Compass trip-based model results

In the spring of 2012, and again in fall of 2014, the model was again calibrated, these times using observations of highway volume and transit boardings from 2010.

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 calibration are shown in Table 2 and Table 3. These tables demonstrate that the aggregate model results match the observed counts and transit boardings sufficiently well. When summed over the region, the links with counts were observed to carry about 28.0 million vehicles per weekday, while Focus is showing 0.2 million additional vehicles, or less than a one percent difference.

Table 2. Sum of Observed Counts & Modeled Volumes on (Non-Tollway) Links with Counts

Sum of Observed Counts	Sum of Modeled Counts
27,966,475	28,200,000

Table 3. Observed and Modeled Transit Boardings

Observed Transit Boardings	Modeled Transit Boardings
317,645	355,000

Air Quality Modeling

Formal air pollutant emissions modeling is conducted by the APCD. However, DRCOG, the APCD, and other agencies work closely together in this effort, both in developing the modeling techniques, assumptions, and parameters, and in executing the model runs. Travel model results are, of course, one of the principal inputs to the air pollutant emissions model. The model produces estimates of the amount of emissions of carbon monoxide (CO), volatile organic compounds (VOCs), oxides of nitrogen (NOx), and particulate matter (PM10) 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

PM10 STREET EMISSIONS REDUCTION COMMITMENTS

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2040 Regional Transportation Plan Conformity
PM10 Emission Reduction Commitments

Adams County

PM10 Emission Reduction Conformity Commitments

Geographic Area of Commitment	For Staging Years	Emission Reduction Commitment
General PM10 Modeling Domain	2015	61.4 %
	2025	61.4 %
	2035	61.4 %
	2040	61.4 %

It is our intention to pursue the above percentages of PM10 emission reductions compared to the 1989 baseline as goals for the years noted.

Name

6-10-14
Date

Chair
Title

Signature needed from Chairman, County Board of Commissioners, Mayor/City Manager of Municipality, or Agency Executive Director.

APPROVED AS TO FORM
COUNTY ATTORNEY

2040 Regional Transportation Plan Conformity
PM10 Emission Reduction Commitments

Arapahoe County

PM10 Emission Reduction Conformity Commitments

Geographic Area of Commitment	For Staging Years	Emission Reduction Commitment
General PM10 Modeling Domain	2015	55 %
	2025	55 %
	2035	55 %
	2040	55 %

It is our intention to pursue the above percentages of PM10 emission reductions compared to the 1989 baseline as goals for the years noted.

Name

April 24/14
Date

Director of Public Works
Title

Signature needed from Chairman, County Board of Commissioners, Mayor/City Manager of Municipality, or Agency Executive Director.

2040 Regional Transportation Plan Conformity
PM10 Emission Reduction Commitments

City of Arvada

PM10 Emission Reduction Conformity Commitments

Geographic Area of Commitment	For Staging Years	Emission Reduction Commitment
General PM10 Modeling Domain	2015	71.5 %
	2025	71.5 %
	2035	71.5 %
	2040	71.5 %

It is our intention to pursue the above percentages of PM10 emission reductions compared to the 1989 baseline as goals for the years noted.

Name: Mark G. Deven

Date: 4-21-14

Title: City Manager

City Manager

Signature needed from Chairman, County Board of Commissioners, Mayor/City Manager of Municipality, or Agency Executive Director.

2040 Regional Transportation Plan Conformity
PM10 Emission Reduction Commitments

City of Aurora

PM10 Emission Reduction Conformity Commitments

Geographic Area of Commitment	For Staging Years	Emission Reduction Commitment
General PM10 Modeling Domain	2015	45 %
	2025	45 %
	2035	45 %
	2040	45 %

It is our intention to pursue the above percentages of PM10 emission reductions compared to the 1989 baseline as goals for the years noted.

Name G. Noe

Date 5/1/14

City Manager

Title

Signature needed from Chairman, County Board of Commissioners, Mayor/City Manager of Municipality, or Agency Executive Director.

2040 Regional Transportation Plan Conformity
PM10 Emission Reduction Commitments

City of Boulder

PM10 Emission Reduction Conformity Commitments

Geographic Area of Commitment	For Staging Years	Emission Reduction Commitment
General PM10 Modeling Domain	2015	70 %
	2025	70 %
	2035	70 %
	2040	70 %

It is our intention to pursue the above percentages of PM10 emission reductions compared to the 1989 baseline as goals for the years noted.

Jane S Brautigam
Name

5/16/14
Date

City Manager, City of Boulder
Title

Signature needed from Chairman, County Board of Commissioners, Mayor/City Manager of Municipality, or Agency Executive Director.

2040 Regional Transportation Plan Conformity
PM10 Emission Reduction Commitments

Boulder County

PM10 Emission Reduction Conformity Commitments

Geographic Area of Commitment	For Staging Years	Emission Reduction Commitment
General PM10 Modeling Domain	2015	31 %
	2025	31 %
	2035	31 %
	2040	31 %

It is our intention to pursue the above percentages of PM10 emission reductions compared to the 1989 baseline as goals for the years noted.

DocuSigned by:
6E741196D6C0495...

Name

May 20, 2014
Date

Vice-Chair, Board of County Commissioners
Title

Signature needed from Chairman, County Board of Commissioners, Mayor/City Manager of Municipality, or Agency Executive Director.

2040 Regional Transportation Plan Conformity
PM10 Emission Reduction Commitments

City of Brighton

PM10 Emission Reduction Conformity Commitments

Geographic Area of Commitment	For Staging Years	Emission Reduction Commitment
General PM10 Modeling Domain	2015	55 %
	2025	55 %
	2035	55 %
	2040	55 %

It is our intention to pursue the above percentages of PM10 emission reductions compared to the 1989 baseline as goals for the years noted.

Name

5-8-14

Date

Brighton City Manager

Title

Signature needed from Chairman, County Board of Commissioners, Mayor/City Manager of Municipality, or Agency Executive Director.

2040 Regional Transportation Plan Conformity
PM10 Emission Reduction Commitments

City and County of Broomfield

PM10 Emission Reduction Conformity Commitments

Geographic **Area of Commitment**	**For Staging Years**	**Emission Reduction Commitment**
General PM10 Modeling Domain	2015	68.2 %
	2025	68.2 %
	2035	68.2 %
	2040	68.2 %

It is our intention to pursue the above percentages of PM10 emission reductions compared to the 1989 baseline as goals for the years noted.

Name

6/11/14
Date

City & County Manager
Title

Signature needed from Chairman, County Board of Commissioners, Mayor/City Manager of Municipality, or Agency Executive Director.

2040 Regional Transportation Plan Conformity
PM10 Emission Reduction Commitments

Castle Rock

PM10 Emission Reduction Conformity Commitments

Geographic Area of Commitment	For Staging Years	Emission Reduction Commitment
PM10 Attainment/Maintenance Area	2015	58.5 %
	2025	58.5 %
	2035	58.5 %
	2040	58.5 %

It is our intention to pursue the above percentages of PM10 emission reductions compared to the 1989 baseline as goals for the years noted.

Mark Stevens
Name

4/24/14
Date

TOWN MANAGER
Title

Signature needed from Chairman, County Board of Commissioners, Mayor/City Manager of Municipality, or Agency Executive Director.

DRCOG
JUN 1 2014
RECEIVED

2040 Regional Transportation Plan Conformity
PM10 Emission Reduction Commitments

City of Centennial

PM10 Emission Reduction Conformity Commitments

Geographic Area of Commitment	For Staging Years	Emission Reduction Commitment
General PM10 Modeling Domain	2015	30 %
	2025	30 %
	2035	30 %
	2040	30 %

It is our intention to pursue the above percentages of PM10 emission reductions compared to the 1989 baseline as goals for the years noted.

Name John Danielson

Title City Manager

5/28/14
Date

Signature needed from Chairman, County Board of Commissioners, Mayor/City Manager of Municipality, or Agency Executive Director.

City of Commerce City

PM10 Emission Reduction Conformity Commitments

Geographic Area of Commitment	For Staging Years	Emission Reduction Commitment
General PM10 Modeling Domain	2015	45 %
	2025	45 %
	2035	45 %
	2040	45 %

It is our intention to pursue the above percentages of PM10 emission reductions compared to the 1989 baseline as goals for the years noted.

Brik McBroom
Name

6.16.14
Date

City Manager
Title

Signature needed from Chairman, County Board of Commissioners, Mayor/City Manager of Municipality, or Agency Executive Director.

2040 Regional Transportation Plan Conformity
PM10 Emission Reduction Commitments

City of Cherry Hills Village

PM10 Emission Reduction Conformity Commitments

Geographic Area of Commitment	For Staging Years	Emission Reduction Commitment
General PM10 Modeling Domain	2015	55 %
	2025	55 %
	2035	55 %
	2040	55 %

It is our intention to pursue the above percentages of PM10 emission reductions compared to the 1989 ~~baseline~~ as goals for the years noted.

Name

05/14/14
Date

CITY MANAGER
Title

Signature needed from Chairman, County Board of Commissioners, Mayor/City Manager of Municipality, or Agency Executive Director.

2040 Regional Transportation Plan Conformity
PM10 Emission Reduction Commitments

Colorado Dept. of Transportation, Region 1
HOT lanes and future toll lanes with CDOT oversight

PM10 Emission Reduction Conformity Commitments

Geographic Area of Commitment	For Staging Years	Emission Reduction Commitment
Sweep Box	2015	75 %
	2025	75 %
	2035	75 %
	2040	75 %
General PM10 Modeling Domain	2015	75 %
	2025	75 %
	2035	75 %
	2040	75 %

It is our intention to pursue the above percentages of PM10 emission reductions compared to the 1989 baseline as goals for the years noted.

Name: [signature] Date: 6-12-14

Title: Region One Transportation Director

Signature needed from Chairman, County Board of Commissioners, Mayor/City Manager of Municipality, or Agency Executive Director.

2040 Regional Transportation Plan Conformity
PM10 Emission Reduction Commitments

Colorado Dept. of Transportation, Region 4

PM10 Emission Reduction Conformity Commitments

Geographic Area of Commitment	For Staging Years	Emission Reduction Commitment
General PM10 Modeling Domain	2015	55 %
	2025	55 %
	2035	55 %
	2040	55 %

It is our intention to pursue the above percentages of PM10 emission reductions compared to the 1989 baseline as goals for the years noted.

Eddie Gentry
Name

5/12/14
Date

LTC OPs I
Title

Signature needed from Chairman, County Board of Commissioners, Mayor/City Manager of Municipality, or Agency Executive Director.

DRCOG
DENVER REGIONAL COUNCIL OF GOVERNMENTS

April 10, 2014

Ms. Ann Jennings
Town Administrator/Clerk
Columbine Valley
2 Middlefield Road
Columbine Valley, CO 80123

Dear Ms. Jennings:

The Denver Regional Council of Governments (DRCOG) is preparing to demonstrate to the US Environmental Protection Agency (EPA) that the new *2040 Regional Transportation Plan* (RTP) and associated *2016-2021 Transportation Improvement Program* (TIP) are in conformity with the Colorado air quality program. A positive conformity finding permits road and transit capacity projects contained in the new *2040 RTP* and *2016-2021 TIP* to be constructed. Critical to achieving a positive conformity finding is meeting the 2040 fine particulate matter (PM_{10}) emission budget of 55 tons per day for mobile sources.

In order to continue to meet the PM_{10} budget, DRCOG is once again asking local governments and state agencies to commit to road sand reductions and street sweeping actions (compared to the 1989 baseline practices). It is through these commitments DRCOG has been able to demonstrate that the PM_{10} air quality standard will not be violated in the future.

Please indicate below which agency conducts winter maintenance (street sanding & sweeping) for Town of Columbine Valley:

☐ Option I. Conducted by Town of Columbine Valley or contractor(s) hired by Town of Columbine Valley

☒ Option II. Conducted by another agency (e.g. the county or CDOT) or its contractor(s)

Please specify this agency CITY OF LITTLETON

If the answer is Option I, **DRCOG is asking you to make PM_{10} emission reduction commitment using the enclosed *PM_{10} Emission Reduction Commitment* form.** This provides an opportunity for Town of Columbine Valley to demonstrate its willingness to assist the region in meeting air quality requirements.

2040 Regional Transportation Plan Conformity
PM10 Emission Reduction Commitments

City and County of Denver

PM10 Emission Reduction Conformity Commitments

Geographic Area of Commitment	For Staging Years	Emission Reduction Commitment
Sweep Box	2015	68 %
	2025	68 %
	2035	68 %
	2040	68 %
Denver CBD	2015	72 %
	2025	72 %
	2035	72 %
	2040	72 %
General PM10 Modeling Domain	2015	60 %
	2025	60 %
	2035	60 %
	2040	60 %

It is our intention to pursue the above percentages of PM10 emission reductions compared to the 1989 baseline as goals for the years noted.

JOSE M. CORNEJO
Name

6/19/14
Date

EXECUTIVE DIRECTOR PUBLIC WORKS
Title

J. M. Cornejo
Signature needed from Chairman, County Board of Commissioners, Mayor/City Manager of Municipality, or Agency Executive Director.

2040 Regional Transportation Plan Conformity
PM10 Emission Reduction Commitments

Douglas County

PM10 Emission Reduction Conformity Commitments

Geographic Area of Commitment	For Staging Years	Emission Reduction Commitment
General PM10 Modeling Domain	2015	55 %
	2025	55 %
	2035	55 %
	2040	55 %

It is our intention to pursue the above percentages of PM10 emission reductions compared to the 1989 baseline as goals for the years noted.

Name

5/2/14
Date

County Manager
Title

Signature needed from Chairman, County Board of Commissioners, Mayor/City Manager of Municipality, or Agency Executive Director.

2040 Regional Transportation Plan Conformity
PM10 Emission Reduction Commitments

E-470 Public Highway Authority

PM10 Emission Reduction Conformity Commitments

Geographic Area of Commitment	For Staging Years	Emission Reduction Commitment
General PM10 Modeling Domain	2015	45 %
	2025	45 %
	2035	45 %
	2040	45 %

It is our intention to pursue the above percentages of PM10 emission reductions compared to the 1989 baseline as goals for the years noted.

Name

Date

Title

Signature needed from Chairman, County Board of Commissioners, Mayor/City Manager of Municipality, or Agency Executive Director.

2035 Regional Transportation Plan Conformity
PM10 Emission Reduction Commitments

City of Edgewater

PM10 Emission Reduction Conformity Commitments

Geographic Area of Commitment	For Staging Years	Emission Reduction Commitment
General PM10 Modeling Domain	2015	60 %
	2020	60 %
	2030	60 %
	2035	60 %

It is our intention to pursue the above percentages of PM10 emission reductions compared to the 1989 baseline as goals for the years noted.

Name

5.19.14
Date

City MGR
Title

Signature needed from Chairman, County Board of Commissioners, Mayor/City Manager of Municipality, or Agency Executive Director.

2040 Regional Transportation Plan Conformity
PM10 Emission Reduction Commitments

City of Englewood

PM10 Emission Reduction Conformity Commitments

Geographic Area of Commitment	For Staging Years	Emission Reduction Commitment
General PM10 Modeling Domain	2015	53.3 %
	2025	53.3 %
	2035	53.3 %
	2040	53.3 %

It is our intention to pursue the above percentages of PM10 emission reductions compared to the 1989 baseline as goals for the years noted.

Name

Title

5/22/14
Date

Signature needed from Chairman, County Board of Commissioners, Mayor/City Manager of Municipality, or Agency Executive Director.

2040 Regional Transportation Plan Conformity
PM10 Emission Reduction Commitments

City of Federal Heights

PM10 Emission Reduction Conformity Commitments

Geographic Area of Commitment	For Staging Years	Emission Reduction Commitment
General PM10 Modeling Domain	2015	40 %
	2025	45 %
	2035	50 %
	2040	55 %

It is our intention to pursue the above percentages of PM10 emission reductions compared to the 1989 baseline as goals for the years noted.

Jacqueline Halbert
Name

4.30.14
Date

City Manager
Title

Signature needed from Chairman, County Board of Commissioners, Mayor/City Manager of Municipality, or Agency Executive Director.

2040 Regional Transportation Plan Conformity
PM10 Emission Reduction Commitments

Town of Foxfield

PM10 Emission Reduction Conformity Commitments

Geographic Area of Commitment	For Staging Years	Emission Reduction Commitment
General PM10 Modeling Domain	2015	64 %
	2025	64 %
	2035	64 %
	2040	64 %

It is our intention to pursue the above percentages of PM10 emission reductions compared to the 1989 baseline as goals for the years noted.

Cheryl Kuechenmeister
Name

6/6/14
Date

Town Administrator
Title

Signature needed from Chairman, County Board of Commissioners, Mayor/City Manager of Municipality, or Agency Executive Director.

2040 Regional Transportation Plan Conformity
PM10 Emission Reduction Commitments

City of Glendale

PM10 Emission Reduction Conformity Commitments

Geographic Area of Commitment	For Staging Years	Emission Reduction Commitment
General PM10 Modeling Domain	2015	55 %
	2025	55 %
	2035	55 %
	2040	55 %

It is our intention to pursue the above percentages of PM10 emission reductions compared to the 1989 baseline as goals for the years noted.

Name

May 1st, 2014
Date

City Manager
Title

Signature needed from Chairman, County Board of Commissioners, Mayor/City Manager of Municipality, or Agency Executive Director.

2040 Regional Transportation Plan Conformity
PM10 Emission Reduction Commitments

City of Greenwood Village

PM10 Emission Reduction Conformity Commitments

Geographic Area of Commitment	For Staging Years	Emission Reduction Commitment
General PM10 Modeling Domain	2015	57 %
	2025	57 %
	2035	57 %
	2040	57 %

It is our intention to pursue the above percentages of PM10 emission reductions compared to the 1989 baseline as goals for the years noted.

Jim Sanders
Name

5/22/14
Date

City Manager
Title

Signature needed from Chairman, County Board of Commissioners, Mayor/City Manager of Municipality, or Agency Executive Director.

2040 Regional Transportation Plan Conformity
PM10 Emission Reduction Commitments

Jefferson County

PM10 Emission Reduction Conformity Commitments

Geographic Area of Commitment	For Staging Years	Emission Reduction Commitment
Foothills	2015	21 %
	2025	21 %
	2035	21 %
	2040	21 %
General PM10 Modeling Domain	2015	41 %
	2025	41 %
	2035	41 %
	2040	41 %

It is our intention to pursue the above percentages of PM10 emission reductions compared to the 1989 baseline as goals for the years noted.

Name

5/14/14
Date

COUNTY ADMINISTRATOR
Title

Signature needed from Chairman, County Board of Commissioners, Mayor/City Manager of Municipality, or Agency Executive Director.

2040 Regional Transportation Plan Conformity
PM10 Emission Reduction Commitments

City of Lafayette

PM10 Emission Reduction Conformity Commitments

Geographic Area of Commitment	For Staging Years	Emission Reduction Commitment
General PM10 Modeling Domain	2015	64 %
	2025	64 %
	2035	64 %
	2040	64 %

It is our intention to pursue the above percentages of PM10 emission reductions compared to the 1989 baseline as goals for the years noted.

Name _____ Date 4/14/14

Title _____

Signature needed from Chairman, County Board of Commissioners, Mayor/City Manager of Municipality, or Agency Executive Director.

2040 Regional Transportation Plan Conformity
PM10 Emission Reduction Commitments

Town of Lakeside

PM10 Emission Reduction Conformity Commitments

Geographic Area of Commitment	For Staging Years	Emission Reduction Commitment
General PM10 Modeling Domain	2015	30 %
	2025	35 %
	2035	45 %
	2040	55 %

It is our intention to pursue the above percentages of PM10 emission reductions compared to the 1989 baseline as goals for the years noted.

Name

4-22-14
Date

MAYOR
Title

Signature needed from Chairman, County Board of Commissioners, Mayor/City Manager of Municipality, or Agency Executive Director.

2040 Regional Transportation Plan Conformity
PM10 Emission Reduction Commitments

City of Lakewood

PM10 Emission Reduction Conformity Commitments

Geographic Area of Commitment	For Staging Years	Emission Reduction Commitment
General PM10 Modeling Domain	2015	45 %
	2025	45 %
	2035	45 %
	2040	45 %

It is our intention to pursue the above percentages of PM10 emission reductions compared to the 1989 baseline as goals for the years noted.

Kathleen E. Hodgson
Name

6/8/14
Date

Lakewood City Manager
Title

Signature needed from Chairman, County Board of Commissioners, Mayor/City Manager of Municipality, or Agency Executive Director.

2040 Regional Transportation Plan Conformity
PM10 Emission Reduction Commitments

City of Littleton

PM10 Emission Reduction Conformity Commitments

Geographic Area of Commitment	For Staging Years	Emission Reduction Commitment
General PM10 Modeling Domain	2015	60 %
	2025	60 %
	2035	60 %
	2040	60 %

It is our intention to pursue the above percentages of PM10 emission reductions compared to the 1989 baseline as goals for the years noted.

Name Michael Penny

4/15/14
Date

City Manager
Title

Signature needed from Chairman, County Board of Commissioners, Mayor/City Manager of Municipality, or Agency Executive Director.

2040 Regional Transportation Plan Conformity
PM10 Emission Reduction Commitments

City of Louisville

PM10 Emission Reduction Conformity Commitments

Geographic Area of Commitment	For Staging Years	Emission Reduction Commitment
General PM10 Modeling Domain	2015	68.3 %
	2025	68.3 %
	2035	68.3 %
	2040	68.3 %

It is our intention to pursue the above percentages of PM10 emission reductions compared to the 1989 baseline as goals for the years noted.

Malcolm Fleming
Name

8/9/14
Date

City Manager
Title

Signature needed from Chairman, County Board of Commissioners, Mayor/City Manager of Municipality, or Agency Executive Director.

2040 Regional Transportation Plan Conformity
PM10 Emission Reduction Commitments

Town of Morrison

PM10 Emission Reduction Conformity Commitments

Geographic Area of Commitment	For Staging Years	Emission Reduction Commitment
General PM10 Modeling Domain	2015	75 %
	2025	75 %
	2035	75 %
	2040	75 %

It is our intention to pursue the above percentages of PM10 emission reductions compared to the 1989 baseline as goals for the years noted.

Name

5-20-14
Date

Mayor
Title

Signature needed from Chairman, County Board of Commissioners, Mayor/City Manager of Municipality, or Agency Executive Director.

2040 Regional Transportation Plan Conformity
PM10 Emission Reduction Commitments

City of Northglenn

PM10 Emission Reduction Conformity Commitments

Geographic Area of Commitment	For Staging Years	Emission Reduction Commitment
General PM10 Modeling Domain	2015	51.6 %
	2025	51.6 %
	2035	51.6 %
	2040	51.6 %

It is our intention to pursue the above percentages of PM10 emission reductions compared to the 1989 baseline as goals for the years noted.

Name

5/22/2014
Date

Director of Public Works
Title

Signature needed from Chairman, County Board of Commissioners, Mayor/City Manager of Municipality, or Agency Executive Director.

2040 Regional Transportation Plan Conformity
PM10 Emission Reduction Commitments

Northwest Parkway Authority

PM10 Emission Reduction Conformity Commitments

Geographic Area of Commitment	For Staging Years	Emission Reduction Commitment
General PM10 Modeling Domain	2015	45 %
	2025	45 %
	2035	45 %
	2040	45 %

It is our intention to pursue the above percentages of PM10 emission reductions compared to the 1989 baseline as goals for the years noted.

Name

5/28/14
Date

CEO
Title

Signature needed from Chairman, County Board of Commissioners, Mayor/City Manager of Municipality, or Agency Executive Director.

2040 Regional Transportation Plan Conformity
PM10 Emission Reduction Commitments

Town of Parker

PM10 Emission Reduction Conformity Commitments

Geographic Area of Commitment	For Staging Years	Emission Reduction Commitment
General PM10 Modeling Domain	2015	60 %
	2025	60 %
	2035	65 %
	2040	65 %

It is our intention to pursue the above percentages of PM10 emission reductions compared to the 1989 baseline as goals for the years noted.

Name

05/14/14
Date

TOWN ADMINISTRATOR
Title

Signature needed from Chairman, County Board of Commissioners, Mayor/City Manager of Municipality, or Agency Executive Director.

2040 Regional Transportation Plan Conformity
PM10 Emission Reduction Commitments

Regional Transportation District

PM10 Emission Reduction Conformity Commitments

Geographic Area of Commitment	For Staging Years	Emission Reduction Commitment
PM10 Attainment/Maintenance Area	2015	56 %
	2025	56 %
	2035	56 %
	2040	56 %

It is our intention to pursue the above percentages of PM10 emission reductions compared to the 1989 baseline as goals for the years noted.

Name Phillip A. Washington

Date 5/27/2014

Title General Manager

Signature needed from Chairman, County Board of Commissioners, Mayor/City Manager of Municipality, or Agency Executive Director.

2040 Regional Transportation Plan Conformity
PM10 Emission Reduction Commitments

City of Sheridan

PM10 Emission Reduction Conformity Commitments

Geographic Area of Commitment	For Staging Years	Emission Reduction Commitment
General PM10 Modeling Domain	2015	40.4 %
	2025	40.4 %
	2035	40.4 %
	2040	40.4 %

It is our intention to pursue the above percentages of PM10 emission reductions compared to the 1989 baseline as goals for the years noted.

Randy Mourning
Name

06/09/2014
Date

Superintendent
Title

Signature needed from Chairman, County Board of Commissioners, Mayor/City Manager of Municipality, or Agency Executive Director.

2040 Regional Transportation Plan Conformity
PM10 Emission Reduction Commitments

Town of Superior

PM10 Emission Reduction Conformity Commitments

Geographic **Area of Commitment**	**For Staging Years**	**Emission Reduction Commitment**
General PM10 Modeling Domain	2015	70 %
	2025	70 %
	2035	70 %
	2040	70 %

It is our intention to pursue the above percentages of PM10 emission reductions compared to the 1989 baseline as goals for the years noted.

Name

4/16/2014
Date

Town Manager
Title

Signature needed from Chairman, County Board of Commissioners, Mayor/City Manager of Municipality, or Agency Executive Director.

2040 Regional Transportation Plan Conformity
PM10 Emission Reduction Commitments

City of Thornton

PM10 Emission Reduction Conformity Commitments

Geographic Area of Commitment	For Staging Years	Emission Reduction Commitment
General PM10 Modeling Domain	2015	60 %
	2025	60 %
	2035	60 %
	2040	60 %

It is our intention to pursue the above percentages of PM10 emission reductions compared to the 1989 baseline as goals for the years noted.

Jayce Hunt
Name

4-23-14
Date

Assistant City Manager
Title

Signature needed from Chairman, County Board of Commissioners, Mayor/City Manager of Municipality, or Agency Executive Director.

2040 Regional Transportation Plan Conformity
PM10 Emission Reduction Commitments

City of Westminster

PM10 Emission Reduction Conformity Commitments

Geographic Area of Commitment	For Staging Years	Emission Reduction Commitment
General PM10 Modeling Domain	2015	35 %
	2025	35 %
	2035	35 %
	2040	35 %

It is our intention to pursue the above percentages of PM10 emission reductions compared to the 1989 baseline as goals for the years noted.

Name _____ 5/21/14
Date

City Manager
Title

2040 Regional Transportation Plan Conformity
PM10 Emission Reduction Commitments

City of Wheat Ridge

PM10 Emission Reduction Conformity Commitments

Geographic Area of Commitment	For Staging Years	Emission Reduction Commitment
General PM10 Modeling Domain	2015	55 %
	2025	55 %
	2035	55 %
	2040	55 %

It is our intention to pursue the above percentages of PM10 emission reductions compared to the 1989 baseline as goals for the years noted.

Name (PATRICK GOFF)

5-28-14
Date

CITY MANAGER
Title

Signature needed from Chairman, County Board of Commissioners, Mayor/City Manager of Municipality, or Agency Executive Director.

APPENDIX D

U.S. DEPARTMENT OF TRANSPORTATION CONFORMITY FINDING

(TO BE PROVIDED)

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APPENDIX E

LIST OF ACRONYMS

ACT	Agency Coordination Team
APCD	Air Pollution Control Division
AQCC	Air Quality Control Commission
BNSFRR	Burlington Northern Santa Fe Railroad
CAMP	Continuous Air Monitoring Project
CDOT	Colorado Department Of Transportation
CMAQ	Congestion Mitigation Air Quality
CO	Carbon Monoxide
DRCOG	Denver Regional Council Of Governments
EPA	United States Environmental Protection Agency
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
HOT	High-Occupancy Toll
HOV	High-Occupancy Vehicle
MPO	Metropolitan Planning Organization
MVRTP	Metro Vision Regional Transportation Plan
NAAQS	National Ambient Air Quality Standards
NO	Nitrogen Oxide
PM	Particulate Matter
Ppm	Parts per Million
RAQC	Regional Air Quality Council
RTD	Regional Transportation District
RTP	Regional Transportation Plan
SIP	State Implementation Plan
TCM	Transportation Control Measures
TDM	Transportation Demand Management
TIP	Transportation Improvement Program
TMA	Transportation Management Area
TMO	Transportation Management Organization
TSSIP	Traffic Signal System Improvement Program
VOC	Volatile Organic Compounds