

**2013 AMENDMENT CYCLE 1**  
**DENVER SOUTHERN SUBAREA 8-HOUR OZONE**  
**CONFORMITY DETERMINATION**

for the  
DRCOG Amended Fiscally Constrained 2035 Regional Transportation Plan and the  
Amended 2012-2017 Transportation Improvement Program

and the  
Southern Subarea Portion of the Upper Front Range 2035 Regional Transportation Plan  
and the 2012-2017 State Transportation Improvement Program for the  
Upper Front Range Transportation Planning Region

Adopted September 18, 2013

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## ABSTRACT

- TITLE:** 2013 Amendment Cycle 1 Denver Southern Subarea 8-Hour Ozone Conformity Determination for the DRCOG Amended Fiscally Constrained 2035 Regional Transportation Plan and the Amended 2012-2017 Transportation Improvement Program and the Southern Subarea Portion of the Upper Front Range 2035 Regional Transportation Plan and the 2012-2017 State Transportation Improvement Program for the Upper Front Range Transportation Planning Region
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# Chapter 1. Introduction

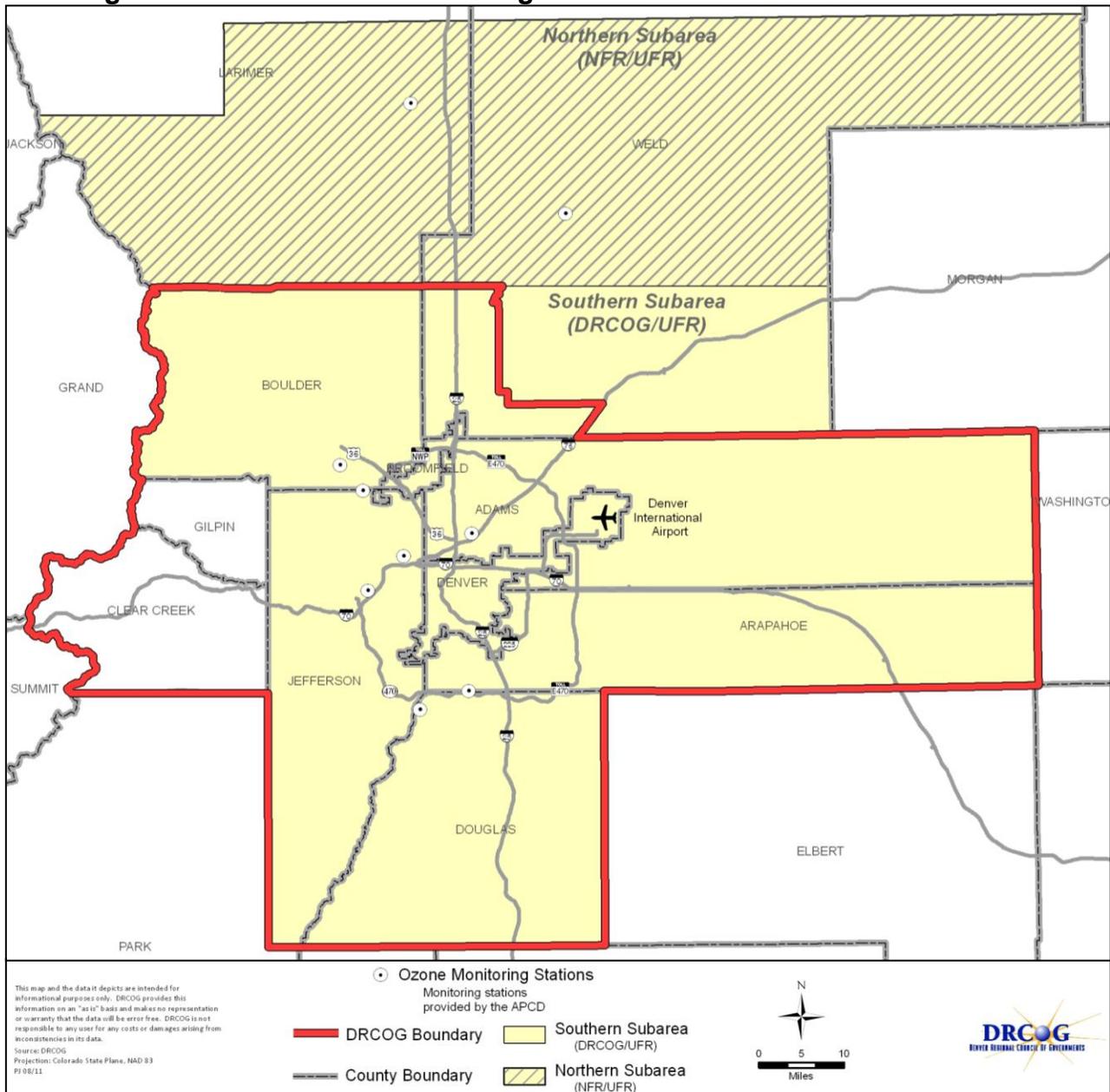
## Background—8-Hour Ozone Nonattainment Area

In 2008, the U.S. Environmental Protection Agency (EPA) lowered the National Ambient Air Quality Standards (NAAQS) for ground-level ozone to 0.075 parts per million (ppm) from the 1997 standard of 0.080 ppm. On April 30, 2012, the EPA designated Denver-North Front Range Area as marginal nonattainment under the 2008 ozone standard (0.075 ppm). The marginal nonattainment designation does not impose any new planning requirements on the State of Colorado at this time; however, the Denver-North Front Range Area must meet the standard before 2015 or new requirements may be imposed.

EPA's final rule designating areas for the 2008 ozone NAAQS became effective July 20, 2012. According to the EPA's *Transportation Conformity Guidance for 2008 Ozone Nonattainment Areas*, a conformity determination must be made with regard to the 2008 ozone NAAQS for metropolitan transportation plans and transportation improvement programs (TIP) within one year after the effective date of the nonattainment designation. The initial conformity determination of the fiscally constrained regional transportation plans (RTP) and TIPs with regard to the 2008 ozone NAAQS has been demonstrated by the two Metropolitan Planning Organizations (MPOs), the Denver Regional Council of Governments (DRCOG) and the North Front Range Metropolitan Planning Organization (NFRMPO), and one Transportation Planning Region (TPR), the Upper Front Range (UFR) TPR, that comprise the 8-hour nonattainment area, by March 2013. FHWA made a conformity determination finding for both DRCOG and the NFRMPO by separate letters dated May 30, 2013.

The Denver-North Front Range 8-hour Ozone Nonattainment Area for the 2008 ozone NAAQS keeps the same boundary as the nonattainment area under the 1997 ozone NAAQS, which covers the counties of: Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, Jefferson, and parts of Larimer and Weld Counties that have the highest concentration of emissions. Figure 1 shows the entire 8-hour ozone nonattainment area, which is comprised of two subareas (Northern and Southern). The boundary between the two subareas is the Boulder/Larimer County line extended through southern Weld County to the Morgan County line.

**Figure 1 Denver-North Front Range Nonattainment Area and Subareas**



EPA found that the motor vehicle emissions budgets (MVEB) for nitrogen oxides (NO<sub>x</sub>) and volatile organic compounds (VOC) contained in the Denver-North Front Range 8-Hour Ozone Attainment Plan under the 1997 ozone NAAQS are adequate for transportation conformity purposes (75 FR 9893, March 4, 2010) effective on March 19, 2010. EPA subsequently approved the NO<sub>x</sub> and VOC MVEBs for transportation conformity purposes in its final rule on August 5, 2011 (76 FR 47443, effective September 6, 2011). As a result, DRCOG and NFRMPO are required to use these budgets for subsequent transportation conformity determinations.

According to the EPA's *Transportation Conformity Guidance for 2008 Ozone Nonattainment Areas*, if 1997 ozone budgets are available for each analysis year in a conformity determination for the 2008 ozone NAAQS, an area would use 1997 ozone budgets that are established for that year.

## **Federal Requirements**

An MPO is required to show conformity of its fiscally constrained RTP and TIP with the State Implementation Plan (SIP) for air quality before 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 NAAQSs and achieving expeditious attainment of such standards. In addition, activities may not cause or contribute to new violations of air quality standards, exacerbate existing violations, or interfere with the timely attainment of required emissions reductions 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 EPA final transportation conformity rule is located at 40 CFR Part 93, Subpart A. To address revised standards and changes in conformity requirements, EPA has promulgated several amendments to the final rule in recent years.

### Conformity Regulations for the 8-Hour Ozone

On January 9, 2008, the EPA administrator signed an amendment to the conformity rule, (the "Final Rule"), to implement the provisions of SAFETEA-LU. The Final Rule was promulgated February 25, 2008. The most recent EPA revision to the conformity rule occurred on March 14, 2012 (77 FR 14979, effective April 13, 2012).

According to 40 CFR §93.109 of the Transportation Conformity Rule, criteria and procedures for determining conformity of transportation plans, programs, and projects, 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 submittal. In this case, EPA found the submitted NO<sub>x</sub> and VOC motor vehicle emissions budgets (MVEB) adequate (ref. 75 FR 9893, March 4, 2010) and approved these emission budgets on August 5, 2011 (76 FR 47443).

Therefore, conformity must be demonstrated for those MVEBs as per 40 CFR §93.118 as described below:

2. §93.109(e) (1) In such 8-hour ozone nonattainment and maintenance areas the budget test must be satisfied as required by §93.118 for conformity determinations made on or after:

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

EPA found the 8-hour ozone NO<sub>x</sub> and VOC MVEBs adequate on March 4, 2010 and these MVEBs became effective on March 19, 2010 (ref. 75 FR 9893, March 4, 2010). EPA approved these emission budgets for use on August 5, 2011 (76 FR 47443). Therefore, these MVEBs are used for the 8-hour ozone conformity determination.

### **Planning Organizations and the Memorandum of Agreement (MOA)**

DRCOG is the MPO for the Denver Transportation Management Area (TMA). The DRCOG TMA includes four urbanized areas and consists of the portions of Adams and Arapahoe counties west of Kiowa Creek; all of Boulder County except Rocky Mountain National Park; all of Broomfield, Denver, Douglas, and Jefferson counties; and parts of southwestern Weld County. The TMA boundary expansion into southwestern Weld County was approved by the Governor on February 21, 2008. DRCOG is also the Transportation Planning Region (TPR) for the TMA, portions of Adams and Arapahoe counties east of Kiowa Creek, and the Rocky Mountain National Park area of Boulder County. DRCOG's 2035 RTP includes the entire DRCOG TPR region. The DRCOG TIP covers the TMA, while CDOT and the State Transportation Improvement Program (STIP) covers the remaining portions of the region.

The NFRMPO is the MPO for the North Front Range TMA. The NFRMPO includes 15 local governments in the urbanized area of Larimer and Weld counties.

The UFR TPR is the transportation planning region covering the remainder of the 8-hour ozone nonattainment area. Located in north-central Colorado, it is comprised of Larimer, Morgan, and Weld Counties, and excludes the urbanized areas in Larimer and Weld Counties (which comprise the NFRMPO region and the portion of Southwest Weld County included in the DRCOG TMA). Figure 2 depicts the boundary of all three MPOs/TPRs involved in this 8-hour ozone conformity determination.

Federal Transportation Regulations at 23 CFR 450.314(b) states “*where a metropolitan planning area (MPA) does not include an entire nonattainment area, there shall be written agreement among the State Department of Transportation, state air quality agency, affected local agencies, and the MPO describing the process for cooperative planning and analysis of all projects outside the MPA within the nonattainment area.*” An MOA was signed in March 2008 by the Colorado Department of Public Health and Environment (CDPHE), Colorado Department of Transportation (CDOT), Regional Air Quality Council (RAQC), UFR TPR, NFRMPO, and DRCOG. A copy of the MOA is in Appendix D.

The MOA calls for the establishment of an overall area motor vehicle emissions budget based on the entire 8-hour ozone nonattainment area, and allows for the option for establishing subarea emissions budgets based on subareas, which are delineated in Figure 1.

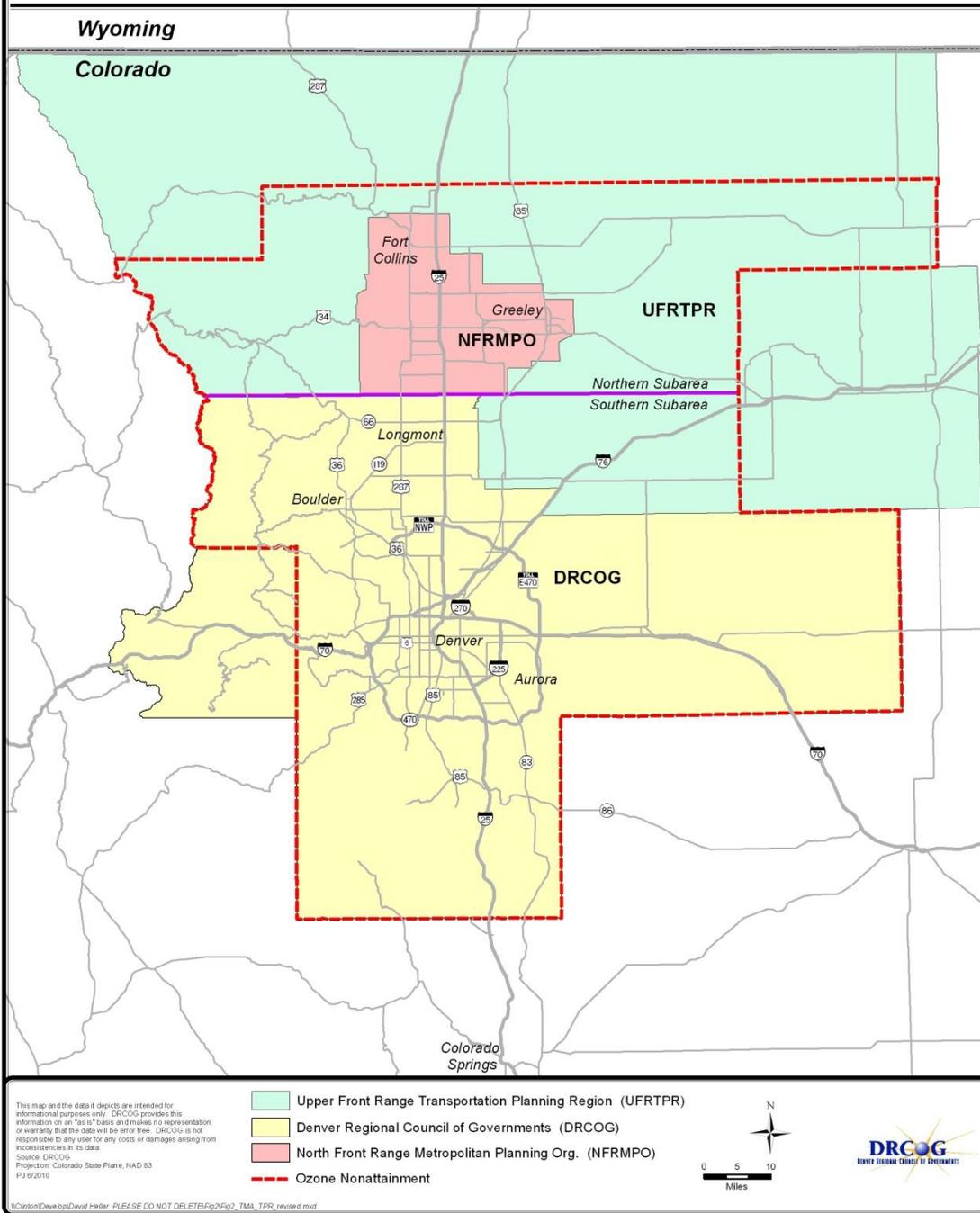
The MOA stipulates that DRCOG will make conformity determinations for the Southern Subarea of the 8-hour ozone nonattainment area, while the NFRMPO will make the conformity determination for the Northern Subarea of the 8-hour ozone nonattainment area. The travel demand model outputs from each of the MPOs are sent to the Air Pollution Control Division (APCD) of CDPHE for generation of emissions estimates. In the Northern Subarea, the 8-hour ozone nonattainment area outside of the NFRMPO model area, also known as the northern “donut” area, will have the transportation forecasting performed by the APCD.

Finally, the MOA states the courses of action to be pursued if one (or both) of the subareas exceeds a conformity test or its (their) emissions budgets.

The NFRMPO and DRCOG worked cooperatively with an interagency consultation group (Federal Highway Administration (FHWA), EPA, CDOT and APCD) to review the conformity documentation and planning assumptions. Furthermore, the NFR Technical Advisory Committee (TAC), or their representative, served as the review team for the NFR socioeconomic data and transportation network as per Regulation No. 10 *Criteria for Analysis of Conformity*.

The MOA noted that after the initial MVEB-based conformity determination, DRCOG and the NFRMPO may switch from using the total nonattainment area MVEBs to using the subarea MVEBs for determining conformity. To switch to use of the subarea MVEBs (or to subsequently switch back to use of the total nonattainment area MVEBs), DRCOG and the NFRMPO must use the process as described in the Denver/NFR Ozone Attainment Plan, that was approved by EPA on August 5, 2011 (76 FR 47443), on pages VI–4 through VI–6.

**Figure 2 TPRs Involved in Denver-North Front Range  
8-Hour Ozone Nonattainment**



## **Current Situation for the Denver Southern Subarea**

### Transportation Planning

#### *DRCOG Region*

The Metro Vision 2035 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 beltway, bicycle and pedestrian facilities, and improvements to the existing roadway system.

The 2035 Metro Vision Regional Transportation Plan (MVRTP) is the transportation plan that implements the transportation element of Metro Vision. The 2035 MVRTP contains an unconstrained vision plan, outlining the region's transportation needs, as well as the Fiscally Constrained 2035 RTP, which includes those projects that can be implemented given the anticipated level of funding. The 2035 MVRTP and Fiscally Constrained 2035 RTP were first adopted on December 19, 2007 and last amended in February 2013.

The 2012-2017 Transportation Improvement Program (TIP) adopted in March 2011 identifies transit, multimodal, and roadway projects to be funded with FY 2012 through FY 2015 federal funds. The regionally significant projects are described in Chapter 3. The 2012-2017 TIP implements the Fiscally Constrained 2035 RTP.

#### *UFR TPR*

The Upper Front Range 2035 Regional Transportation Plan was approved by the Upper Front Range Regional Planning Commission on December 13, 2007. The UFR TPR 2035 RTP contains both a Vision Plan as well as a Fiscally Constrained Plan. Short-range transportation projects in the UFR TPR are contained in the STIP. There are no regionally significant amendments to either of these documents since the last determination in February 2013.

### Air Quality Planning

#### *Other Pollutants*

Currently, the DRCOG region is designated as a maintenance area for carbon monoxide (CO) and particulate matter equal to and less than 10 microns in aerodynamic diameter (PM10). The CO and PM10 conformity determination adopted on February 20, 2013 by the DRCOG Board is being updated concurrently with this document.

## *8-Hour Ozone*

The current State Implementation Plan (SIP) for the Denver-North Front Range 8-hour Ozone Nonattainment Area was approved by the Air Quality Control Commission (AQCC) in December 2008; and approved by the EPA on August 5, 2011. This SIP demonstrates how the region would attain the 1997 8-hour ozone standard (0.085 ppm) by 2010, and also establishes mobile source emissions budgets. Two air quality planning agencies were charged with preparing the SIP. The RAQC is the air quality planning agency for the Denver metropolitan area (Southern Subarea) and the North Front Range Transportation and Air Quality Planning Council (NFRT & AQPC) is the air quality planning agency for the NFRMPO and the Northern Subarea.

The nine-county Denver Metro Area/Northern Front Range has been designated as marginal nonattainment for the 2008 8-hour ozone standard (0.075 ppm). A new SIP or modeled attainment demonstration is not required as long as the area attains the standard by 2015.

## **Process**

### Agency Roles

The Conformity SIP, also known as the AQCC Regulation Number 10 or conformity implementation plan, was developed by the AQCC and adopted in 1998. It formally defines the process for finding conformity. The EPA approved the Regulation Number 10 on September 21, 2001 (66FR48561), making it federally enforceable. The Regulation Number 10 was updated and approved by the AQCC on Dec 15, 2011. It has been submitted to the EPA for final approval.

In November 1998, a MOA was signed by the CDPHE and DRCOG for the purpose of defining the specific roles and responsibilities in conformity evaluations and findings. A similar MOA was also signed by the CDPHE and NFRMPO in November 1998. Following the EPA's approval of the updated Regulation Number 10, the 1998 MOA between CDPHE and DRCOG will be updated to reflect the changes made in the Regulation Number 10.

### Public Participation

Public participation was encouraged throughout the development of DRCOG's 2035 MVRTP and the 2012-2017 TIP. Public hearings (and associated 30-day comment periods) were held before the DRCOG Board for the:

- 2035 Metro Vision Regional Transportation Plan and its original conformity document on December 5, 2007.
- 2035 MVRTP 2008 Cycle 1 amendments and conformity document on July 16, 2008.
- 2035 MVRTP 2008 Cycle 2 amendments and conformity document on December 17, 2008.
- 2035 MVRTP 2009 Cycle 1 amendments and conformity document on July 15, 2009.
- 2035 MVRTP 2009 Cycle 2 amendments and conformity document on December 16, 2009.
- 2035 MVRTP Update and conformity documents on December 15, 2010.
- 2012-2017 TIP and its conformity document on February 16, 2011.
- 2035 MVRTP 2011 Cycle 1 amendments and conformity document on July 20, 2011.
- 2035 MVRTP 2012 Cycle 2 amendments and conformity document on January 16, 2013.
- 2035 MVRTP 2013 Cycle 1 amendments and conformity document on July 17, 2013.

Consistent with the MOA, no specific public hearing was held in the UFR TPR. However, public notice of the two MPOs' public hearings was circulated within the UFR TPR. Summaries of testimony received during the review periods and at the public hearings are available at the DRCOG office. The public was also encouraged to provide input to their local elected officials and government staff who work closely with DRCOG.

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## **Chapter 2. Implementation of Control Measures**

For this conformity determination, there are no new transportation control measures (TCMs) identified for timely completion or implementation as part of the applicable implementation plan. The 8-hour Ozone Attainment Plan (SIP) that was adopted by the AQCC in December, 2008, and approved by EPA on August 5, 2011, did not include any TCMs.

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## Chapter 3. Emissions Tests

### General Description

The transportation plan and program must pass a series of 8-hour ozone emissions tests to demonstrate conformity. These emissions tests relate to the two ozone precursors, Nitrogen oxides (NO<sub>x</sub>) and Volatile Organic Compounds (VOC). 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 SIP.

### Budgets Analysis Years

In accordance with EPA regulations 40 CFR 93.118, the interagency consultation group agreed upon the following staging years for this 8-hour ozone conformity determination.

- **2015**—an intermediate modeling year
- **2025**—an intermediate modeling year
- **2035**—the last year (horizon) of regional transportation plans

Under the terms of the MOA (as described above), DRCOG is responsible for the 8-hour ozone nonattainment area's Southern Subarea (everything within the 8-hour ozone nonattainment area south of the north line of Township 3), while the NFRMPO is responsible for the conformity determination for the 8-hour ozone nonattainment area's Northern Subarea (everything within the 8-hour ozone nonattainment area north of the north line of Township 3). The entire Denver-North Front Range nonattainment area, with both the Northern and Southern Subareas, is shown in Figure 1.

### 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. The MOA stipulates that the emissions estimates are to be performed by the APCD. Information concerning vehicle miles traveled and operating speeds was updated as part of this conformity finding process. These planning assumptions were used with the EPA emission model (MOVES) to estimate emissions. The DRCOG travel demand model covers the whole Southern Subarea. Appendix B describes the

modeling structure and recent enhancements for the DRCOG travel demand model in more detail.

### DRCOG Demographic Assumptions

The population forecast for the Southern Subarea of the Denver-North Front Range 8-Hour Ozone Nonattainment Area in 2035 is 4,061,076. This is an increase of 41 percent over the year 2010 estimated population of 2,872,251. Employment is forecasted to be 2,329,691 in 2035, compared to the year 2010 estimate of 1,678,021, an increase of approximately 39 percent. Growth in population and employment will be the principal factors for the increased demand for travel on the region's transportation facilities and services. Table 1 shows the latest forecasts of population and employment for 2010, 2015, 2025, and 2035 for the Southern Subarea of the Denver-North Front Range Nonattainment Area, as depicted in Figure 1. Table 2 lists 2010 and 2035 population and employment estimates by each of the counties in the DRCOG ozone modeling Southern Subarea.

**Table 1**

**Population and Employment Forecasts –  
DRCOG Ozone Modeling Southern Subarea**

	<b>2010</b>	<b>2015</b>	<b>2025</b>	<b>2035</b>
Population	2,872,251	3,095,130	3,613,031	4,061,076
Employment	1,678,021	1,863,540	2,108,740	2,329,691

**Table 2**

**2010 and 2035 Population and Employment Estimates by County –  
DRCOG Ozone Modeling Southern Subarea**

<b>County</b>	<b>Population</b>		<b>Employment</b>	
	<b>2010</b>	<b>2035</b>	<b>2010</b>	<b>2035</b>
Adams County	455,155	728,028	204,531	331,702
Arapahoe County	563,874	787,406	336,956	442,279
Boulder County	302,198	373,301	188,833	198,895
Broomfield County	51,697	87,693	37,401	76,880
Denver County	596,720	760,726	512,252	689,934
Douglas County	283,811	482,295	111,259	205,705
Jefferson County	548,793	691,254	266,007	343,730
Weld County*	70,004	150,373	20,782	40,566
<b>Total DRCOG Ozone Modeling Southern Subarea</b>	<b>2,872,251</b>	<b>4,061,076</b>	<b>1,678,021</b>	<b>2,329,691</b>

\* Includes entire extent of Weld County that lies within the DRCOG 8-hour ozone modeling domain (i.e. Southern Subarea of 8-hour Ozone Nonattainment Area).

## Transportation Assumptions

In order to complete the emissions tests, the 2010, 2015, 2025, and 2035 transportation networks must first be defined. DRCOG's Fiscally Constrained 2035 RTP specifies financially constrained highway and transit system improvements and resulting networks to be completed by the year 2035. The detailed list of improvement projects by completion year staging for 2013 Cycle 1 is displayed in Appendix A. The 2012-2017 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 Fiscally Constrained 2035 RTP, listed below:

- US-85 from Cook Ranch Road to Meadows Parkway: widen roadway to four lanes.
- I-25 from US-36 to 120<sup>th</sup> Avenue: add two HOT lanes.
- I-25 from RidgeGate Pkwy to County Line South Ramps: widen roadway to 8 lanes.
- West Corridor, Denver Union Station to Jefferson County Government Center: new light rail, stations, park-n-Rides.
- Gold Line, Denver Union Station to Ward Road: new light rail, stations, park-n-Rides.
- I-225 Corridor, Parker Road to Smith Road: new light rail, stations, parking.
- Northwest Rail, Denver Union Station to Westminster (71<sup>st</sup> Ave Station): new rail, stations, parking.
- East Corridor, Denver Union Station to Denver International Airport: new rail, stations, and park-n-Rides.
- Denver Union Station: intermodal center.
- 120<sup>th</sup> 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 2012-2017 TIP also includes 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 Fiscally Constrained 2035 RTP using federal and state resources, in addition to those listed above include:

- Wadsworth Boulevard (SH-121) from 36<sup>th</sup> Avenue to 46<sup>th</sup> Avenue: widen roadway to six lanes.
- Wadsworth Parkway (SH-121) from 92<sup>nd</sup> Avenue to SH-128/120<sup>th</sup> Avenue: widen roadway to six lanes.
- 104<sup>th</sup> Avenue from Grand View Ponds to US-85: widen roadway to four lanes.
- I-70 from Brighton Boulevard to York Street: roadway reconstruction and interchanges.
- I-70 from I-270 to Havana Street: widen roadway to ten lanes.
- Hampden Avenue (US-285) from Colorado to I-25: widen roadway to six lanes.
- Hampden Avenue (SH-30) from Dayton Street to Havana Street: widen roadway to six lanes.
- I-270 from Vasquez to Quebec Street: widen roadway to six lanes.
- US-36 at Wadsworth Boulevard: interchange reconstruction.
- I-25 from SH-66 to WCR 38: add two HOT lanes.
- US-85 from Louviers to MP191.75 and from Sedalia (SH-67) to Meadows Pkwy: widen to 4 lanes.
- North Metro Rail Line, Denver Union Station to 72nd 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:

- New interchanges at I-25/Douglas Lane and at US-85/North Meadows Drive in Castle Rock.
- 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.
- Peña Boulevard from I-70 to Jackson Gap Street: widen roadway to six lanes.

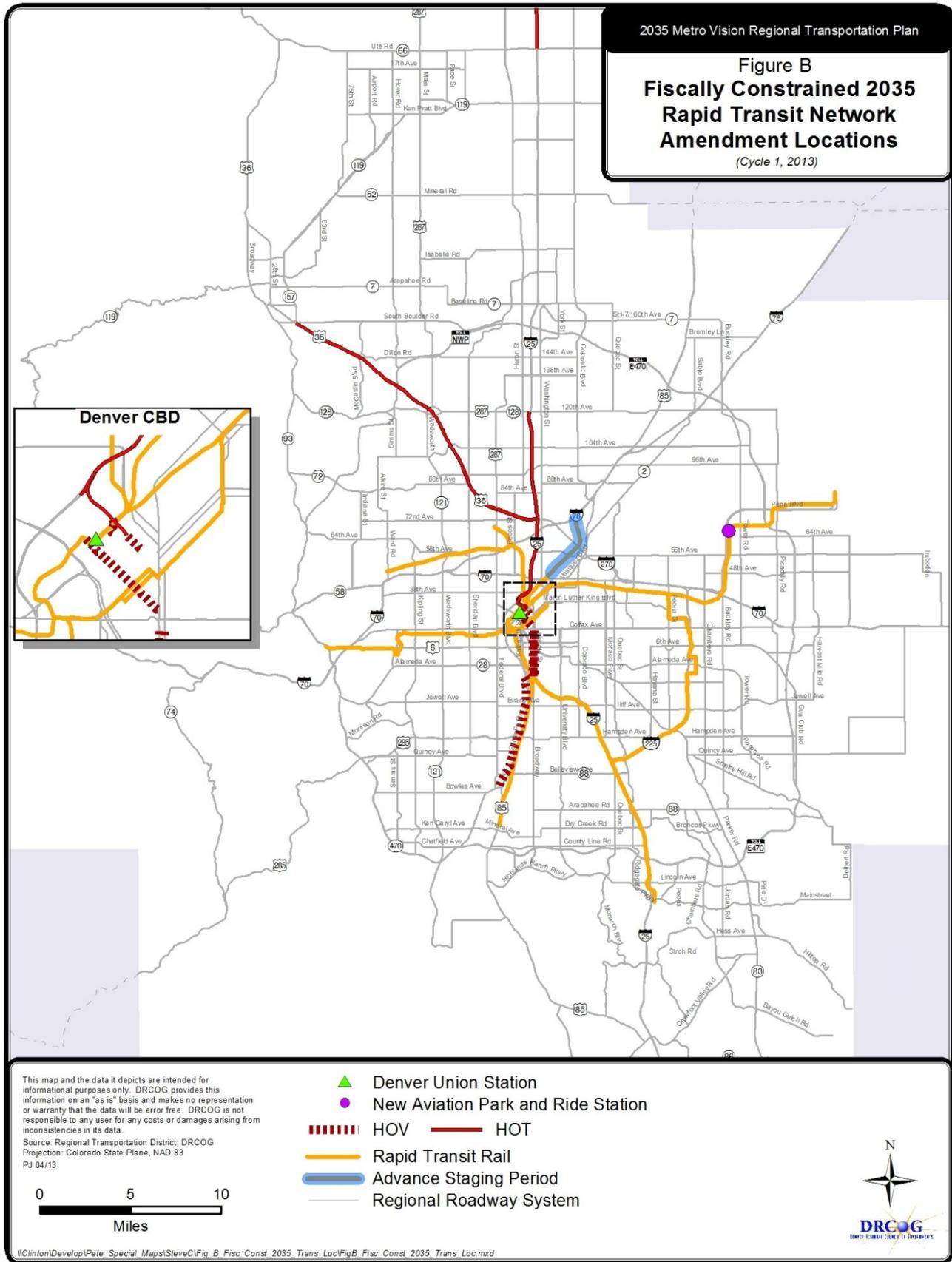
- Jefferson Parkway from SH-93 to SH-128: new four-lane tollroad, plus 3 partial interchanges.

The major proposed 2013 Cycle 1 project amendments to the Fiscally Constrained 2035 RTP roadway network are described in Table 4. All changes (e.g. staging year updates) are depicted in Appendix A.

The base 2010 rapid transit network includes the existing Central, Southwest, Southeast, 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; and bus lanes on Broadway and Lincoln. The remaining rapid transit system to be completed by 2035 is shown in Figure 3. The 2013 Cycle 1 amendment for FasTracks will advance the National Western Stock Show to 72<sup>nd</sup> North Metro Rail segment from the 2035 stage to the 2025 stage. The amendment will also add a new Park-and-Ride station (Aviation Station) to the East Rail Line at approximately Pena Boulevard and 61<sup>st</sup> Avenue.

The proposed 2013 Cycle 1 project and operational amendments to the Fiscally Constrained 2035 RTP are described in Table 4.

**Figure 3 Fiscally Constrained 2035 Rapid Transit Rail Network Amendment Locations**



**Table 3**  
**Proposed 2013 Cycle 1 Amendments to the Fiscally Constrained 2035 RTP Rapid Transit System**

FasTracks Components	Current RTP Project Description	Type of Change to the FC-2035-RTP	Proposed Model Network Staging
North Metro Rail Line	Denver Union Station to 72nd Ave	Change network staging of segment from National Western Stock Show Station to 72nd Ave Station from 2025-2035 to 2015-2024	2015 - 2024
East Rail Line	Denver Union Station to Denver International Airport	Add new Park-and-Ride Station (Aviation Station) at Pena Boulevard/61 <sup>st</sup> Avenue	2015-2024

*UFR TPR*

There were no regionally significant transportation improvement projects in the UFR TPR portion of the Southern Subarea, and no amendments are proposed for this cycle. The 2012-2017 STIP does include construction of a park-and-ride lot in Fort Lupton on US-85.

Air Quality Modeling Assumptions

The APCD estimates air pollution emissions using MOVES. The conformity analysis for this 8-hour ozone conformity finding began in March 2013 after amendment proposals were submitted for inclusion.

**Mobile Source Measures**

The regional emissions analysis does not reflect the air quality benefits of such travel demand management programs as DRCOG’s Regional TDM Program, Teleworking, Eco Pass, and other transportation demand management actions. In addition, other programs whose benefits are more difficult to ascertain are not fully incorporated into the model. Examples of such programs include compressed workweeks and programs initiated after 1998.

The DRCOG model does reflect emissions reduction benefits created by DRCOG’s Traffic Signal System Improvement Program (TSSIP), which is funded through the TIP. The goal of this program is to ensure that the region’s traffic signals operate in a coordinated manner that makes the most efficient use of arterial street capacity. The efficiency objectives include:

- Minimizing vehicle stops.
- Minimizing travel delay.
- Minimizing disruption caused by malfunctioning equipment.

## Emission Test Results

According to the EPA's *Transportation Conformity Guidance for 2008 Ozone Nonattainment Areas*, if an area does not have budgets for the 2008 ozone NAAQS, but has budgets for a previous ozone NAAQS (i.e., the 1997 ozone NAAQS), these budgets must be used in the budget test. Since budgets for the 2008 ozone NAAQS are not available, the SIP budgets established for the 1997 ozone NAAQS are used in this conformity.

The results of the Denver Southern Subarea emissions tests by year are reported in Table 4. The emissions estimates were generated by APCD using the transportation inputs from DRCOG's travel demand models and the MOVES emissions model. The 8-hour ozone conformity analysis was performed for the years 2015, 2025, and 2035, which meet the requirements for the staging years specified in 40 CFR 93.118. 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. Therefore, conformity is demonstrated for the Denver Southern Subarea.

**Table 4**  
**8-Hour Ozone Conformity for Denver Southern Subarea**  
**(Emission Tons per Day)**

SIP budgets	2015 Emissions	2025 Emissions	2035 Emissions	Pass/Fail
Volatile Organic Compounds (VOC)				
89.7	<b>79.7</b>	<b>56.1</b>	<b>49.1</b>	Pass all tests
Oxides of Nitrogen (NOx)				
102.4	<b>84.4</b>	<b>48.6</b>	<b>43.2</b>	Pass all tests

## Summary of 8-hour Ozone Conformity Findings for the Denver Southern Subarea

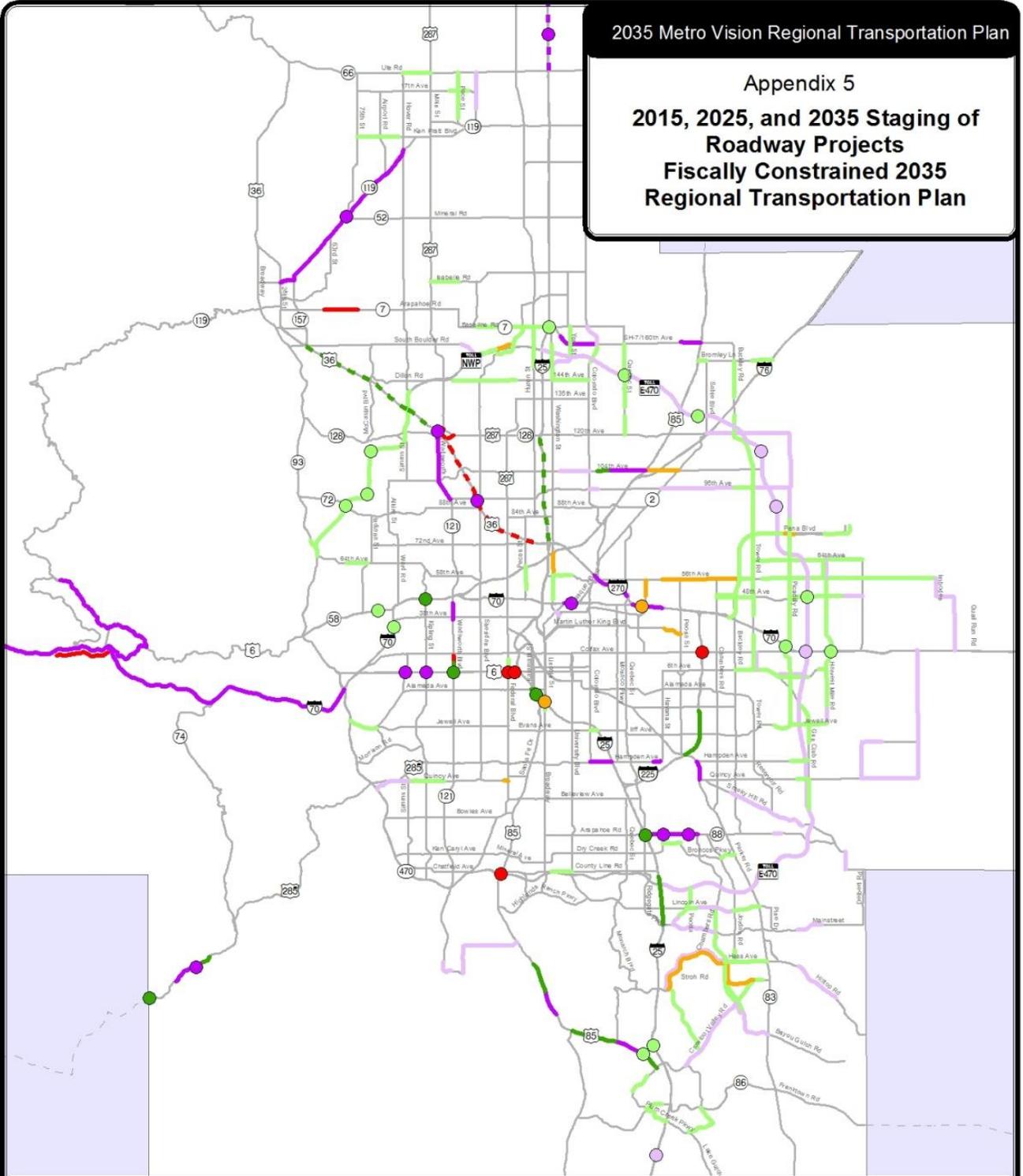
Based on the quantitative conformity analysis, the DRCOG staff have determined that the DRCOG Fiscally Constrained 2035 RTP and 2012-2017 TIP and the Southern Subarea portion of the UFR 2035 RTP and 2012-2017 STIP demonstrate conformity for the 2008 8-hour ozone standard for the Denver Southern Subarea. Appendix C of this conformity determination includes more information on the transportation and demographic assumptions used in this emissions analysis.

**APPENDIX A**  
**DRCOG TRANSPORTATION NETWORK ASSUMPTIONS**

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2035 Metro Vision Regional Transportation Plan

Appendix 5  
 2015, 2025, and 2035 Staging of  
 Roadway Projects  
 Fiscally Constrained 2035  
 Regional Transportation Plan



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.

Source: DRCOG  
 Projection: Colorado State Plane, NAD 83  
 RJ 11/12

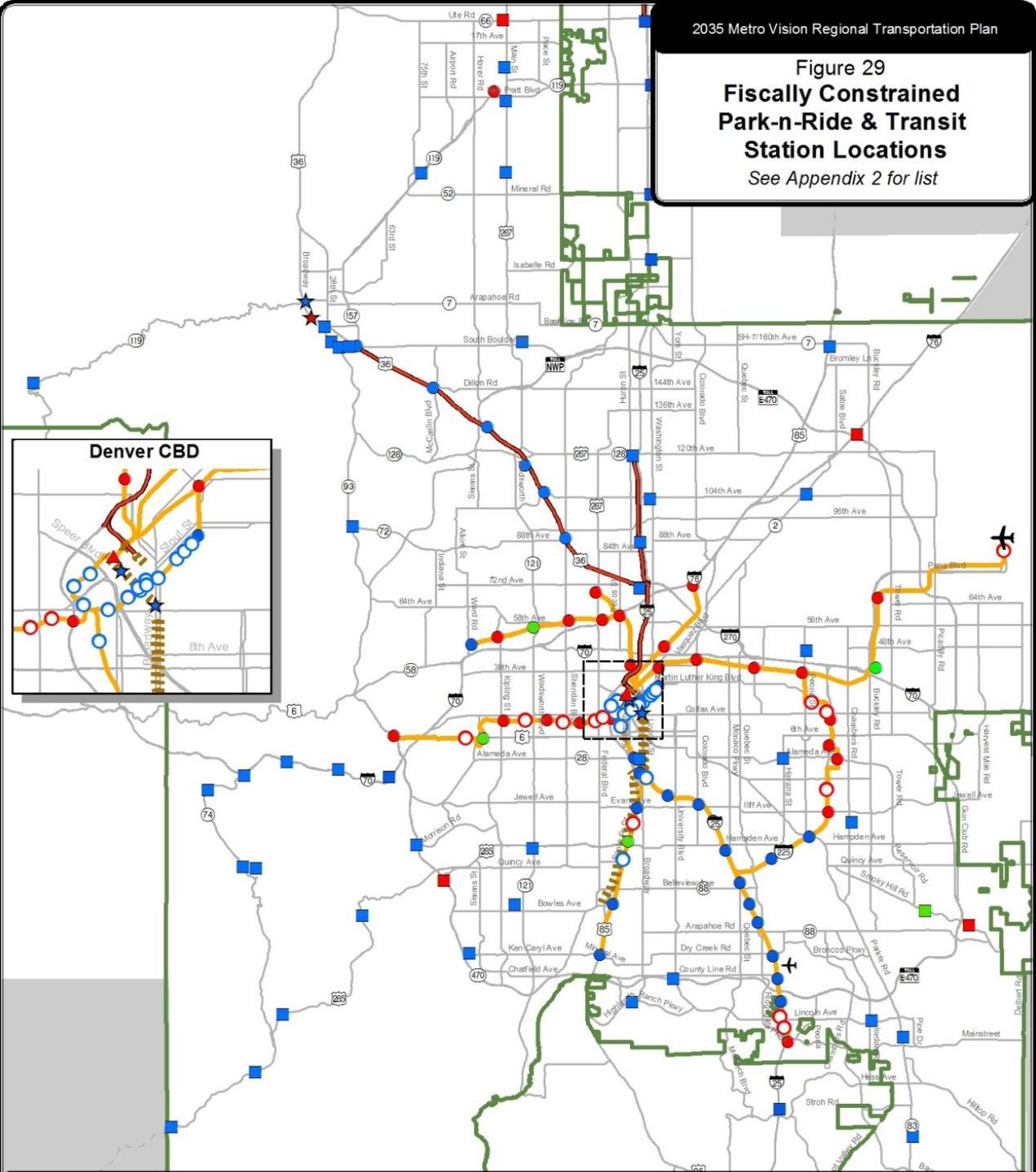


Roadway Segment  
 Managed Lanes (HOT)  
 New or Improved Interchange



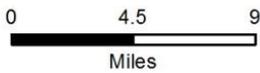
U:\Clinton\Development\2035 RTP 2013 Cycle 1 Amendments\RTP Figures 2013 Cycle 205\_Appendix\_Fig4\_Fiscally\_Constrained\_2035\_S\_Staging.mxd

**Figure 29**  
**Fiscally Constrained**  
**Park-n-Ride & Transit**  
**Station Locations**  
*See Appendix 2 for list*



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.

Source: Regional Transportation District, DRCOG  
 Projection: Colorado State Plane, NAD 83  
 PJ 05/13



- | existing | expand | new |                                       |
|----------|--------|-----|---------------------------------------|
| ●        | ●      | ●   | Rapid Transit Station with Parking    |
| ○        | ○      | ○   | Rapid Transit Station without Parking |
| ■        | ■      | ■   | Park-n-Ride Lot                       |
| ★        |        | ★   | Denver Union Station                  |
|          |        | ★   | Other Stations/Transit Centers        |
| —        |        | —   | Tier 1 Rapid Transit Rail             |
| —        |        | —   | RTD Service Boundary                  |
| —        |        | —   | Regional Roadway System               |
| —        |        | —   | HOV                                   |
| —        |        | —   | HOT                                   |



\\Clinton\Develop\2035 RTP 2013 Cycle 1 Amendments\Figures\Fig29\_PnR\_S\_Cycle2.mxd

## **APPENDIX B**

### **DRCOG Transportation model CALIBRATION description**

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## Introduction

In support of the conformity determination for the 2035 Regional Transportation Plan (RTP), the Denver Regional Council of Governments' (DRCOG) Metro Vision Resource Center employed the Regional 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 previous model, Compass, was an aggregate model that did not include this level of detail.

The *Focus* model sums the individual 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* models the many choices each person makes each day 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
- (5) the address where each trip starts from and goes to
- (6) the mode for each trip, with choices including walk and biking
- (7) which major streets or bus routes were chosen to reach each destination

The model takes into account many characteristics of people, such as their age 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 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.

## **Demographic Development Estimation**

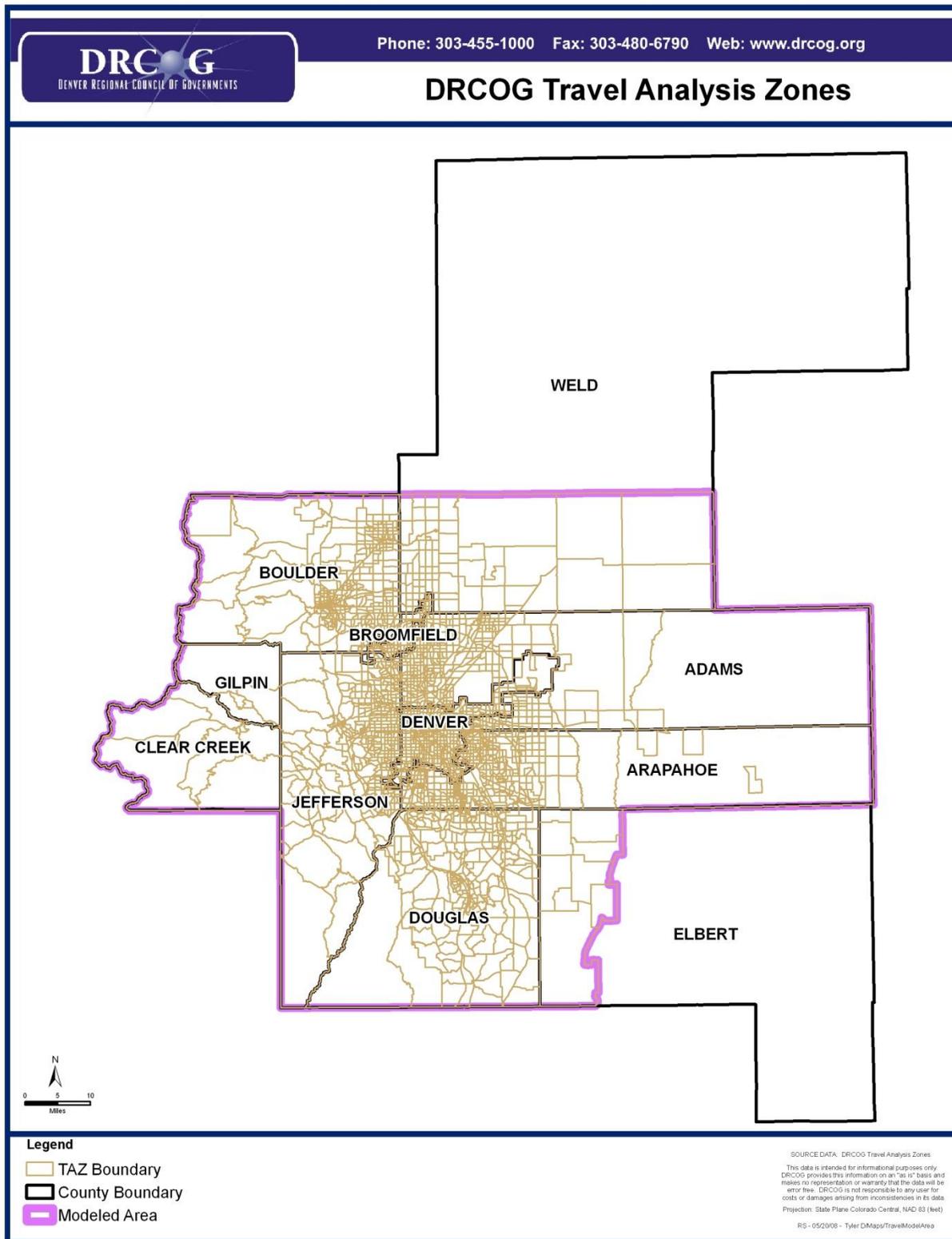
DRCOG works with a panel of economists and planners from both private and public sectors to review current growth trends and evaluate the output of a regional forecast model. This model relates the regional economy to national forecasts by industrial sector. Once employment levels are predicted, a demographic model is used to determine the migration levels needed to generate the labor force to fill the expected jobs. The forecasts are reviewed annually with major revisions expected every five years.

## **Small Area Development Estimates**

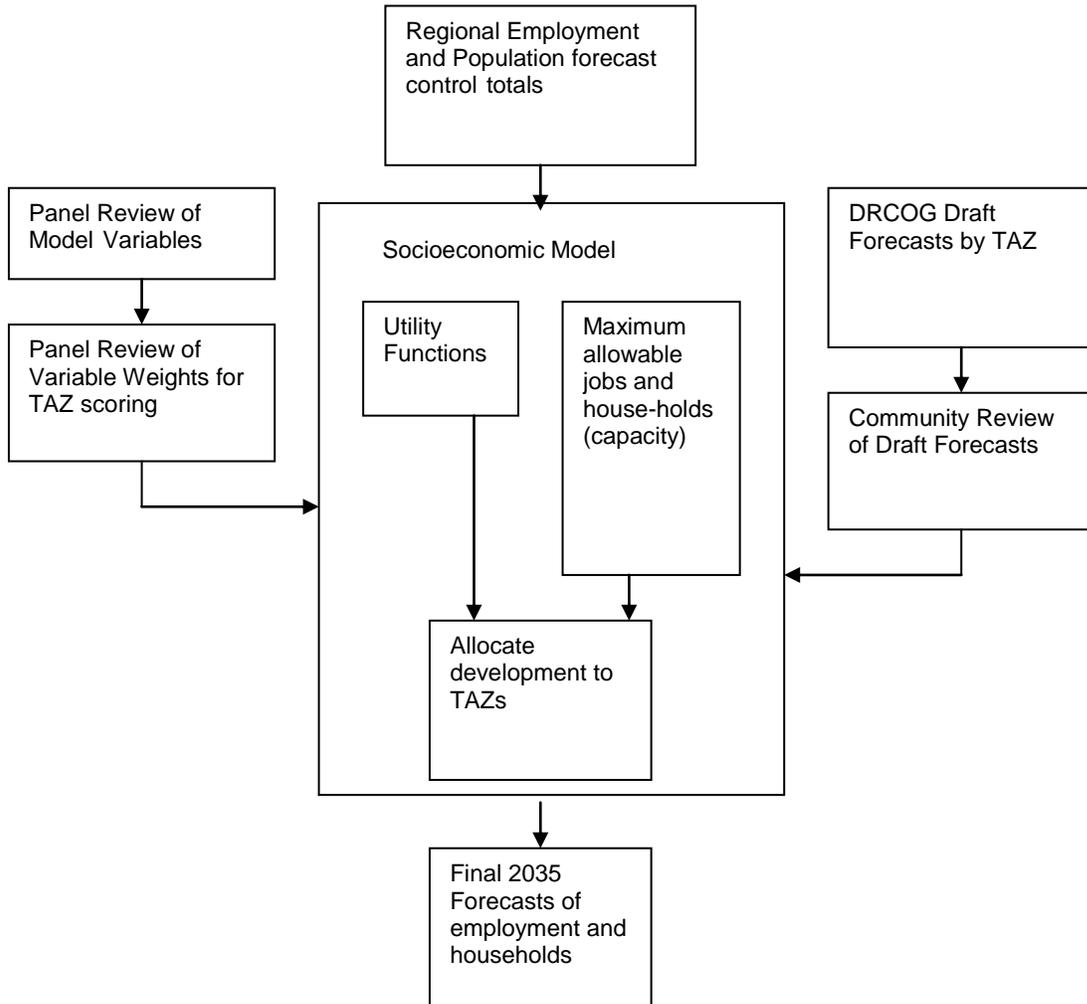
To provide development data at a level of detail necessary for the travel model, the regional urban activity forecasts are disaggregated into 2,800 transportation analysis zones (TAZs), as shown in Figure 1. The allocation to TAZs is carried out based on an attractiveness index for each TAZ, which in effect develops a desirability “score” for each TAZ. This score is based on roughly 20 variables such as miles of arterial roadway in the TAZ, rapid transit service, vacant land, local land use plans, growth over the last decade, environmental constraints, and income characteristics. Separate attractiveness indices and allocations are developed for commercial and retail employment, and for households. The zones are filled with new development in the given category starting with the TAZ with the highest attractiveness index. The amount of development allocated to a TAZ is controlled by the amount of vacant land in the zone available for residential or employment uses, the expected density in the zone, and other factors. The model works its way

through the list of zones until all of the growth is allocated. 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 TAZs; the regional urban growth boundary affects expected densities, and the development totals in TAZs outside that boundary; and planned urban centers affect the development capacity in the TAZs in which they are planned. Figure 2 shows a flowchart for the process of socioeconomic forecasting in the Denver region. The forecasting results were refreshed in 2009.

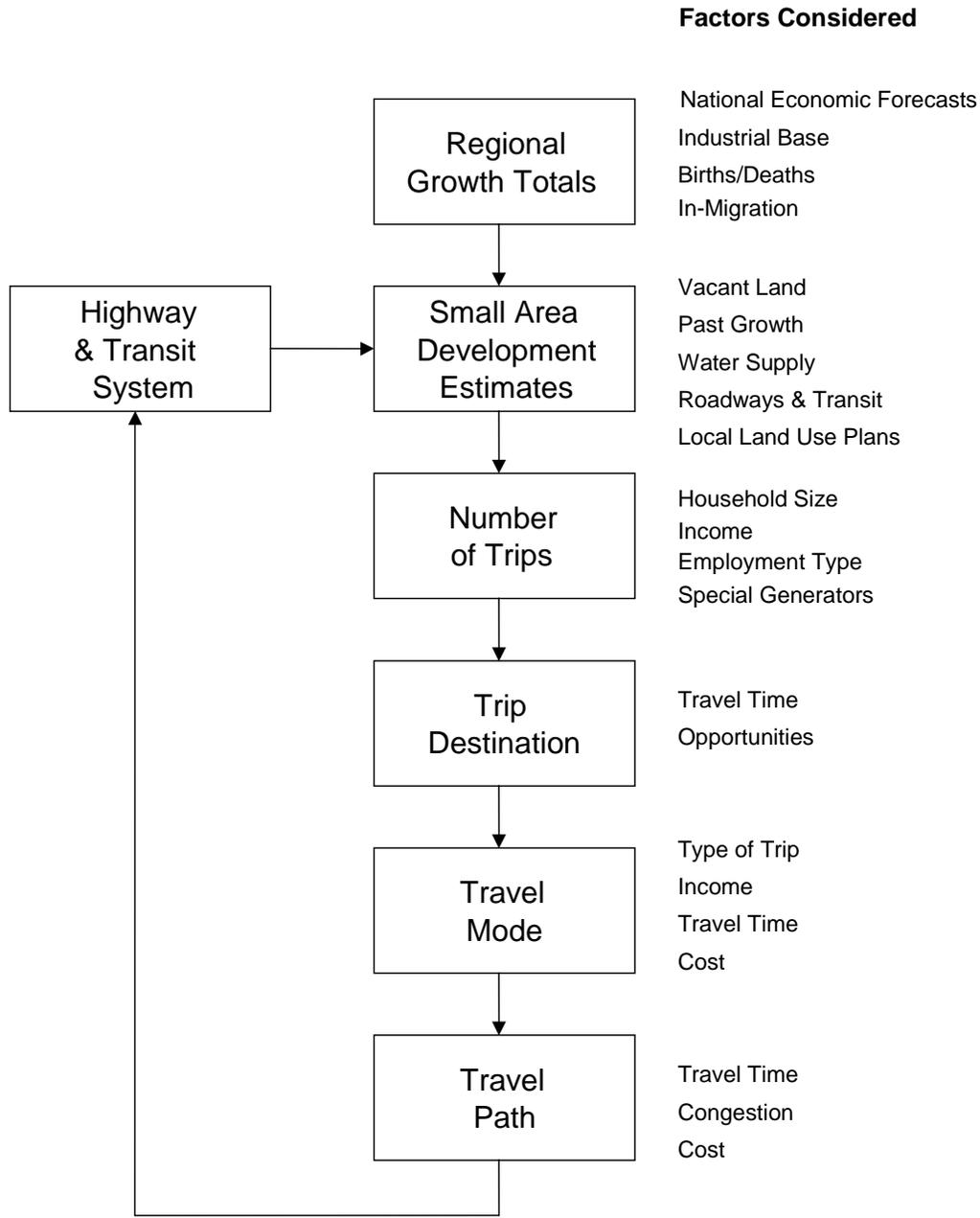
**Figure 1**  
**DRCOG Travel Analysis Zones**



**Figure 2**  
**Socioeconomic Model Elements and Flow**



**Figure 3**  
**Travel Model Elements and Flow**



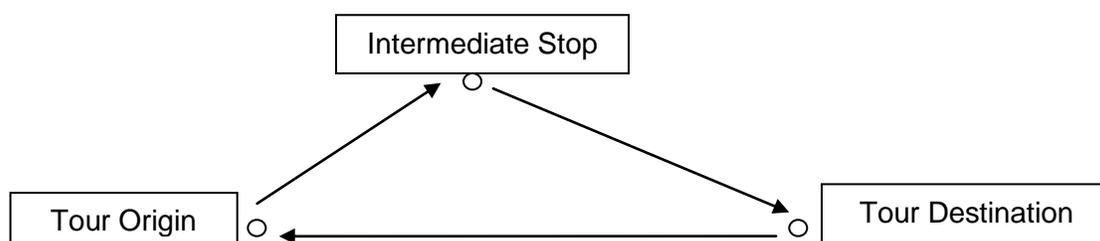
## Focus Model Process Overview

Figure 3 shows a simplified diagram of how the *Focus* model components flow after the socioeconomic forecast has been completed.

The model begins with 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). Then the travel “skims” are created (travel times, costs, etc.). Tours are the first travel elements to be created. Figure 4 shows a diagram to explain how tours are related to trips. This example diagram has one tour composed of three trips 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 automobiles 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 shortest 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. Population Synthesizer	14. Tour Time of Day Simulation
2. TransCAD Initialization	15. Tour Primary Destination Choice
3. TransCAD Trip Generation	16. Tour Priority Assignment
4. TransCAD Skimming	17. Tour Main Mode Choice
5. Size Sum Variable Calculator	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	

## Population Synthesizer

The model begins with a population synthesizer called PopSyn. PopSyn creates a forecast of individual households and persons with detailed demographic characteristics for chosen year. It operates by drawing household and person records from the US Census year 2000 Public Use Microsample (PUMS) with the goal of matching forecasted demographic controls, including land use model households by zone.

## **Highway and Transit Skims**

The highway and transit skims are made by finding shortest time paths for origin-destination zone pairs by time-of-day. The skims are used extensively in later model components location choice, mode choice, and time of day choice.

## **Denver International Airport/Internal-External/ External-External Trips**

After skimming is run, 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. The work location choice model is a nested logit model with the highest nest for a regular workplace at home or outside the home. At the second level in the next, if an “outside the home” workplace is selected, a particular workplace location zone is chosen.

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-8<sup>th</sup> grade, 9<sup>th</sup>-12<sup>th</sup> grade, and university. Four separate models are used to reflect that the decision-making of school location for different grade ranges have 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 ***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 ***tour primary destination choice*** model selects the destination of tour based the development (e.g. jobs and households) located within the zone. Then it 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.

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 1 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 generates intermediate stops on each tour.

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 to

### **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). 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. Finally, the model is run several times, feeding back the output speeds to the input stages that require them as input (among them, the trip distribution stage) until the output speeds and the input speeds match. 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.

### **Model Calibration**

Each *Focus* model component was calibrated using 2005 inputs to 2005 external data sources individually and then the entire model was calibrated aggregately against roadway counts and RTD transit boardings.

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, the model was again calibrated, this time 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 utility function constants, coefficients, and adding variables. Then the model was re-run, results compared again, and modifications made again. This process was iterated as time allowed 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 well.

**Table 2. Observed and Modeled Vehicle Miles Traveled on Links with Counts**

<b>Observed VMT</b>	<b>Modeled VMT</b>
29,061,936	28,285,657

**Table 3. Observed and Modeled Transit Boardings**

<b>Observed Transit Boardings</b>	<b>Modeled Transit Boardings</b>
317,645	320,584

### **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.

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**APPENDIX C**  
**MODELING SUMMARY TABLES**

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**Table 1 – Denver Regional Council of Governments**

**Assumptions for the Entire Modeling Area and Data for Base and Future Years**

	<b>Base Year (2010)</b>	<b>Interim Year (2015)</b>	<b>Future Year (2035)</b>
<b>Total Population</b>	2,907,353	3,135,399	4,132,611
<b>Employment</b>	1,690,287	1,876,573	2,346,897
<b>Annual Growth Rate (Pop.)</b>	-	1.4%	1.6%
<b>Dwelling Units (Households)</b>	1,160,379	1,266,000	1,697,924
<b>Persons/Dwelling Unit (Household)</b>	2.47	2.42	2.40
<b>VMT by Roadway Type</b>			
-Freeway	26,416,797	28,427,764	36,334,245
-Expressway	4,340,918	6,124,852	7,981,432
-Principal	22,916,066	26,186,277	35,096,198
-Minor	8,065,783	7,450,020	10,254,925
-Other (Collectors, Centroid Connectors, Ramps)	11,836,132	12,637,883	17,592,755
<b>Total</b>	<b>73,575,695</b>	<b>80,826,796</b>	<b>107,259,554</b>
<b>Speed by Roadway Type (miles per hour)</b>			
-Freeway	61.9	60.9	56.2
-Expressway	49.0	47.9	43.8
-Principal	34.9	34.9	32.3
-Minor	32.0	31.7	29.0
-Other (Collectors, Centroid Connectors, Ramps)	23.2	22.9	21.7
<b>Total (Average Speed)</b>	<b>38.0</b>	<b>37.9</b>	<b>34.9</b>
<b>Lane Miles by Roadway Type</b>			
-Freeway	2,082	2,136	2,331
-Expressway	499	627	662
-Principal	3,465	4,045	4,787
-Minor	3,207	2,953	3,076
-Other (Collectors, Centroid Connectors, Ramps)	6,488	6,370	6,447
<b>Total</b>	<b>15,742</b>	<b>16,131</b>	<b>17,304</b>

**Table 2 – 8-Hour Ozone Emission Rates (Gram/Mile)  
For the DRCOG Modeling Area**

	<b>Intermediate Year (2015)</b>	<b>Intermediate Year (2025)</b>	<b>Future Year (2035)</b>
<b>VOC</b>	<b>0.93</b>	<b>0.56</b>	<b>0.43</b>
<b>NOx</b>	<b>0.98</b>	<b>0.48</b>	<b>0.38</b>

## **APPENDIX D**

### **MEMORANDUM OF AGREEMENT—TRANSPORTATION CONFORMITY EVALUATIONS CONDUCTED UNDER THE 8-HOUR OZONE STANDARD**

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**APPENDIX E**  
**U.S. DEPARTMENT OF TRANSPORTATION CONFORMITY FINDING**  
**(TO BE PROVIDED)**

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## APPENDIX F

### List of Acronyms

AADT	Average Annual Daily Traffic
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
CDPHE	Colorado Department of Public Health and Environment
CMAQ	Congestion Mitigation Air Quality
CO	Carbon Monoxide
DRCOG	Denver Regional Council of Governments
DTD	CDOT Division of Transportation Development
EAC	Early Action Compact
EPA	United States Environmental Protection Agency
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
HOT	High-Occupancy Toll
HOV	High-Occupancy Vehicle
HPMS	Highway Performance Monitoring System
MOA	Memorandum of Agreement
MPO	Metropolitan Planning Organization
MVEB	Motor Vehicle Emissions Budget
MVRTP	Metro Vision Regional Transportation Plan
NAAQS	National Ambient Air Quality Standards
NFRT & AQPC	North Front Range Transportation and Air Quality Planning Council
NFRMPO	North Front Range Metropolitan Planning Organization
NFRRTM	North Front Range Regional Travel Model
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
STIP	State Transportation Improvement Program
TCM	Transportation Control Measures
TDM	Transportation Demand Management
TIP	Transportation Improvement Program
TMA	Transportation Management Area
TMO	Transportation Management Organization
TPR	Transportation Planning Region
TSSIP	Traffic Signal System Improvement Program
UFR	Upper Front Range Transportation Planning Region
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compounds

