Appendix G

Clark County, Nevada

Regional Transportation Plan FY 2006-2030

Chapter 5 Air Quality and Transportation Conformity Analysis

Final Report 2006

5 AIR QUALITY AND TRANSPORTATION CONFORMITY ANALYSIS

5.1 The Air Quality Conformity Process

5.1.1 Introduction

Meets Objectives: 1.4, 4.4

This section describes the air quality conformity analysis conducted as part of the development of the Regional Transportation Plan 2006-2030 (RTP) and the Transportation Improvement Program for Fiscal Years 2006-2008 (TIP).

The Las Vegas region is in non-attainment for three pollutants: carbon monoxide (CO), particulate matter 10 microns in size or less (PM_{10}), and Ozone (O_3). Non-attainment is the term used to describe levels of these pollutants that the U.S. Environmental Protection Agency (EPA) has designated as not meeting the clean air standards for that pollutant as defined in the National Ambient Air Quality Standards (NAAQS). Within Clark County, the area defined as Hydrographic Basin 212 is designated as a non-attainment area for two pollutants – CO and PM_{10}. This area is roughly coincidental with the Las Vegas Valley. On September 15, 2004 the EPA designated about 60 percent of Clark County as non-attainment for O_3. This area extends from the Las Vegas Valley south and east to the Colorado River. Figure 1-4 in the Introduction shows the study boundaries for each pollutant.

The Clean Air Act Amendments of 1990 (CAAA) require that each non-attainment area and pollutant be addressed by a control plan, referred to as the State Implementation Plan (SIP), developed by the state air quality planning agency. The SIP sets out policies and actions to ensure that air quality meets the NAAQS within a time frame determined under EPA regulations. In southern Nevada, responsibility for developing the SIP is delegated by the State of Nevada to Clark County. The Clark County Department of Air Quality and Environmental Management (DAQEM) is tasked with SIP development. Under the provisions of the CAAA, the RTC, as the MPO for the region, is the agency responsible for making the determination of conformity.

Much of these regulated pollutants is produced by automobiles and other road transportation, so are classified as “mobile source emissions”. Any RTP/TIP must include a determination that implementation will result in reduction of these pollutants to acceptable levels in ways that conform to the SIP. The term “conformity” describes the determination of this acceptable result. Supporting the determination is a complex modeling process that is based on assumptions about what happens if existing conditions are extended into the future and about what happens if the projects and programs in the RTP/TIP are implemented. A conforming RTP/TIP model outcome projects that the regulated pollutants will be reduced to acceptable levels within time frames that meet the NAAQS.

This Section outlines the complex technical evaluation process involved in the conformity demonstration. Descriptions of other aspects of the process are provided in the Appendices. Appendix I is a list of the projects included in the Travel Demand Model, Appendix II describes the methods used to forecast travel and resulting emissions and Appendix III details the Air Quality and Transportation Control Measures assumed in the Model.

5.1.2 Conformity Guidelines

RTC's Vision Statement is to provide *“a safe, clean, effective regional transportation system that enhances mobility and air quality for our citizens and visitors”*. To that end, the Commission has adopted the following goal for the transportation planning process:

> *“Implement transportation systems that improve air quality”*

The specific procedures for reaching this goal are those established under Federal law for ensuring conformity between transportation plans and air quality improvement plans. This process of conformity is intended to ensure that the projects and programs proposed in the RTP, TIP and TIP amendments conform to the purpose of the CAAA and the SIPs. This means *“...conformity to the (implementation) plan’s purpose of eliminating or reducing the severity and number of violations of the national ambient air quality standards and achieving expeditious attainment of such standards...”*. The provisions of the CAAA in relation to conformity are amplified in the US Environmental Protection Agency (EPA) Final Rule, 40 CFR Part 93, as amended September 15, 1997. The conformity determination described in this section was performed in accordance with US DOT and EPA guidance and procedures, and also in accordance with the Transportation Conformity SIP, *“Transportation Conformity Plan for the Las Vegas Valley Nonattainment Area”, Clark County Board of Commissioners, March 1999*. (See http://www.co.clark.nv.us/air_quality/sip_studies.htm for related studies.)

5.1.3 State Implementation Plans

The State Implementation Plan (SIP) is a federally required document that defines strategies to ensure the existing and future attainment of the National Ambient Air Quality Standards (NAAQS) as defined by the United States Environmental Protection Agency (EPA). For metropolitan planning organizations, like the RTC of Southern

Nevada, the SIP also establishes a mobile source emissions budget that is used in the evaluation of transportation plan conformity. A transportation plan is in conformance with the objectives of the SIP when the predicted tailpipe emissions from all travel, as defined in the long-range plan, is at or below the budget thresholds for all of the horizon years that comprise the RTP.

The Las Vegas area is in non-attainment for PM10, Carbon Monoxide, and ozone and has approved SIPs for PM10 and CO. On July, 9, 2004, the EPA granted approval of the PM10 SIP. In February of 2006, the Clark County Department of Air Quality and Environmental Management submitted a CO SIP Revision to the EPA approved CO SIP (November 2004) to reflect changes in the EPA modeling process for defining tailpipe emission and to revise the mobile source emission budgets accordingly. The EPA approved the 2006 CO SIP revision on August 7, 2006, with an effective date (date as which the budgets can be used for Conformity) of September 6, 2006.

The DAQEM is in the process of developing a SIP for ozone and expects to submit the Document to the EPA in the fall of 2007. In the meantime, the RTC will utilize the EPA approved "Action versus No-Build" test for defining conformity for this pollutant, as there is currently no approved mobile source emission budget or SIP.

5.1.4 Regional Emissions Analysis: Budgets for CO, PM_{10} and Ozone

The principal step toward making a conformity determination is to demonstrate that the anticipated levels of atmospheric pollution which will result from planned and programmed transportation projects will be less than the relevant budget defined in the State Implementation Plan. The CO SIP budgets for mobile source emissions are shown on Table 5-1:

Table 5-1: Mobile Source CO Emissions Budgets for the Las Vegas Valley

Year	CO Emissions Budget (tons per day)
2006	623
2010	690
2020	817
2030	881

Source: Clark County DAQEM, Carbon Monoxide Modeling and SIP Update, August 2005

For PM_{10}, the SIP budget established for 2003 to demonstrate reasonable further progress (RFP) towards attainment of the 24-hour standard, and the budget established for the attainment year of 2006 apply to the conformity determination and are set out in Table 5-2.

Table 5-2: Mobile Source PM10 Emissions Budgets for the Las Vegas Valley

Year	PM10 Emissions Budget (tons per day)
2003	155.77 (24-hour RFP)
2006	141.41 (24-hour standard)

Source: Clark County DAQEM

The DAQEM has yet to submit an O_3 SIP to the EPA. The O_3 SIP will include a mobile source emission budget for conformity. Prior to adequate or approved budgets, marginal and below areas may choose between two measures of conformity:

- The "build-no-greater than no-build" test, a test shows that forecasts of the levels of O_3 resulting from the planned projects and programs will be no worse than doing nothing, and
- The "no greater than 2002" test, a test shows that forecasts of the levels of O_3 will not be any worse than they were in 2002.

5.1.5 Regional Emissions Analysis: Horizon Analysis Years

Under Federal Regulations, conformity has to be determined for a series of "Horizon" years. These must include the designated attainment year, if applicable, and the last year of the Transportation Plan and they must be not more than 10 years apart. It has been normal RTC practice to also demonstrate conformity for the first year of the TIP - in this case 2006. For this conformity determination, the following horizon years are used: 2006 for CO and PM_{10}, 2008 for O_3 and 2010, 2020 and 2030 for all pollutants.

5.1.6 Transportation Control Measures

A second component of a conformity determination is an assessment of the progress in implementing TCMs. These measures are intended to reduce emissions or concentrations of pollutants from transportation sources by reducing vehicle use or otherwise reducing vehicle emissions.

As part of the conformity process, the RTC has to certify that TCMs identified in the SIPs are being implemented on schedule and that no federal funds are being diverted from these projects in such a way as to delay their timely implementation.

The scope and status of TCMs is further discussed in Section 5.9 with additional details provided in Appendix III.

5.1.7 Consultation on Conformity Procedures

The technical procedures used to determine the SIP budgets and to demonstrate conformity are developed in conjunction with local entities through the DAQEM Technical Advisory Committee (TAC).

DAQEM's TAC reports to the Executive Advisory Committee of the Clark County Board of Commissioners. This technical committee consists of staff representatives from Clark County, the RTC, the Cities of Boulder City, Henderson, Las Vegas and North Las

Vegas, and the NDOT, as well as members from industry and from the public. The DAQEM website is at http://www.co.clark.nv.us/air_quality/index.htm.

Consultation between local and Federal agencies is maintained through the inter-agency consultation procedures contained in the Transportation Conformity SIP, *"Transportation Conformity Plan for the Las Vegas Valley Nonattainment Area", Clark County Board of Commissioners, March 1999*. These procedures include periodic meetings of the Air Quality Conformity Working Group.

The Air Quality Conformity Working Group meets monthly and discusses a variety of topics related to air quality issues. It consists of representatives from each of RTC's member entities, in addition to representatives of the Federal Highway Administration, Federal Transit Administration, and the EPA. The main focus of these meetings is to avoid delay in the conformity process by coordinating air quality and conformity discussions.

5.1.8 Conformity Determination Technical Methodology

The calculation of mobile source emissions for each horizon year involves several steps, and these are described in the remaining sections of this chapter, as follows:

- The underlying assumptions regarding population and employment change in the region are outlined in Section 5.2.
- All regionally significant transportation projects, regardless of funding source, are included in the Travel Demand Forecast (TDF) model, which is then used to forecast vehicle miles of travel (VMT) and travel speeds in the region. A general overview of the modeling process, planning assumptions and resulting regional forecasts is given in Section 5.3, with more details of technical procedures offered in Appendix II.
- The Mobile 6.2 emissions model is then used to develop emission factors for CO that indicates how much pollutant is produced for each vehicle mile of travel. These factors are applied to the forecasts from the travel demand model to derive the modeled total of mobile source CO emissions. These procedures are discussed, and the results summarized, in Section 5.5.1 and Appendix III.
- The emissions benefit from TCMs is then subtracted from the modeled vehicle CO emissions to produce a forecast of net mobile source CO emissions, as described in Section 5.5.2.
- The procedures for establishing PM_{10} concentrations are described in Section 5.6.
- The procedures for establishing O_3 concentrations are described in Section 5.7.

The predicted net CO, PM_{10} and O_3 emissions that result from these procedures are then compared with the mobile source emissions budgets described above. The results are set out in Section 5.8, which concludes with the formal Finding of Conformity on the Transportation Improvement Program for FY 2006-2008.

5.2 Population and Employment Forecasts

5.2.1 Background

The key planning assumptions made as a foundation for the air quality emissions analysis and Conformity Finding relate to the projection of future land use, population and employment. These projections are used to determine future travel demand and travel patterns and the effect these will have on mobile source emissions.

The RTC does not have State legislative authority to develop the population and employment forecasts used in the travel demand forecasting and emissions analysis process. In accordance with inter-local agreement and established practice, the population and employment projections used in this analysis are based upon those developed for Clark County by the Center for Business and Economic Research at the University of Nevada, Las Vegas (CBER).

5.2.2 County and Regional Population Forecasts

The CBER forecasts are for Clark County as a whole, and the series used in this analysis were based upon 2003 data, published in February, 2004. These projections were updated on the basis of actual information for 2004, 2005, and early 2006.

The TDF model covers the area generally known as the Las Vegas Valley, comprising the Cities of Las Vegas, North Las Vegas and Henderson as well as those parts of unincorporated Clark County lying within the Bureau of Land Management Cooperative Land Sale and Exchange Area as designated by the Southern Nevada Public Land Management Act of 2002 displayed in Figure 1-4 as the BLM Disposal Boundary (2002). The Las Vegas Non-Attainment Area is defined as Hydrographic Basin 212, which is centered on the Las Vegas Valley. It includes bordering upland and mountain areas that are mostly uninhabited and that are held as open and recreational lands by various Federal and State agencies. The few settlements within these outlying areas have a total population of less than 2,000. In developing the CO SIP, it was agreed between the local air planning agency and the US EPA that it was acceptable to use the modeled area as a basis for estimating the mobile source emissions to be used in setting the mobile source emissions budget and in subsequent conformity determinations.

Most of the population in Clark County is concentrated in the Las Vegas Valley. Based upon analyses performed in the mid-1990s, it has been estimated that 95 percent of the population of the County lives within the valley. This percentage is embodied in a number of inter-local agreements by various agencies involved in planning activity, including Clark County's Planning Department, the School District, the RTC, the Southern Nevada Regional Planning Coalition and the Southern Nevada Water Authority, and it is, therefore, used to calculate the population control total for the Las Vegas Valley in the travel demand forecasting and air quality conformity process.

5.2.3 County and Regional Employment Forecasts

The future year land use forecast was created through the work of Southern Nevada Regional Planning Coalition (SNRPC) Land Use Workgroup (LUWG) with the members representing the cities of Las Vegas, North Las Vegas, Henderson, urbanized Clark County and the RTC. The Workgroup was formed to develop a consensus based process to define future land use development plans for the RTC's transportation planning process. Based on the available vacant land of the Assessor's 2003 closed roll parcel, the group created GIS data of planned land development using the RTC/SNRPC planned land use development definition. This future land use is in 5-year increments by jurisdiction covering the years from 2005 through 2035. Table 5-3 sets out the forecast developed acres for 2005 to 2030.

Table 5-3: Forecast Developed Acres, 2005-2030

Time Period	Forecast Growth Acres		
	Residential	Non-Residential	TOTAL
2005-2010	21,218	16,447	37,665
2010-2015	13,275	11,070	24,345
2015-2020	7,423	6,761	14,184
2020-2025	5,677	3,855	9,532
2025-2030	4,444	3,005	7,449
TOTAL	**52,037**	**41,138**	**93,175**

Source: Regional Transportation Commission, *Planning Variable Development and Methodology*, 2005

5.2.4 Zonal Forecasts

The projected population and employment totals are disaggregated into 1,209 internal Transportation Analysis Zones (TAZs) for input into the travel demand model. Projected changes in population and employment are allocated to the TAZs using an estimate of the available vacant land in each TAZ and information on the nature and phasing of development provided by LUWG.

5.2.5 Other Socio-Economic Data

In addition to total population and employment, the model utilizes certain other socio-economic indicators. These include dwelling units, average household income, school enrollment, and various classes of employment. The number of dwellings in each zone was estimated from land use data on the extent of residential land, using density and occupancy factors derived from the 2000 Census and local entity sources. Average household income and school enrollment were also developed from local sources. A detailed description of the methodology is provided in Appendix II.

5.3 Travel Demand Forecast Model Procedures and Assumptions

5.3.1 Background

The Las Vegas Regional Travel Demand Forecast Model follows established professional practice through the implementation of the "four step" process for forecasting vehicular travel demand. In the first step, trip generation, personal trip productions and attractions in each zone are calculated from the estimates of population, employment and other socio-economic variables discussed in Section 5.2. In the second step, trip distribution, these productions and attractions are associated with each other through algorithms that develop a pattern of zone-to-zone movements. In the third step, the estimates of personal travel are converted into a demand for vehicle trips based on estimates of transit ridership and average vehicle occupancy. In the final step, the demand for vehicle travel is assigned to the modeled street network to give estimates of traffic flow. Each of these steps is discussed in turn in later in this section.

The model calculations are performed using the TRANSCAD modeling software package developed by the Caliper Corporation of Newton, Massachusetts. Caliper converted the model from the TranPLAN software that had previously been used. The resulting model also incorporates Phase I of a series of improvements to model input data and procedures.

The Phase I improvements include:

- Refinement of the zone system to increase the number of zones from 751 to 1140 (1131 internal zones plus 9 external cordon stations),
- Addition of network links,
- Verification of roadway attribute data,
- Locating and coding of over 800 traffic count locations and 40 screen lines for use in model calibration,
- Use of trip rates developed from the 1996 household travel survey,
- Improved estimation of visitor trips using data from the 1996 visitor and airport surveys,
- New procedures to develop trip tables and assigned traffic flows by time-of-day, breaking the day into seven time periods,
- New “feed-back” procedures that improve the match between input and output speeds and
- Re-calibration.

The main input assumptions and results of these procedures are summarized below. Further information on several of the procedures is set out in Appendix II.

An important part of the model improvement process has been a regular program of inter-agency consultation among the RTC, local entities and the Nevada Department of Transportation (NDOT). This has been accomplished through the establishment of the Travel Demand Forecasting and Modeling Subcommittee (TDFMS). This formally constituted Subcommittee of the RTC meets monthly under the procedures of the Nevada Open Meeting Law. Many of the changes made have been discussed and refined through this process.

Phase 1a and update of package 1 of the model improvement process, which include a number of additional improvements to data and procedures, is complete by 2003 and is employed in this TIP and RTP development and air quality conformity determinations. The following table provides current RTC 2004 Model chronology and components.

Table 5-4: Model Chronology

Name of Model	Developer	Release Date	Software Platform	Calibration Year	# of TAZs	Features Utilized by RTC 2004 Model
Resort Corridor MIS Interim Mode Choice	Parsons Brinkerhoff Quade & Douglas	1995	Transplan	1995	751	Model structure and mode choice model
Las Vegas Travel Demand Model	Parsons Brinkerhoff Quade & Douglas	2000	Transplan	1995	1140	Visitor trip generation models; visitor distribution models; other trip marticies
RTC Las Vegas Phase I Model	Caliper Corporation	2002	TransCAD 4.0	2000	1140	Time of day distribution; highway skims; feedback looping
RTC Las Vegas Phase I Model Update	Caliper Corporation	2003	TransCAD 4.6	2000	1218	TAZ structure; employment planning variables; highway network; highway assignment; cold start flows and VMT
RTC Phase 1A Regional Travel Model	Parsons Corporation	2003	TransCAD 4.6	2000	1218	Household planning variables; highway network classification; resident socioeconomic submodels; resident trip generation models; resident trip distribution models; auto occupancy models
RTC 2004 Model (Update Package 1)	Parsons Corporation	2004	TransCAD 4.7	2002/2003	1219	Updated planning variables; updated highway networks; updated link capacities; added special generators; initialized travel times; updated time of day distributions; updated transit share matrix

Source: Parsons, RTC Regional Travel Demand Model, 2004

5.4 Transportation Analysis Zones

As noted in sub-section 5.2.4, the socio-economic data used in the model is disaggregated into 1209 internal Transportation Analysis Zones. Most of these are bounded by highway or other major streets, although railroads and natural barriers such as major washes are also used to define zone boundaries. Zones range from 0.25 to 0.5 sq. mile in much of the developed part of the region and often 1 sq. mile in the suburbs. There are a few larger zones in the outlying areas.

5.4.1 Base Year Model Networks

The travel demand modeling process begins with the identification of the streets and highways to be included in the network. The model network includes, at a minimum, all roads that are federally classified as collectors or above, as well as streets that are included in the consolidated Master Plan for Streets and Highways for the Las Vegas Valley. In total, the network of composed of 8,150 links. These cover approximately 1,200 route miles of roadway within the valley, as well as links representing the minor roads that connect zone centroids to the network, and roads leading into and out of the region. Table 5-5 summarizes the contents of the 2000 base year model network.

Table 5-5: Base Year Model Network Link Miles and Lane Miles by Roadway Type

Description	Link Miles	Route Miles (approx.)	Lane Miles
Interstates	133	66.5	382
Freeways	48	24	113
Expressways	23	11.5	41
Arterials	532	532	2173
Collectors & Local Roads	504	504	1442
Ramps	104		125
Centroid Connector Links	988		
External Links	68		193
TOTAL	**2400**	**1138**	**4469**

Source: Regional Transportation Commission, Travel Demand Model, 2004

5.4.2 Network Attributes

Each link in the network is defined by a number of attributes. The main ones are:

- Link length,
- Number of lanes, (*)
- Posted speed limits, (*)
- Roadway group,
- Area type,
- Free-flow speed,
- Capacity and
- Speed-capacity equation coefficients.

The attributes denoted by an asterisk are coded using a variety of sources, including geographic files maintained by the Clark County GIS Management Office (GISMO), survey photography, local entity records and field checking. Network roads are grouped into 11 facility types and four area types. These classifications are used to enter default values for other roadway attributes such as free-flow speed and capacity and also to summarize system performance.

The roadway facility types are based on generalized descriptions of the type of facility. They include:

- Interstates,
- Other freeways,
- High-Occupancy Vehicle (HOV) lanes,
- Expressways,
- Two classes of arterial roads,
- Collectors,
- Local roads,

- Other roads used by transit,
- Two classes of ramps,
- Zone centroid connector links and
- External cordon station connector links.

The four area types are:
- Central Business District of the City of Las Vegas,
- Resort Corridor,
- Other areas characterized by urban density and land use, and
- Suburban areas.

In the Phase I mode, free-flow speeds and capacities are set to default values for each facility type and area type. The values for free-flow speeds are set out in Table 5-6 and capacities in Table 5-7.

Table 5-6: Free-Flow Speeds

Functional Class	Free-Flow Speeds by Area Type			
	CBD	Resort	Urban	Suburban
System Ramps	40	40	51	53
Minor Arterials	31	31	36	41
Major Arterials	31	33	39	43
Ramps	15	25	28	36
Interstates	53	53	56	60
Freeways	51	51	54	59
Expressways	50	50	50	50
Collectors	29	29	33	39
Other	25	25	25	25
HOV	55	55	60	65

Source: Regional Transportation Commission, Travel Demand Model, 2004

Table 5-7: Free-Flow Capacities

Functional Class	Free-Flow Speeds by Area Type			
	CBD	Resort	Urban	Suburban
System Ramps	2,000	2,000	2,000	2,000
Minor Arterials	560	600	600	640
Major Arterials	700	750	750	800
Ramps	1,600	1,600	1,600	1,600
Interstates	2,000	2,000	2,000	2,000
Freeways	2,000	2,000	2,000	2,000
Expressways	925	925	925	925
Collectors	420	450	450	480
Other	416	416	416	416
HOV	1,950	1,950	1,950	1,950

Source: Regional Transportation Commission, Travel Demand Model, 2004

The speed-capacity equation coefficients are used in the assignment process to control the relationship between traffic flow, capacity and congested speed, using the procedures outlined in sub-section 5.3.11 below. The actual coefficients are developed as part of the model calibration process and reflect the observed characteristics of different types of roadway in the area.

5.4.3 Forecast Year Networks

The development of the future year networks begins with the identification and selection of "regionally significant" capacity-adding transportation projects that are proposed for inclusion in the RTP and TIP. The definition of regional significance is that contained in Section 2.2 of the RTCs *"Policies and Procedures"*, as amplified through the inter-agency consultative procedures laid down in the *"Transportation Conformity Plan for the Las Vegas Valley Nonattainment Area", Clark County Board of Commissioners, March 2005*, and in 40 CFR 93 S.93.101. All such projects are included in the model network, irrespective of funding source. Projects may involve the addition of new links to the network or the modification of attributes on existing model links. Projects are identified by location and attributes before being coded into the model network.

Projects are categorized by anticipated horizon year of completion, i.e., 2006, 2008, 2010, 2020 or 2030. Links in the base year network are added or modified and are defined as additions or changes to the system that will be operational in each horizon year. Alignments, design scope and attributes for new roads, and changes in the attributes of existing roads, are defined by NDOT and the local entities as part of the TIP process. Projects included in the model analysis are listed in Appendix I. Table 7-4 in Chapter 7 lists the all the projects that are included in the RTC Transportation Capital Program, and shows how they were classified for the purposes of modeling and aur quality analysis.

5.4.4 Trip Generation

Trip generation is the process of generating estimates of the person trips produced in, or attracted to, each zone. This is done through the application of trip generation rates which are applied to the zonal estimates of population and employment described in Section 5.2.

Trip rates for valley residents are based on the number of households in each zone, classified by the average zonal household income. In the Phase I model, the trip rates represent only those trips made in private vehicles or on transit. Walking and bicycle trips are excluded from the model. Trips made by commercial vehicles and taxis are estimated separately, as are all trips into and out of the region (see sub-section 5.3.9 below). Resident Person-Trip Rates were developed from a Household Travel Survey undertaken for the RTC in 1996. All trip rates are held constant for the forecast horizon years. Table 5-8 summarizes the total number of person trips generated. A full description of the method used to develop the trip rates is contained in Appendix II.

Table 5-8: Person-Trips in the Las Vegas Valley, 2005-2030

Trip Purpose	Average Weekday Person Trips					
	2005	2006	2008	2010	2020	2030
Home-Based Work	1,111,831	1,169,001	1,283,295	1,397,566	1,692,542	1,861,709
Home-Based School	428,273	450,642	495,375	540,111	661,027	735,476
Home-Based Shopping	515,127	541,605	594,569	647,535	784,195	862,139
Other Home-Based	2,173,397	2,285,224	2,508,963	2,732,803	3,309,467	3,645,193
Non-Home-Based	1,572,853	1,653,674	1,815,341	1,977,013	2,394,441	2,634,273
Total Resident Trips	**5,801,480**	**6,100,147**	**6,697,542**	**7,295,028**	**8,841,672**	**9,738,789**
Multi-Day Visitor Trips	750,107	781,015	842,829	904,643	1,139,232	1,254,396
Same-Day Visitor Trips	7,985	7,985	7,985	7,985	7,985	7,985
Total Visitor Trips	**758,092**	**788,999**	**850,814**	**912,628**	**1,147,217**	**1,262,381**
Total Person Trips	**6,559,572**	**6,889,147**	**7,548,356**	**8,207,656**	**9,988,888**	**11,001,170**

Source: Regional Transportation Commission, Travel Demand Model, 2004

5.4.5 Trip Distribution

RTC model distributes trips using a conventional gravity distribution algorithm. In this, zonal trip productions for each purpose are matched with trip attractions based on a computed probability function employing the travel time between zones. The two key elements in this process are the estimation of travel times using the model network, and the “Friction Factors” that define the probability function.

In line with present modeling practice, the Phase I model uses an estimate of travel times that seeks to ensure the times used for the trip distribution step correspond reasonably to those in the final model output. This is done by means of a feed-back loop that runs several iterations of the model and applies defined criteria as to the desired level of convergence between input and output speeds. This process is described in more detail in Appendix II.

The Friction Factors were derived using data on actual length of trips taken from the 1996 Household Travel Survey. These were compiled into a table of factors by trip length for each travel purpose. The Friction Factor Tables are set out in Appendix II which provides a more extensive description of the procedures used.

Tables 5.9a through 5.9f below present a summary of the travel demand model run results. For detailed explanation of trip purpose, please refer to 2004 RTC Travel Demand Model documentation in Appendix II.

Table 5-9a: 2005 Trip Distribution Summary

Trip Purpose	Average		Total	Trips within Same TAZ	
	Distance	Time	Trips	Number	Percent
Home-Based Work Income Group 1	7.88	17.70	90,045	293	0.32%
Home-Based Work Income Group 2	8.92	19.16	108,981	212	0.19%
Home-Based Work Income Group 3	9.63	20.04	272,698	587	0.22%
Home-Based Work Income Group 4	10.83	21.54	640,106	881	0.14%
Home-Based School	4.47	11.62	428,274	18,744	4.38%
Home-Based Shopping	5.02	12.65	515,127	8,799	1.71%
Home-Based Other	6.66	15.27	2,173,398	24,508	1.13%
Non-Home-Based	6.09	14.76	1,572,853	42,333	2.69%
Hotel-Based Convention	4.20	14.23	56,071	1,024	1.83%
Hotel-Based Business	6.67	17.69	16,832	72	0.43%
Hotel-Based Gaming	4.13	13.96	174,638	4,813	2.76%
Visitor Hotel-Based Other	4.37	14.13	180,122	4,313	2.39%
Visitor Non-Hotel-Based Other	4.46	14.11	76,244	1,898	2.49%
Non-Hotel Gaming	3.94	13.53	129,803	4,906	3.78%
Visitor Airport	6.70	20.36	102,092	-	0.00%
Resident Airport	11.59	25.92	14,304	-	0.00%
Airport-Based Business	8.38	22.03	4,368	-	0.00%
Airport-Based Other	7.61	20.55	1,083	-	0.00%
Non-Airport-Based Business	6.01	15.01	1,661	12	0.71%
Non-Airport-Based Other	4.45	14.13	873	20	2.28%

Table 5-9b: 2006 Trip Distribution Summary

Trip Purpose	Average		Total	Trips within Same TAZ	
	Distance	Time	Trips	Number	Percent
Home-Based Work Income Group 1	8.01	18.02	94,686	301	0.32%
Home-Based Work Income Group 2	9.08	19.54	114,571	217	0.19%
Home-Based Work Income Group 3	9.84	20.47	286,656	594	0.21%
Home-Based Work Income Group 4	11.03	21.95	673,087	895	0.13%
Home-Based School	4.63	11.84	450,642	19,143	4.25%
Home-Based Shopping	5.05	12.73	541,605	9,233	1.70%
Home-Based Other	6.76	15.50	2,285,225	25,198	1.10%
Non-Home-Based	6.18	14.98	1,653,674	44,031	2.66%
Hotel-Based Convention	4.16	14.31	58,410	1,074	1.84%
Hotel-Based Business	6.66	17.87	17,541	75	0.43%
Hotel-Based Gaming	4.07	14.03	182,346	5,097	2.80%
Visitor Hotel-Based Other	4.31	14.20	188,120	4,606	2.45%
Visitor Non-Hotel-Based Other	4.42	14.21	79,469	2,030	2.55%
Non-Hotel Gaming	3.89	13.59	135,875	5,096	3.75%
Visitor Airport	6.66	21.95	104,201	-	0.00%
Resident Airport	11.89	27.68	15,053	-	0.00%
Airport-Based Business	8.51	23.62	4,368	-	0.00%
Airport-Based Other	8.03	22.59	1,083	-	0.00%
Non-Airport-Based Business	6.04	15.13	1,661	12	0.70%
Non-Airport-Based Other	4.38	14.17	873	21	2.38%

Table 5-9c: 2008 Trip Distribution Summary

Trip Purpose	Average		Total	Trips within Same TAZ	
	Distance	Time	Trips	Number	Percent
Home-Based Work Income Group 1	8.26	18.59	103,974	326	0.31%
Home-Based Work Income Group 2	9.41	20.20	125,749	231	0.18%
Home-Based Work Income Group 3	10.26	21.23	314,568	624	0.20%
Home-Based Work Income Group 4	11.43	22.66	739,004	962	0.13%
Home-Based School	4.99	12.34	495,376	20,390	4.12%
Home-Based Shopping	5.18	12.96	594,569	10,252	1.72%
Home-Based Other	6.98	15.94	2,508,963	28,334	1.13%
Non-Home-Based	6.37	15.33	1,815,338	48,825	2.69%
Hotel-Based Convention	4.09	14.40	63,088	1,390	2.20%
Hotel-Based Business	6.67	18.09	18,958	101	0.53%
Hotel-Based Gaming	4.00	14.07	197,760	6,273	3.17%
Visitor Hotel-Based Other	4.23	14.22	204,116	5,776	2.83%
Visitor Non-Hotel-Based Other	4.37	14.25	85,919	2,410	2.80%
Non-Hotel Gaming	3.82	13.61	148,017	5,804	3.92%
Visitor Airport	6.80	23.71	108,418	-	0.00%
Resident Airport	12.49	29.89	16,551	-	0.00%
Airport-Based Business	8.83	25.60	4,368	-	0.00%
Airport-Based Other	8.60	24.59	1,083	-	0.00%
Non-Airport-Based Business	6.11	15.33	1,661	11	0.69%
Non-Airport-Based Other	4.28	14.16	873	24	2.72%

Table 5-9d: 2010 Trip Distribution Summary

Trip Purpose	Average		Total	Trips within Same TAZ	
	Distance	Time	Trips	Number	Percent
Home-Based Work Income Group 1	8.45	19.16	113,260	354	0.31%
Home-Based Work Income Group 2	9.65	20.88	136,919	247	0.18%
Home-Based Work Income Group 3	10.55	22.00	342,435	665	0.19%
Home-Based Work Income Group 4	11.68	23.41	804,951	1,057	0.13%
Home-Based School	5.29	12.83	540,111	22,221	4.11%
Home-Based Shopping	5.24	13.13	647,535	11,481	1.77%
Home-Based Other	7.10	16.31	2,732,801	32,823	1.20%
Non-Home-Based	6.46	15.71	1,977,012	56,065	2.84%
Hotel-Based Convention	4.02	14.76	67,766	1,611	2.38%
Hotel-Based Business	6.60	18.64	20,376	110	0.54%
Hotel-Based Gaming	3.88	14.36	213,175	7,547	3.54%
Visitor Hotel-Based Other	4.11	14.51	220,112	7,098	3.22%
Visitor Non-Hotel-Based Other	4.25	14.51	92,369	2,998	3.25%
Non-Hotel Gaming	3.70	13.85	160,160	6,678	4.17%
Visitor Airport	6.73	26.75	112,636	-	0.00%
Resident Airport	12.83	33.35	18,049	-	0.00%
Airport-Based Business	8.95	28.82	4,368	-	0.00%
Airport-Based Other	8.95	27.89	1,083	-	0.00%
Non-Airport-Based Business	6.10	15.56	1,661	12	0.71%
Non-Airport-Based Other	4.12	14.37	873	28	3.21%

Table 5-9e: 2020 Trip Distribution Summary

Trip Purpose	Average		Total	Trips within Same TAZ	
	Distance	Time	Trips	Number	Percent
Home-Based Work Income Group 1	9.19	20.78	136,916	487	0.36%
Home-Based Work Income Group 2	10.53	22.71	165,827	334	0.20%
Home-Based Work Income Group 3	11.51	23.96	414,861	879	0.21%
Home-Based Work Income Group 4	12.47	25.03	974,937	1,434	0.15%
Home-Based School	5.58	13.41	661,027	29,104	4.40%
Home-Based Shopping	5.08	13.01	784,194	20,914	2.67%
Home-Based Other	7.34	16.89	3,309,465	47,206	1.43%
Non-Home-Based	7.03	16.92	2,394,441	71,951	3.00%
Hotel-Based Convention	3.98	15.85	84,299	1,996	2.37%
Hotel-Based Business	6.77	20.26	25,348	104	0.41%
Hotel-Based Gaming	3.85	15.46	266,455	9,869	3.70%
Visitor Hotel-Based Other	4.10	15.65	274,936	9,245	3.36%
Visitor Non-Hotel-Based Other	4.22	15.46	115,071	3,929	3.41%
Non-Hotel Gaming	3.66	14.84	200,853	8,187	4.08%
Visitor Airport	12.42	37.18	150,365	0	0.00%
Resident Airport	18.25	43.52	21,906	0	0.00%
Airport-Based Business	14.67	39.35	4,368	0	0.00%
Airport-Based Other	15.12	38.57	1,083	0	0.00%
Non-Airport-Based Business	6.36	16.24	1,661	13	0.80%
Non-Airport-Based Other	4.00	15.27	873	30	3.43%

Table 5-9f: 2030 Trip Distribution Summary

Trip Purpose	Average		Total	Trips within Same TAZ	
	Distance	Time	Trips	Number	Percent
Home-Based Work Income Group 1	9.42	22.16	148,389	598	0.40%
Home-Based Work Income Group 2	10.88	24.45	181,133	398	0.22%
Home-Based Work Income Group 3	12.02	26.12	455,369	977	0.21%
Home-Based Work Income Group 4	12.81	27.02	1,076,818	1,751	0.16%
Home-Based School	5.75	14.61	735,476	31,832	4.33%
Home-Based Shopping	5.19	13.87	862,139	26,736	3.10%
Home-Based Other	7.42	17.88	3,645,192	59,712	1.64%
Non-Home-Based	7.42	18.43	2,634,271	83,625	3.17%
Hotel-Based Convention	4.00	16.59	90,536	2,286	2.53%
Hotel-Based Business	6.57	21.05	27,242	127	0.47%
Hotel-Based Gaming	3.79	16.04	284,910	11,677	4.10%
Visitor Hotel-Based Other	4.03	16.26	294,484	11,088	3.77%
Visitor Non-Hotel-Based Other	4.08	15.93	123,389	5,052	4.09%
Non-Hotel Gaming	3.52	15.25	214,451	10,025	4.67%
Visitor Airport	18.71	45.44	195,406	-	0.00%
Resident Airport	24.11	52.38	23,979	-	0.00%
Airport-Based Business	20.69	47.64	4,368	-	0.00%
Airport-Based Other	20.81	46.59	1,083	-	0.00%
Non-Airport-Based Business	6.37	16.65	1,661	21	1.24%
Non-Airport-Based Other	3.84	15.66	873	36	4.09%

5.4.6 Mode Split

In the travel models for the Las Vegas Valley, district-to-district mode split factors are applied to trip tables resulting from the trip distribution step to estimate person trips by transit and person trips by auto. Auto occupancy factors are then applied to convert person trips made in automobiles to vehicle trips for traffic assignment. For the RTC 2004 travel models, aggregate auto occupancy models were developed. These models accounted for differing characteristics of production zones.

The RTC 2004 auto occupancy models do not account for trip interchange characteristics such as travel time savings on HOV lanes or trip attraction zone characteristics, such as parking cost or special carpool parking preferences. Such characteristics might be taken into account when a mode choice model is developed or adopted for the region.

5.4.7 Vehicle Occupancy and Other Trips

The nested logit mode split model that is being developed will include a component for estimating single-occupant and multi-occupant vehicle trips. In the Phase I model, the calculation of the number of vehicle trips starts with the estimate of person trips summarized in Table 5-8. Zone-to-zone transit trips are subtracted to give the number of persons traveling in autos. This is then turned into an estimate of auto trips through the application of vehicle occupancy rates derived from an earlier household survey. The rates set out in Table 5-10 are held constant for all forecast horizon years. Note that the term “auto” in this context includes light trucks and vans used for personal travel as well as passenger cars.

Table 5-10: Vehicle Occupancy Rates

Travel Purpose	Average Vehicle Occupancy (Persons per Vehicle)
Home-Based Work	1.06
Home-Based School	1.23
Home-Based Shopping	1.43
Other Home-Based	1.70
Non-Home-Based	1.53
Overall Average	**1.39**

Source: Regional Transportation Commission, Travel Demand Model, 2004

As noted in paragraph 5.3.6, the calculation of person trips uses trip rates that reflect only personal travel trips made entirely inside the region. Trips not included are ones into and out of the region and through trips that cross the region. Projections of total vehicle travel include these and commercial trips made by trucks, buses and taxis.

The model network includes nine cordon stations on roads crossing the regional boundary which are connected to the rest of the network by external connector links. Total traffic passing these cordon stations in the base year is controlled to observed traffic count data. Projections of external trips and the distribution of the local end of those trips have been developed jointly with NDOT through the inter-agency consultative process.

Commercial vehicle trips, including light delivery and service trips as well as truck trips, are separately forecasted and distributed as are taxi trips. These projections are added to the number of auto trips to give total vehicle trips summarized in Table 5-11.

Trips by buses are not included in the Phase I model; the VMT associated with these trips is added into the process at a later stage. Appendix II provides more detailed discussion on the travel demand model.

Table 5-11: Vehicle Trips in the Las Vegas Valley, 2005-2030

Trip Purpose	Average Weekday Vehicle Trips					
	2005	2006	2008	2010	2020	2030
Auto Trips	4,465,602	4,696,208	5,156,575	5,616,529	6,798,258	7,499,605
External Trips	159,738	171,941	191,504	199,445	239,153	278,860
Truck Trips	183,137	183,184	209,974	227,865	299,642	340,631
Taxi Trips	192,944	197,681	207,155	216,630	285,565	363,664
Total Vehicle Trips	**5,001,421**	**5,249,014**	**5,765,208**	**6,260,470**	**7,622,618**	**8,482,760**

Source: Regional Transportation Commission, Travel Demand Model, 2004

5.4.8 Time-of-Day Analysis and Trip Balancing

Trip generation and all subsequent steps are performed for each resident, visitor or “other” travel purpose and are defined in terms of desire for movement between zones of production and zones of attraction. Before assigning trips to the model network, the trips have to be converted into origin-destination format.

In a related process, average daily vehicle trips for each purpose are distributed across seven time periods. These periods were defined through the inter-agency consultative process and are based on the observed distribution of traffic flow as shown by continuous traffic counts. The periods are:

- From midnight to 7 a.m. (7 hours),
- From 7 to 9 a.m. (2 hours),
- From 9 a.m. to 2 p.m. (5 hours),
- From 2 to 4 p.m. (2 hours),
- From 4 to 6 p.m. (2 hours),
- From 6 to 8 p.m. (2 hours) and
- From 8 p.m. to midnight (4 hours).

Both processes use a set of tables that give, for each travel purpose, the proportion of daily trips that start or return in each time period. These tables, and the detailed procedures used, are set out in Appendix II.

5.4.9 Network Trip Assignment

An equilibrium highway assignment process is used to load zone-to-zone vehicle trips on to specific roadway paths through the network. Trips are assigned to paths between zones based on computed travel times that take into account the relationships among traffic flow, free-flow speed, roadway capacity and congested (or "loaded") speed and travel time. The formula used is a modification of the Bureau of Public Roads (BPR) formula for computing the decrease in speed as roads approach congested volumes. The coefficients in the formula have been developed from the *Highway Capacity Manual* and modified through the model calibration process to reflect local conditions. Additional documentation of the assignment process is described in Appendix II.

The assignment is performed for each of the seven time periods. Results are then aggregated to produce daily traffic flows on each link in the network. The following tables present summaries of the unadjusted modeled forecasts for the Valley.

Table 5-12a: 2005 Trip Assignment Summary

Road Type	Daily VMT	Total Daily Flow	Average Daily Speed
External Links	522,147	198,940	21.74
System to System Ramps	257,457	1,268,450	46.35
Minor Roads	4,431,082	23,811,218	33.69
Major Roads	13,908,661	77,675,208	34.59
Ramps	1,047,686	5,977,272	30.78
Interstates	8,810,725	20,158,753	48.81
Freeways	2,622,572	11,572,938	49.77
Expressways	506,379	1,297,732	45.18
Collectors	2,583,594	11,411,673	32.74
Centroid Connectors	2,735,152	9,630,396	25.00
Local Roads	15,469	246,719	15.87
Total	**37,440,924**	**163,249,299**	

Table 5-12b: 2006 Trip Assignment Summary

Road Type	Daily VMT	Total Daily Flow	Average Daily Speed
External Links	544,602	211,465	21.74
System to System Ramps	290,492	1,356,728	46.11
Minor Roads	4,833,839	25,413,239	33.65
Major Roads	14,420,022	80,337,195	34.39
Ramps	1,083,136	6,262,367	31.00
Interstates	9,418,598	21,514,684	48.29
Freeways	3,108,907	12,804,594	49.62
Expressways	450,206	961,542	48.50
Collectors	2,841,157	12,516,609	32.60
Centroid Connectors	2,922,464	10,107,402	25.00
Local Roads	15,144	251,135	15.56
Total	**39,928,566**	**171,736,960**	

Table 5-12c: 2008 Trip Assignment Summary

Road Type	Daily VMT	Total Daily Flow	Average Daily Speed
External Links	607,755	235,037	21.74
System to System Ramps	341,568	1,940,164	44.72
Minor Roads	5,439,127	28,587,887	32.93
Major Roads	15,356,117	84,915,746	33.86
Ramps	1,234,124	7,150,332	31.16
Interstates	10,529,327	23,789,637	47.27
Freeways	4,567,426	15,901,378	52.28
Expressways	198,762	554,680	48.32
Collectors	3,310,084	14,382,993	32.16
Centroid Connectors	3,255,261	11,094,648	25.00
Local Roads	15,271	256,760	15.49
HOV	243,363	1,412,699	53.83
Total	**45,098,185**	**190,221,961**	

Table 5-12d: 2010 Trip Assignment Summary

Road Type	Daily VMT	Total Daily Flow	Average Daily Speed
External Links	631,693	245,873	21.74
System to System Ramps	356,470	2,322,862	42.90
Minor Roads	6,100,189	31,325,102	32.52
Major Roads	16,623,022	90,735,972	33.17
Ramps	1,355,581	7,813,118	31.10
Interstates	11,359,075	26,139,524	46.65
Freeways	5,395,363	18,210,980	51.92
Expressways	193,598	510,134	48.17
Collectors	3,498,212	14,938,529	31.66
Centroid Connectors	3,581,532	12,072,565	25.00
Local Roads	15,632	264,678	14.60
HOV	486,752	2,563,426	52.49
Total	**49,597,119**	**207,142,763**	

Table 5-12e: 2020 Trip Assignment Summary

Road Type	Daily VMT	Total Daily Flow	Average Daily Speed
External Links	789,029	323,437	21.74
System to System Ramps	535,554	3,422,368	46.86
Minor Roads	8,695,678	40,626,076	32.10
Major Roads	19,182,320	102,453,567	32.20
Ramps	1,716,600	10,327,193	30.84
Interstates	15,700,354	36,547,172	47.47
Freeways	7,464,694	24,354,863	51.08
Expressways	7,652	74,546	40.83
Collectors	4,146,492	17,196,009	30.05
Centroid Connectors	4,693,489	14,604,471	25.00
Local Roads	15,818	303,221	12.31
HOV	1,160,461	4,734,450	51.82
Total	**64,108,141**	**254,967,373**	

Table 5-12f: 2030 Trip Assignment Summary

Road Type	Daily VMT	Total Daily Flow	Average Daily Speed
External Links	957,758	410,073	21.74
System to System Ramps	596,490	3,687,417	45.75
Minor Roads	10,596,263	47,290,460	31.04
Major Roads	20,900,273	110,261,393	30.89
Ramps	1,885,604	11,284,974	30.30
Interstates	19,148,610	42,803,507	44.81
Freeways	8,208,423	26,259,031	49.76
Expressways/Beltways	12,316	110,630	29.76
Collectors	4,682,685	19,020,316	29.18
Centroid Connectors	5,448,182	16,187,708	25.00
Local Roads	16,854	323,539	11.44
HOV	1,173,322	4,780,195	50.53
Total	**73,626,781**	**282,419,243**	

Source: Regional Transportation Commission, Travel Demand Model, 2004

5.4.10 Calibration

An important aspect of the development of the travel demand model is the calibration and validation of the model against observed traffic conditions. The procedures and measures used, as well as the validation results, are contained in Appendix II. Based upon these, the 2004 RTC model has been judged to be acceptable for regional analysis. This was reflected in the decision of the RTC to adopt the Phase I model for use in this TIP and conformity analysis.

5.4.11 Travel Forecasts

The VMT in Table 5-13 is the travel assigned to the model network. In addition there are two elements of travel not included in the network modeling. These are intra-zonal trips and transit vehicle trips.

The first is computed by applying an intra-zonal trip length to the intra-zonal trips tabulated in the trip table but not assigned to the network. Since TRANSCAD does not have a procedure for calculating this length, a default length of one mile has been used, based on the fact that nearly all zones in the model are no more than one square mile in area. Transit vehicle trips and trip lengths are obtained from RTC transit operations statistics.

Table 5-13: Summary of Forecast VMT by Estimated Travel Speed

Speed Range	Vehicle Miles Traveled									
	2003	2005	2006	2007	2009	2010	2015	2020	2025	2030
Average Speed :greater than 75 mph	1,683,700	1,793,269	1,848,054	1,902,838	2,012,408	2,067,192	2,341,115	2,615,038	2,888,962	3,162,885
Average Speed: 70 to 75 mph	650,900	692,313	713,020	733,726	775,140	795,846	899,379	1,002,912	1,106,445	1,209,978
Average Speed: 60 to 70 mph	374,400	394,399	411,407	424,543	450,814	470,950	543,628	609,306	674,985	775,663
Average Speed: 55 mph	277,500	293,471	301,956	310,441	329,412	337,897	376,324	416,751	459,177	501.604
Average Speed: 50 mph	101,000	104,169	105,754	107,338	110,508	112,092	120,015	127,938	135,862	143,785
Average Speed: 45 mph	194,050	203,569	207,928	212,288	222,007	227,366	253,163	278,960	304,757	330,554
Average Speed: 40 mph	85,600	88,431	89,846	91,262	94,092	95,508	102,585	109,662	116,738	123,815
Average Speed: 35 mph	205,049	210,706	212,374	216,374	222,041	225,624	240,055	255,986	271,916	287,847
Average Speed: 30 mph	37,272	38,495	39,980	39,980	40,722	42,207	45,507	48,807	52,107	55,407
Average Speed: 25 mph	31,625	32,662	33,922	33,922	35,182	35,812	38,612	41,412	44,212	47,012
TOTAL VMT	**3,641,096**	**3,851,484**	**3,963,283**	**4,072,713**	**4,292,325**	**4,410,494**	**4,960,384**	**5,506,773**	**6,055,161**	**6,638,550**

5.4.12 Vehicle Miles Traveled for Ozone Non-attainment Area

The 8-hour Ozone Non-attainment Area is larger than Las Vegas Regional Travel Demand modeling domain. The VMT outside the modeling area are calculated using available NDOT traffic counts. Table 5-13 displays the forecast VMT by estimated travel speed for the horizon years considered in this analysis (2006, 2007, 2009, 2010, 2015, 2020, 2025 and 2030). The VMT summarized in Table 5-13 is taken from the roadway network inside the Ozone Non-attainment boundary but outside of the RTC TDF model boundary. The 2003 VMT is also displayed. 2003 data was derived from NDOT traffic counts presented in the 2003 Annual Traffic Report.

The remaining paragraphs and tables in this section describe the steps used to create Table 5-13.

- **Table 5-13a: List of Roadway Corridors** – This table includes corridor endpoints, length, total lanes, and posted speed.

- **Table 1 (in Appendix II, part C): Historic Summary of AADTs** – This table lists the history of annual average daily traffic (AADT) as recorded in the NDOT Annual Traffic Report. AADTs, where available, are listed from 1990 to 2003. Also listed are the NDOT Count Station, segment length, and segment description. The change in AADT between the beginning and ending years is also listed.

- **Table 2 (in Appendix II, part C): Summary of Forecast AADTs (2005 to 2030)** – This table lists the forecast AADTs for the segments described in Table 1. Forecast AADTs are based on the data in Table 1 and planning and engineering judgment. This table also lists the annual change in AADT as derived from Table 1.

- **Table 3 (in Appendix II, part C): Summary of Forecast VMT and Average Speed (2005 to 2030)** – This table displays the forecast VMT for each segment listed in Table 1 and 2. VMT was calculated by multiplying the forecast AADT by the segment length. The average speed was estimated from data in NDOT's Annual Speed Monitoring Report. Where available, the speed monitoring station number is listed under the heading 'Speed Source'. If speed monitoring data is not available, the average travel speeds have been estimated. This dataset assumes that the average travel speed will not change on a segment during the 2005 to 2030 period.

- **Table 4 (in Appendix II, part C): Summary of Forecast VMT by Average Speed Classification (2005 to 2030)** – This table rearranges the data in Table 3 by assigning it to one of the following average speed classifications: greater than 75 mph, 70 to 75 mph, 60 to 70 mph, 55 mph, 50 mph, 45 mph, 40 mph, and 35 mph. Total VMT by speed classification and horizon year is listed.

Table 5-13a: List of Roadway Corridors

Corridor	Endpoints	Length (mi)	Lanes (both dir.)	Posted Speed
I-15 South	CA Stateline and TDF Model Boundary	25	4	70
I-15 North	TDF Model Boundary and Moapa/Glendale	33	4	75
US 95 South	CA Stateline and US 93 Interchange	62	2 to 4	70
US 95 North	TDF Model Boundary and Ozone Boundary	14	4	70
US 93 South	AZ Stateline and Boulder Beach	5	2	Varies
US 93 North	I-15 Interchange and Ozone Boundary	20	2	70
US 93/95	US 95/93 Interchange and TDF Model Boundary	5	4	65
SR 160	TDF Model Boundary and Ozone Boundary	12	2	70
SR 159	SR 160 and TDF Model Boundary	14	2	Varies
SR 157	US 95 and end of road at Mt. Charleston	21	2	Varies
SR 158	SR 157 and SR 156	7	2	Varies
SR 156	US 95 and end of road at Mt. Charleston	18	2	Varies
SR 163	US 95 and AZ Stateline	26	2 to 4	Varies
Casino Drive	Needles Highway and SR 163	13	2 to 4	Varies
Bruce Woodbury Drive	Needles Highway and Casino Drive	8	2	Varies
Davis Dam Road	SR 163 and Davis Dam	7	2	Varies
Needles Highway	CA Stateline and SR 163	13	2 to 4	Varies
SR 147	TDF Model Boundary and Ozone Boundary	2	2	65
SR 168	Ozone Boundary near Glendale	6	2	Varies
Valley of Fire Road	I-15 Interchange and Ozone Boundary	15	2	65
SR 161	I-15 Interchange and Ozone Boundary	12	2	70
SR 164	I-15 Interchange and Searchlight	20	2	70

In addition to VMT and speed estimates for the roadways listed in Table 5-13a, estimates of VMT and speed were made for travel on minor arterials, collectors and local streets in the cities of Boulder City, Laughlin, Searchlight, Blue Diamond, Cal-Nev-Ari, and Goodsprings. Estimates were based on VMT per person. Datasets from the 2004 Urban Mobility Report (http://mobility.tamu.edu/ums) were used to assist in the development of VMT per person for the cities listed above. It was assumed that all travel on interstates, freeways, expressways, and major arterials was captured in the itemized estimates summarized in Table 5-13a and the tables in Appendix II, part C. Therefore, the estimates summarized in Table 5-13c and 5-13e only cover travel on roadways classified as minor arterials, collectors, and locals.

These estimates were calculated using the steps listed below.

1. Population forecasts for the six cities were developed. They are summarized in Table 5-13b.

2. VMT per capita was estimated. This data is summarized in Table 5-13d.

Table 5-13b: Population Forecasts

City	2003	2005	2010	2015	2020	2025	2030
Boulder City	14,966	15,500	17,000	18,500	20,000	21,500	23,000
Laughlin	7,076	7,250	8,000	8,500	9,000	9,500	10,000
Searchlight	576	600	600	600	600	600	600
Blue Diamond	282	300	300	300	300	300	300
Cal-Nev-Ari	278	300	300	300	300	300	300
Goodsprings	232	250	250	250	250	250	250

Source: Regional Transportation Commission staff

Table 5-13c: Estimate of VMT Per Capita

City	VMT							
	per Capita	2003	2005	2010	2015	2020	2025	2030
Boulder City	5	74,830	77,500	85,000	92,500	100,000	107,500	115,000
Laughlin	5	35,380	36,250	40,000	42,500	45,000	47,500	50,000
Searchlight	2	1,152	1,200	1,200	1,200	1,200	1,200	1,200
Blue Diamond	2	564	600	600	600	600	600	600
Cal-Nev-Ari	2	556	600	600	600	600	600	600
Goodsprings	2	464	500	500	500	500	500	500

Source: Texas Transportation Institute, Urban Mobility Study

According to ***Flexibility in Highway Design***, **Chapter 3, Functional Classification** (http://fhwa.dot.gov/environment/flex/ch03.htm), travel on minor arterials, collectors, and local roads account for 46.7 percent of average daily travel on US roadways. These VMTs were then disaggregated to minor arterials, collectors, and locals using factors listed in Table 5-13d which were derived from Flexibility in Highway Design and the RTC TDF Model.

Table 5-13d: Summary of Percent VMT and Average Speed for Minor Arterials, Collectors, and Local Roadways

Roadway Type	Percent VMT	Speed (mph)
Minor Arterial	39	35
Collector	33	30
Local	28	36

The data in Table 5-13d was then used to develop the VMT by average speed values in Table 5-13e.

Table 5-13e: Summary of Forecast VMT by Speed on Minor Arterials, Collectors, and Local Roads

Place/Roadway Type (Average Speed)	VMT						
	2003	2005	2020	2015	2020	2025	2030
Boulder City							
Minor Arterials (35 mph)	29,184	30,225	33,150	36,075	39,000		
Collectors (30 mph)	24,694	25,575	28,050	30,525	33,000	35,475	37,950
Locals (25 mph)	20,952	21,700	23,800	25,900	28,000	30,100	32,200
Laughlin							
Minor Arterials (35 mph)	13,798	14,138	15,600	16,575	17,550		
Collectors (30 mph)	11,675	11,963	13,200	14,025	14,850	15,675	16,500
Locals (25 mph)	9,906	10,150	11,200	11,900	12,600	13,300	14,000
Searchlight							
Minor Arterials (35 mph)	449	468	468	468	468	468	468
Collectors (30 mph)	380	396	396	396	396	396	396
Locals (25 mph)	323	336	336	336	336	336	336
Blue Diamond							
Minor Arterials (35 mph)	220	234	234	234	234	234	234
Collectors (30 mph)	186	198	198	198	198	198	198
Locals (25 mph)	158	168	168	168	168	168	168
Cal-Nev-Ari							
Minor Arterials (35 mph)	217	234	234	234	234	234	234
Collectors (30 mph)	183	198	198	198	198	198	198
Locals (25 mph)	156	168	168	168	168	168	168
Goodsprings							
Minor Arterials (35 mph)	181	195	195	195	195	195	195
Collectors (30 mph)	153	165	165	165	165	165	165
Locals (25 mph)	130	140	140	140	140	140	140
TOTAL							
Minor Arterials (35 mph)	44,049	45,494	49,881	53,781	57,681	61,581	65,481
Collectors (30 mph)	37,272	38,495	42,207	45,507	48,807	52,107	55,407
Locals (25 mph)	31,625	32,662	35,812	38,612	41,412	44,212	47,012

Source: Regional Transportation Commission

5.4.13 Travel Forecast Corrections

A series of corrections and adjustments are made to the modeled forecasts of travel before they are used as a basis for estimating mobile source emissions.

The first set of adjustments involves correcting for errors observed when assigned traffic volumes on the 2000 base year network are compared with traffic counts. NDOT and the local entities have an extensive program of traffic counts and over 800 count locations are coded into the base year network. These counts are classified according to roadway group. The aggregate modeled volume at count locations in each facility type is compared with the corresponding counts to produce an overall percentage error for count locations in that facility type. This error is then expressed as a correction factor that is then applied to the VMT for all links in that group. Table 5-14 lists these comparisons and correction factors.

Table 5-14: Correction to Base Year Ground Counts

Facility Type	Number of Count Stations	Aggregate Model Flow	Aggregate Count Flow	Conversion Factor
External Links	9	112,727	102,602	0.9102
System Ramps	13	134,836	196,481	1.4572
Minor Arterials	141	2,049,854	2,003,566	0.9774
Major Arterials	422	12,859,299	12,175,368	0.9468
Ramps	160	1,147,781	1,220,426	1.0633
Interstates	74	3,867,929	3,884,533	1.0043
Freeways	31	1,407,451	1,572,015	1.1169
Expressways/Beltways	1	50,123	46,475	0.9272
Collectors	114	698,328	819,954	1.1742

This step results in link volumes and VMT that are corrected to observed volumes. In accordance with Federal guidance, this corrected model VMT is then benchmarked against the base year VMT from the Highway Performance Monitoring System (HPMS).

The system-wide correction factor used to control the corrected model VMT to the 2000 HPMS is calculated in two steps. Firstly, total Annual VMT (AVMT) from the HPMS for the 1995 Urbanized Area is converted into Annual Average Weekday VMT (AAWDVMT). Second, an estimate is made of the corrected model AAWDVMT that occurs outside the 1995 Urbanized Area boundary. This is the subtracted from the corrected model total before the latter is compared with the HPMS to develop a HPMS correction factor for the 1995 Urbanized Area. This factor is then applied to the entire system in the model to derive corrected and benchmarked base year VMT.

The process is summarized as follows.

- Year 2000 HPMS Annual VMT for the 1995 Urbanized Area: 8,874,521,000
- Year 2000 HPMS Annual Average Daily VMT: 24,314,000
- Year 2000 HPMS Annual Average Weekday VMT: 25,066,000

- Year 2000 Model AAWDVMT for the Las Vegas Valley: 23,982,404
- Year 2000 AAWDVMT corrected to counts: 25,335,327
- Year 2000 Estimated AAWDVMT outside 1995 Urbanized Area: 627,791
- Year 2000 AAWDVMT in 1995 Urbanized Area: 24,707,536

- Year 2000 HPMS correction factor for 1995 UZA: 1.0145
- Year 2000 HPMS adjusted AAWDVMT for the Las Vegas Valley: 25,066,000

The correction and HPMS factors are applied to all future horizon years, so that the emissions for each year are calculated using the modeled growth in VMT based upon a corrected and HPMS adjusted 2000 base.

5.4.14 Travel Forecast Seasonal Adjustments

The corrected and HPMS adjusted AAWDVMT is then adjusted to reflect the winter and summer conditions that are characteristic of peak CO emissions and O_3 emissions respectively. This involves two factors. The first is a seasonal adjustment from AAWDVMT to December average weekday VMT. 2004 NDOT continuous traffic counts are employed to calculate this factor (0.969). The summer seasonal adjustment factors are calculated using the average of June, July and August ADT. Table 5-15 shows the factors. There are no significant differences in seasonal traffic patterns across the various roadway functional classes, so the same factor is applied equally to all modeled VMT. The 2004 seasonal adjustment factor is also held constant for all future horizon years.

Table 5-15: Seasonal Adjustment Factors

Summer adjustment factor	1.021711371
Winter adjustment factor	0.969123638

Source: NDOT, Hourly Counts, 2004

5.5 Carbon Monoxide Mobile Source Emissions Forecasts

5.5.1 Mobile Source CO Emissions

Mobile source emissions for CO are calculated by using emission factors developed through the Mobile6.2 emissions model. These emission factors are the average emissions per vehicle-mile for a particular speed of travel, as determined by the EPA. The settings used in the Mobile6.2 model were developed in cooperation with the Clark County Department of Air Quality Management, and are similar to those used in the development of the CO SIP.

The Mobile6.2 model takes into consideration the effects of the different emissions from various vehicle types, such as passenger vehicle, light truck, heavy truck and motorcycle, as well as the effect of the mix of gasoline-powered and diesel-powered vehicles.

Specific input settings define the following factors for each forecast horizon year:

- Fleet mix composition,
- Mileage accumulation rates by vehicle type and age,
- Vehicle registration rates by vehicle type and age,
- Impact of inspection/maintenance programs,
- Impact of anti-tampering programs,
- Impact of refueling controls,
- Reid vapor pressure of fuel,
- Daily minimum, maximum and ambient temperatures,
- Oxygen content of fuel and
- Vehicle speed.

A more detailed breakdown of the Mobile6.2 program input and output settings are presented in Appendix II.

1) The link-specific emissions calculation is performed based on the procedure outlined in the 2005 CO SIP (see Appendix III);
2) Adjust the daily volumes to hourly volumes;
3) Adjust the link speeds using the hourly volume to capacity ratio in the BPR curve;
4) Calculate the hourly link VMT as the hourly volume times the link length;
5) Calculate the link emissions as the link VMT times the MOBILE6.2 composite emission factor for the link roadway type, hour, and adjusted link speed;
6) Adjust the emissions to average December day, by HPMS factor, count-to-model volume factor, growth factor and transit factor.

The emissions for each facility type are then summed to give the modeled mobile source emissions for each year, as shown in Table 5-16.

Table 5-16: 2006-2030 CO Emissions Summary

Facility Type	Total CO Emissions (tons/day)			
	2006	**2010**	**2020**	**2030**
External	4.59	4.48	4.32	5.06
System-to-system Ramp	5.82	5.66	6.15	6.58
Minor Arterial	46.20	48.12	52.43	59.31
Major Arterial	133.54	127.28	113.68	118.80
Ramp	15.68	15.56	14.55	15.42
Interstate	99.15	99.26	105.45	124.78
Freeway	37.13	53.36	55.23	58.68
Expressway	4.21	1.49	0.04	0.06
Collector	31.67	32.31	32.88	38.00
Centroid	31.08	32.02	31.80	34.75
Local	0.16	0.14	0.12	0.12
HOV	0.00	4.92	9.04	8.79
TOTAL	**409.22**	**424.60**	**425.69**	**470.35**
Budget	**623.00**	**690.00**	**817.00**	**881.00**

Source: Clark County Carbon Monoxide Modeling and SIP Update, October, 2005, DAQEM

5.5.2 Transportation Control Measures

Modeled mobile source CO emissions are reduced through the application of TCMs as defined in the State Implementation Plan. Appendix III contains a full discussion of the derivation and effectiveness of control measures. Table 5-17 summarizes the primary CO control measures discussed in the appendix, together with the predicted emissions. Under EPA's emission model - Mobile 6, the TCM factors and the emission reduction are included in the input file 'setup', instead of the TCM's being subtracted from the total emission output, as was the case in the previous RTP conformity analysis that applied Mobile 5.

Table 5-17: Primary CO Control Measures and Benefits

Control Measure	CO Benefit							
	2006		2010		2020		2030	
	Tons/ day	%	Tons/ day	%	Tons/ day	%	Tons /day	%
Base Emissions	419.21	--	440.31	--	453.98	--	500.87	--
Technician Training	10.42	2.48	15.71	3.56	23.89	5.26	25.30	5.05
Base Less Tech Training	408.79	N/A	424.60	N/A	430.09	N/A	475.57	N/A
CBG	31.92	7.61	37.48	8.51	37.25	--	40.38	8.06
Alternative Fuels	0.42	0.10	0.42	0.10	1.37	0.30	1.63	0.32
TCM/TDM	0.30	0.07	0.30	0.30	2.33	0.51	3.26	0.65
Total Reduction	43.06	--	56.13	--	64.84	--	70.57	
Reduction from Non-I/M Programs	32.06	9.52	46.42	9.52	40.95	9.52	45.27	9.52

5.5.3 Calculation of Net CO Emissions

Modeled mobile source CO emissions are reduced through the application of credits for the various Transportation Control Measures. The first of these measures - technician training - is related to the Vehicle Inspection and Maintenance Program, and the effect of this program is included in the emissions modeling process through the application of the relevant Mobile 6 input settings (see Appendix II).

The other TCM's have the effect of reducing emissions below the level predicted through the modeling process. Based on the information supplied by the DAQEM and summarized in Table 5-17, reduction factors are included in the CO input setup file, meaning that the credit for the reduction as a result of applying the above factors are taken within the Mobile 6 modeling of the travel output from the RTC' travel demand model.

Table 5-18: CO Emissions Reductions Due to Transportation Control Measures

	Emissions in Tons Per Day			
	2006	2010	2020	2030
Modeled CO Emissions	409.23	424.60	425.69	470.35
TCM's credited in Model setup	n/a	n/a	n/a	n/a
Net CO Emissions	**409.23**	**424.60**	**425.69**	**470.35**

5.6 PM10 Modeling Assumptions

5.6.1 Transportation Activities Contribution to PM_{10} Emissions

According to the 2001 PM_{10} SIP, over 37 percent of the Las Vegas Valley's dust emissions are related to transportation activities; 26 percent of the PM_{10} emissions are linked to travel on paved roads and 9 percent can be attributed to travel on unpaved roads. While the inventory process has correctly characterized the problem, it is beneficial to review the primary sources of PM_{10} to understand how control regulations for construction will reduce future emissions and help to demonstrate positive air quality conformity.

The paved roadway network itself is not directly responsible for emissions. Rather, fugitive dust originating from construction activities and disturbed vacant land are the primary contributors. Wind and construction “track out” deposit dust on roads and the movement of vehicles traveling over the pavement re-entrains the dust into the air, which contributes to the regional PM_{10} emission problem. Paved road emissions also include a category of streets where the paved surface does not exceed 28 feet in width and are classified as streets with “unpaved shoulders”. The idea is that, due to the narrow paved width, vehicles often travel onto the shoulders and track dust back onto the paved surface, contributing to the regional PM_{10} emissions.

On the other hand, when vehicles travel over unpaved roads they directly disturb the surface and create PM_{10} emissions, which also contribute to the regional PM_{10} problem at a rate of about 9 percent of the total. In addition to PM_{10} emissions linked to travel on paved and unpaved roads, there are several other PM_{10} emission sources that must be accounted for within the transportation conformity process. These include:

- Vehicular exhaust,
- Vehicular brake wear,
- Vehicular tire wear and
- Road construction.[1]

5.6.2 PM_{10} Emission Budgets for the Annual and the 24 Hour NAAQS

As noted in Section 5.1.4, the SIP budgets provide a stepped approach to achieving the NAAQS for PM_{10}, with 2003 attainment budget for the annual standard and a 2006 budget for the 24-hour standard. The reduction in the mobile source emission budget between the years 2003 and 2006, as shown in Table 5-2, reflects the effectiveness of the control strategies for both construction activities and the stabilization of disturbed lands as defined within the 2001 PM_{10} SIP; see pages 5.33 - 5.36 of the 2001 PM_{10} SIP.

5.6.3 PM_{10} Emissions From Paved Roads and Unpaved Shoulders

Table 5-19 identifies the PM_{10} roadway silt loading rates given in PM_{10} SIP for paved roads and for roads with unpaved shoulders.

[1] Note that road construction is treated the same way that general construction is treated - all applicable dust control regulations are applied to the site during construction activity to ensure emission reductions.

Table 5-19: Roadway Silt Loading Factors – 2001 PM_{10} SIP

Roadway Category	Paved Roads with Improved Shoulders			Paved Roads with Unimproved Shoulders	
	1998	2001 (15% reduction)	2006 (30% reduction)	All Years	
Ext. Connector	0.49	0.42	0.470		
Freeway Ramps	0.86	0.73	0.620		
Minor Arterial	1.04	0.88	0.470	1.34	
Major Arterial	0.49	0.42	0.490	1.34	
Ramps	0.86	0.73	0.620		
Interstate	0.02	0.02	0.020		
Freeway	0.02	0.02	0.020		
Expressway	0.49	0.42	0.020		
Collector	0.86	0.73	0.620	24.70	
Local	1.70	1.45	1.720	24.70	
Inter-Zonal Trips	1.70	1.45	1.720		
Public Transit	1.70	1.45	0.014		

Note: Clark County has assumed a 15% reduction in silt loading from the control of wind erosion sources in 2001, and a 30% reduction in 2006. See Page L-7 of the PM_{10} SIP.

5.6.4 VMT and Silt Loading

The silt loading factors in Table 5-19 are based on measurements taken during 1998. At that time, as during most of the past decade, the Las Vegas Valley was experiencing very rapid urban development resulting in much disturbance to the land surface. Dust from this disturbed land gets onto adjoining roadways, where traffic then stirs it back into the air. As development proceeds, the production of dust from land in stabilized areas will decrease, with a resulting decline in dust emissions from roadways in those areas. The State Implementation Plan budget for 2006 reflects a 30 percent reduction in silt load factors from the 1998 base observations. As shown in that table, there is a big difference between the dust emissions from the various roadway facility types, from 0.1 grams per vehicle-mile on Interstates to over 1 gram per vehicle-mile on local roads. However, there is no differentiation between the factors that apply in different parts of the valley.

5.6.5 Unimproved Shoulder Calculation: SIP Control Implementation Schedule

Calculations for roadways with unimproved shoulders come directly from data developed by Clark County in support of the PM10 SIP. Based on the programming of CMAQ funds to reduce/eliminate roadways with less than 28' of paving, the SIP roadway remediation schedule is as follows:

- 50 percent in 2004
- 25 percent in 2005
- 25 percent in 2006

It is assumed there will be no significant area of unpaved shoulders remaining after 2006.

5.6.6 PM_{10} Roadway Emissions Calculation

Table 5-20a shows the calculation of PM_{10} emissions from unpaved shoulders and paved roadways based on these silt loading factors and assumptions.

Table 5-20a: PM_{10} Unpaved Roadway Analysis 2006 Horizon Year

Facility Type	Total Interpolated 2006 AAWDVMT	Total road miles	Unpaved Shoulders Miles	%	VMT	Silt Loading (g/m^2)	PM_{10} Emissions Factors (g/v-m)	Unpaved Shoulder Emissions (kg/day)
External connectors	505,111							
System Ramps	398,737							
Minor Arterials	4,603,172	571.6	57.2	3.34	153,546	1.34	5.627	864
Major Arterials	13,996,410	82.2	21.0	8.52	1,191,908	1.34	5.627	6,707
Ramps	1,183,996							
Interstates	9,404,566							
Freeways	3,113,274	65.0	0.0					
Beltway	499,028	32.9	0.0					
Collectors	3,224,191	632.5	30.3	1.60	51,485	24.70	37.403	1,926
Centroid connectors	3,413,328	2,871.8	335.7	3.90	133,001	24.70	37.403	4,975
Other Local Roads	19,305							
HOV Lanes	0							
Model network total	39,856,006							
Public Transit Bus	67,578							
Intra-zonal	99,624							
DAILY TOTALS	**40,023,208**				**1,529,941**			**14,471**
				convert to US tons per day				0.001102
				PM10 Emissions (tons per day)				**15.95**

Notes: Unpaved shoulder emissions - assumed no unpaved shoulders after 2006 (see text).
For comparison with budget and vehicle and road Construction emissions analysis, see PM_{10} Summary Sheet

Table 5-20b: PM_{10} Paved Roadway Analysis 2006 Horizon Year

Facility Type	Total Interpolated 2006 AAWDVMT	Silt Loading (g/m^2)	PM_{10} Emissions Factors (g/v-m)	paved Shoulder Emissions (kg/day)
External connectors	505,111	0.470	1.850	934
System Ramps	398,737	0.620	2.215	883
Minor Arterials	4,449,626	0.470	1.850	8,231
Major Arterials	12,804,502	0.490	1.901	24,335
Ramps	1,183,996	0.620	2.215	2,622
Interstates	9,404,566	0.020	0.238	2,235
Freeways	3,113,274	0.020	0.238	740
Beltway	499,028	0.020	0.238	119
Collectors	3,172,706	0.620	2.215	7,026
Centroid connectors	3,280,327	1.720	4.299	14,101
Other Local Roads	19,305	1.720	4.299	290
HOV Lanes	0	0.014	0.188	428
Model network total	38,998,379			61,309
Public Transit Bus	67,578			
Intra-zonal	99,624			
DAILY TOTALS	**40,023,208**			**14,471**
convert to US tons per day				0.001102
PM10 Emissions (tons per day)				**67.58**

Table 5-20c: PM_{10} Roadway Analysis 2010 Horizon Year (Amendment)

Facility Type	Corrected 2010 AAWDVMT	VMT by Silt Loading Category	2006 Silt Loading Factors (g/m^2)	2006 PM_{10} Emission Factors (g/v-m)	2010 Paved Road Emissions (kg/day)
External connectors	611,083	611,083	0.470	1.850	1,130
System Ramps	552,083	496,875	0.620	2.215	1,100
System Ramps		55,208	0.020	0.238	13
Minor Arterials	6,337,103	5,703,393	0.470	1.850	10,550
Minor Arterials		633,710	0.470	1.850	1,172
Major Arterials	16,727,895	16,727,895	0.490	1.901	31,792
Ramps	1,531,950	1,378,755	0.620	2.215	3,053
Ramps		153,195	0.020	0.238	36
Interstates	12,124,674	12,124,674	0.020	0.238	2,881
Freeways	6,404,874	6,404,874	0.020	0.238	1,522
Beltway	190,788	190,788		0.000	0
Collectors	4,365,587	3,929,029	0.020	0.238	934
Collectors		436,559	0.620	2.215	967
Centroid connectors	4,469,567	4,022,610	0.490	1.901	7,645
Centroid connectors		446,957	1.720	4.299	1,921
Other Local Roads	19,507		0.620	2.215	0
HOV Lanes	577,827	577,827	1.720	4.299	2,484
Public Transit Bus	80,079	80,079	0.020	0.238	19
Intra-zonal	158,199	158,199	1.720	4.299	680
DAILY TOTALS	**54,151,216**	**54,131,709**			**67,901**
		convert to US tons per day			0.001102
		PM_{10} Emissions (tons per day)			**74.85**

Table 5-20d: PM_{10} Roadway Analysis 2020 Horizon Year (Amendment)

Facility Type	Corrected 2020 AAWDVMT	VMT by Silt Loading Category	2006 Silt Loading Factors (g/m^2)	2006 PM_{10} Emission Factors (g/v-m)	2020 Paved Road Emissions (kg/day)
External connectors	789,029	789,029	0.470	1.850	1,459
System Ramps	535,554	321,332	0.620	2.215	712
System Ramps		214,222	0.020	0.238	51
Minor Arterials	8,695,678	5,217,407	0.470	1.850	9,651
Minor Arterials		3,478,271	0.470	1.850	6,434
Major Arterials	19,182,320	19,182,320	0.490	1.901	36,456
Ramps	1,716,600	1,029,960	0.620	2.215	2,281
Ramps		686,640	0.020	0.238	163
Interstates	15,700,354	15,700,354	0.020	0.238	3,731
Freeways	7,464,694	7,464,694	0.020	0.238	1,774
Beltway	7,652	7,652	0.020	0.238	2
Collectors	4,146,492	2,487,895	0.620	2.215	5,510
Collectors		1,658,597	0.490	1.901	3,152
Centroid connectors	4,693,489	2,816,093	1.720	4.299	12,106
Centroid connectors		1,877,396	0.620	2.215	4,158
Other Local Roads	15,818	15,818	1.720	4.299	68
HOV Lanes	1,160,461	1,160,461	0.020	0.238	276
Public Transit Bus	94,514	94,514	1.720	4.299	406
Intra-zonal	218,608	218,608	1.720	4.299	940
DAILY TOTALS	64,421,263	64,421,263			89,329
		convert to US tons per day			0.001102
		PM_{10} Emissions (tons per day)			**98.47**

Notes: Unpaved shoulder emissions - assumed no unpaved shoulders after 2006 (see text).
For comparison with budget and vehicle and road Construction emissions analysis, see PM_{10} Summary Sheet

Table 5-20e: PM_{10} Roadway Analysis 2030 Horizon Year (2.25 VW March 2, 2006 Amendment SIP Values)

Facility Type	Corrected 2025 AAWDVMT	VMT by Silt Loading Category	2006 Silt Loading Factors (g/m^2)	2006 PM_{10} Emission Factors (g/v-m)	2030 Paved Road Emissions (kg/day)
External connectors	957,758	957,758	0.470	1.850	1,772
System Ramps	596,490	298,245	0.620	2.215	661
System Ramps		298,245	0.020	0.238	71
Minor Arterials	10,596,263	5,298,132	0.470	1.850	9,800
Minor Arterials		5,298,132	0.470	1.850	9,800
Major Arterials	20,900,273	20,900,273	0.490	1.901	39,721
Ramps	1,885,604	942,802	0.620	2.215	2,088
Ramps		942,802	0.020	0.238	224
Interstates	19,148,610	19,148,610	0.020	0.238	4,550
Freeways	8,208,423	8,208,423	0.020	0.238	1,951
				0.000	
Beltway	12,316	12,316	0.020	0.238	3
Collectors	4,682,685	2,341,343	0.620	2.215	5,185
Collectors		2,341,343	0.490	1.901	4,450
Centroid connectors	5,448,182	2,724,091	1.720	4.299	11,710
Centroid connectors		2,724,091	0.620	2.215	6,033
Other Local Roads	16,854		1.720	4.299	0
HOV Lanes	1,173,322	1,173,322	0.020	0.238	279
Public Transit Bus	108,949	108,949	1.720	4.299	468
Intra-zonal	202,641	202,641	1.720	4.299	871
DAILY TOTALS	73,938,370	73,921,516			99,637
		convert to US tons per day			0.001102
		PM_{10} Emissions (tons per day)			**109.83**

Notes: Unpaved shoulder emissions - assumed no unpaved shoulders after 2006 (see text).
For comparison with budget and vehicle and road Construction emissions analysis, see PM_{10} Summary Sheet

5.6.7 PM_{10} Emissions from Vehicles

The SIP emission rates for on-road mobile sources, including actual vehicle emission calculations for Vehicular Sulfate Particulate Matter, Tire Wear, Brake Wear and Exhaust Particles are set out in Tables 5.20c though 5.20c.

For this conformity analysis, the DAQEM advises that, in view of the minimal difference between the rates for the various facility types, it is acceptable to use a single rate for all VMT in each horizon year analysis. The rates are:

- For 2001: 0.077 grams per vehicle-mile
- For 2006: 0.072 grams per vehicle-mile

The rate for 2001 is used for the 2003 horizon year and the rate for 2006 is used for all subsequent years, as shown in Table 5-21. The resulting emissions are summarized in Table 5-22.

Table 5-21: Mobile Source PM_{10} Emission Factors

Roadway Category	(Grams per Vehicle-Mile)			
	2006	2010	2020	2030
Ext. Connector	0.0334	0.0293	0.0262	0.026
Freeway Ramps	0.0334	0.0293	0.0262	0.026
Minor Arterial	0.0334	0.0293	0.0262	0.026
Major Arterial	0.0334	0.0293	0.0262	0.026
Ramps	0.0334	0.0293	0.0262	0.026
Interstate	0.0334	0.0293	0.0262	0.026
Freeway	0.0334	0.0293	0.0262	0.026
Expressway	0.0334	0.0293	0.0262	0.026
Collector	0.0334	0.0293	0.0262	0.026
Local	0.0334	0.0293	0.0262	0.026
Inter-Zonal Trips	0.0334	0.0293	0.0262	0.026
Public Transit	0.0334	0.0293	0.0262	0.026

Table 5-22: PM_{10} Vehicle Emissions

	2006	2010	2020	2030
AAWDVMT	39,856,006	54,151,216	70,239,176	73,938,370
Vehicle Emissions Factor (gm/v-m)	0.0334	0.0293	0.0262	0.026
PM10 Vehicle Emissions (kg/day)	1,331	1,587	1,840	1,922
PM10 Vehicle Emissions (tons/day)	**1.47**	**1.75**	**2.03**	**2.12**

5.6.8 Roadway Construction PM_{10} Emissions

A series of PM_{10} inventories were conducted during the 1999-2000 period in support of the SIP development. The following identifies the assumptions for the purpose of estimating PM_{10} from highway construction.

CONSTRUCTION: **Highway Construction PM_{10} Emission Rates**

- **Define Average Project Length (From the TIP for each year)**
  Lane mile in analysis year divided by the total number of projects.

- **Estimate number of Projects under construction for analysis period**
  One third of the total projects in the TIP - assumption is that the average project is four months in duration; therefore there are three four-month project periods.

- **Convert the Lane Miles of Project to Acres**
  5280 x 12 (average lane width) = 63,360 square feet in a lane mile
  63,360/43,560 (number of square feet in an acre) = 1.45 acres per lane mile
  Factor: 1.45 x project lane mile average x number of projects = number of acres under construction

- **Apply SIP emission factor = .42 tons/month = 840 pounds/acre/month**

- **Apply Best Management Practice reduction factor to total acres under construction = Product - (product x .68)**

- **Convert to Average Day Emissions: divide by 30.5 (annual average days in month)**

***WIND EROSION*: Highway Construction Emission Calculations for PM_{10}**

- **Define Project Acres**
  Obtain acre calculation for analysis period from Step 1 of Highway Construction.

- **Apply PM_{10} Wind Erosion Rates Per Day to Acre Calculation**
  35% of Acres x 7.60 x 10^{-4} tons
  65% of acres x 1.98 x 10^{-2} tons

- **Define Total Daily Wind Erosion**
  Add products from Step 2

- **Apply Sections 90 through 94 Regulations**
  Reduce by 71%

These rates are applied to the estimated acreage covered by highway construction projects, and the results are set out in Table 5.23. For the years 2003 through 2005, acreages have been calculated based on projects identified in the TIP. The average of these three years is used as a basis for 2006 and subsequent years.

Table 5-23: PM_{10} Emissions from Highway Construction and Wind Erosion

Source	2006	2010	2020	2030
Construction				
Number of Projects Per Year	38	43	50	43
Average Length (lane-miles)	7969.30	8501.3	9535.4	9983.7
Lane-Miles	209.71842	197.70465	190.708	232.17907
Estimated Acreage	305	288	277	338
Emissions Factors (tons/acre/month)	0.42	0.42	0.42	0.42
PM10 Vehicle Emissions (tons/day)	4.20	3.96	3.82	4.65
Best Practices Reduction (%)	68%	68%	68%	68%
Net PM_{10} Emissions (tons/day)	**1.34**	**1.27**	**1.22**	**1.49**
Wind Erosion				
Estimated Acreage	305	288	277	338
Erosion Rate (tons/acre/day) 35% of site	0.00076	0.00076	0.00076	0.00076
65% of site	0.01980	0.01980	0.01980	0.01980
PM10 Emissions (tons/day)	4.01	3.78	3.64	4.44
Sections 90-94 Reduction (%)	71%	71%	71%	71%
Net PM_{10} Emissions (tons/day)	**1.16**	**1.10**	**1.06**	**1.29**

5.6.9 Particulate Matter (PM_{10}) Analysis Methodology

§93.119 - In non-attainment or maintenance areas without a motor vehicle emissions budget, the transportation plan and TIP must contribute to PM_{10} emission reductions. A description of the PM_{10} analysis methodology is shown below.

- **Establish analysis horizon years**
  - Year 1998 will serve as the "base" and form the basis for each later scenario, and the validation of the travel demand model against "observed" traffic volumes shall be documented.

  - The horizon years 2006, 2010 and 2020, shall serve as intermediate analysis points. The long-range horizon year of the transportation plan's forecast period, the year 2030, shall be the final emissions analysis year.

- **Define the "Baseline" scenario**
  - Federal planning guidance indicates the baseline scenario shall be defined as the transportation system that would result from including all in-place facilities, on-going transportation demand management and transportation system management (TDM/TSM) measures, and completion of committed and underway regionally significant projects. The RTC's 2003 model scenario, augmented with the addition of committed and underway regionally significant projects from the last conforming TIP, shall be considered as representative of the "Baseline" transportation system.

  - The RTC has adopted socioeconomic and demographic data estimates and projections for 2001, disaggregated for modeling purposes to traffic analysis zones, which coincides with the population total defined in the 2001 PM_{10} SIP.

- **Define the "Action" scenarios**
  - An "Action" scenario shall be defined, for each horizon/analysis year, as the transportation system that would result from implementation of the RTP and TIP including all facilities in the Baseline scenario, plus completion of projects identified in the proposed TIP (short-term) or Regional Plan (mid- and long-term), plus the incremental effects of known TDM/TSM measures, plus the completion of any other regionally significant projects whether or not they appear in a conforming plan or TIP. An "Action" scenario shall be defined for the horizon years of 2006-2008 (TIP), 2006, 2010, 2020 and 2030. The RTC has adopted socioeconomic and demographic projections, disaggregated to traffic analysis zones, for each of these horizon years which shall serve as input to the trip generation process.

- **Estimate the resultant emissions**
  - Emissions expected to result in each analysis year from travel on the transportation systems as defined by the "Baseline-1998" and the "Action" scenarios shall be calculated. For example, to complete the year 2006 analysis, the projected travel demand (person-trips) for the December of year 2005 (inflated to represent January of 2006) will be loaded on both the "Baseline-1998" and the "Year 2006 Action" scenario transportation systems. The procedures for determining regional transportation-related emissions are included in §93.122 of the EPA's revised transportation conformity regulation (dated August 15, 1997).

- **Document the PM_{10} emissions**
  - The PM_{10} emissions predicted by the horizon year scenarios, defined in above, shall be less than the mobile source emission budget established in the 2001 PM_{10} SIP. The approved PM_{10} mobile source emissions budget is 141.41 tons per day for 2006 and successive planning horizon years.

The Table 5-24 summarizes the calculation of total PM_{10} mobile source emissions for each of the horizon analysis years.

Table 5-24: Total PM_{10} Mobile Source Emissions

Source	Tons Per Day			
	2006	2010	2020	2030
Unpaved Shoulder Dust	15.95	0.00	0.00	0.00
Paved Road Dust	67.58	74.85	98.47	109.83
Vehicle Emissions	1.47	1.75	2.03	2.12
Highway Construction	1.34	1.27	1.22	1.49
Windblown Construction Dust	1.16	1.10	1.06	1.29
PM_{10} Mobile Source Emissions	**87.51**	**78.96**	**102.77**	**114.72**

5.7 Ozone Modeling Assumptions

Whenever the RTC advances a conformity finding it must be linked to an RTP because this is the required legal mechanism for: 1) defining the extent of the anticipated travel network, i.e., projects programmed into the Plan; 2) estimating total regional travel and VMT output based on demographic factors such as household size, auto ownership, employment locations, and trip making characteristics and 3) estimating total emissions by pollutant as VMT applied to the EPA mobile model.

Conformity is satisfied if the estimated emissions from all travel are less than the SIP budgets for each of the attainment dates. For O_3, this is not possible because the EPA gave non-attainment areas until 2007 to develop a new SIP and mobile source budget for O_3. In the absence of an emission budget, the RTC will compare the "Action" scenario versus the "No Build" scenario as defined in 40 CFR Part 93. The regulatory prescribed comparison is structured as follows.

Travel demand (VMT) and the associated emission estimates are generated for future travel under two scenarios. For the "Action" scenario all travel is loaded onto the "anticipated" built network as defined in the project listing that comprises the 2006-2030 project list in the RTP. Total daily regional travel, driven by the assumed demographic factors as discussed above, is loaded onto the anticipated physical roadway network, which provides the output to estimate total daily emissions.

The emission estimates are calculated for the "Action" scenario by required horizon year, i.e., 2008, 2010, 2010 and 2030. The emission output for the "Action" scenario is compared against the "No Build" scenario for each of the horizon years. If the "Action" scenario emission estimates are less than the "No Build" for each of the horizon years, the region is determined to be in positive transportation conformity for O_3.

The "No Build" scenario is defined as: 1) the in-place roadway network as of RTP's start year of 2004, 2) assumption of the continuation of all ongoing travel demand management and/or transportation system management activities, 3) the continued application of any SIP mandated control measures, and 4) inclusion and assumption of completion for all "ongoing" roadway construction projects. For the "No Build" scenario, the same travel demand factors applied to the "Action" scenario are loaded onto the "No Build" scenario for each of the horizon years without the benefit of roadway improvements identified in each "Action". Emission estimates are calculated based on total travel in the same manner completed for the "Action" scenarios.

5.7.1 Estimating Regional Travel for Ozone Conformity

The RTC estimates travel by horizon years for CO and PM_{10} utilizing the regional travel demand model, which encompasses the Las Vegas urban area. The non-attainment area for O_3 is larger than the extent of the travel model domain the RTC maintains. Therefore, the RTC estimates regional travel for the roadway network outside of the urban area. Working with NDOT, RTC estimated VMT and travel speeds for the roadway network outside of the urban area. This included segments of I-15, US 93, US 95, State Route (SR) 157, SR 158, SR 159, SR 160, SR 161, SR 163, SR 164, SR 167, SR 168 and roadways in Boulder City and Laughlin. VMT estimates were based on regression analysis data provided by NDOT. Travel speed estimates were based on data published in NDOT's Annual Speed Monitoring Report Details on this process are provided in Appendix II.

5.7.2 Ozone Roadway Emissions Calculation

Tables 5-25a through 5-25d display the results of air quality modeling for O_3. The modeling process uses levels of nitrous oxides (NO_x) and volatile organic compounds (VOC), precursors of O_3, to forecast the effectiveness of the RTP/TIP on levels of O_3.

Table 5-25a: 2008 Horizon Year VOC and NO_x Emissions for TDF Modeling Area

ROAD TYPE	NO_x (tons/day)		VOC (tons/day)		Build vs. No Build	
	Build	No Build	Build	No Build	NO_x	VOC
External	0.51	0.51	0.55	0.55	0.00	0.00
System-to-system Ramp	0.49	0.46	0.47	0.45	0.03	0.02
Minor Arterial	4.90	4.87	4.69	4.67	0.03	0.02
Major Arterial	13.39	13.55	12.88	13.06	-0.16	-0.18
Ramp	1.28	1.28	1.24	1.24	0.01	0.00
Interstate	10.84	10.86	8.38	8.42	-0.02	-0.04
Freeway	5.32	5.17	4.00	3.93	0.15	0.07
Expressway	0.18	0.19	0.15	0.16	-0.01	-0.01
Collector	3.58	3.72	3.50	3.64	-0.13	-0.14
Centroid	3.72	3.76	5.47	5.53	-0.04	-0.06
Local	0.02	0.02	0.03	0.03	0.00	0.00
HOV	0.28	0.29	0.21	0.22	-0.01	-0.01
TOTAL EMISSIONS	**44.51**	**44.68**	**41.57**	**41.88**	**-0.17**	**-0.31**

Table 5-25b: 2008 Horizon Year NO_x Emissions Outside TDF Modeling Area

ROAD TYPE	Build		No Build		NO_x (Build vs. No Build) tons per day
	Emissions (tons/day)	Congested Speed	Emissions (tons/day)	Congested Speed	
Assuming a three miles congested speed reduction between Build and No Build					
Minor Arterials	0.041	35.00	0.042	32.00	0.000
Collectors	0.043	30.00	0.044	27.00	-0.001
Other Local Roads	0.039	25.00	0.039	22.00	0.000
TOTAL EMISSIONS	**0.124**		**0.125**		**-0.001**
Assuming no speed change between Build and No Build					
Minor Arterials	0.041	35.00	0.041	35.00	0.00
Collectors	0.043	30.00	0.043	30.00	0.00
Other Local Roads	0.039	25.00	0.039	25.00	0.00
TOTAL EMISSIONS	**0.124**		**0.124**		**0.00**

Table 5-25c: 2008 Horizon Year VOC Emissions Outside TDF Modeling Area

ROAD TYPE	Build		No Build		VOC (Build vs. No Build) tons per day
	Emissions (tons/day)	Congested Speed	Emissions (tons/day)	Congested Speed	
Assuming a three miles congested speed reduction between Build and No Build					
Minor Arterials	0.041	35.00	0.041	32.00	0.000
Collectors	0.044	30.00	0.044	27.00	0.000
Other Local Roads	0.058	25.00	0.058	22.00	0.000
TOTAL EMISSIONS	**0.144**		**0.144**		**0.000**
Assuming no speed change between Build and No Build					
Minor Arterials	0.041	35.00	0.041	35.00	0.000
Collectors	0.044	30.00	0.044	30.00	0.000
Other Local Roads	0.058	25.00	0.058	25.00	0.000
TOTAL EMISSIONS	**0.144**		**0.144**		**0.000**

Table 5-25d: 2010 Horizon Year VOC and NO_x Emissions for TDF Modeling Area

	NO_x (tons/day)		VOC (tons/day)		Build vs. No Build	
ROAD TYPE	**Build**	**No Build**	**Build**	**No Build**	**NO_x**	**VOC**
External	0.42	0.42	0.48	0.48	0.00	0.00
System-to-system Ramp	0.40	0.41	0.41	0.42	-0.01	-0.01
Minor Arterial	4.36	4.36	4.46	4.53	0.00	-0.07
Major Arterial	11.51	11.46	12.00	11.97	0.06	0.03
Ramp	1.11	1.12	1.14	1.14	0.00	0.00
Interstate	9.23	9.19	7.68	7.66	0.04	0.02
Freeway	4.95	4.83	4.01	3.92	0.12	0.09
Expressway	0.14	0.12	0.12	0.11	0.02	0.02
Collector	2.98	3.38	3.15	3.77	-0.40	-0.62
Centroid	3.27	3.28	5.03	5.03	0.00	-0.01
Local	0.01	0.01	0.02	0.02	0.00	0.00
HOV	0.45	0.45	0.36	0.36	0.00	0.00
TOTAL EMISSIONS	**38.84**	**39.02**	**38.86**	**39.42**	**-0.18**	**-0.56**

Table 5-25e: 2010 Horizon Year NO_x Emissions Outside TDF Modeling Area

	Build		No Build		NO_x (Build vs. No Build) tons per day
ROAD TYPE	**Emissions (tons/day)**	**Congested Speed**	**Emissions (tons/day)**	**Congested Speed**	
Assuming a three miles congested speed reduction between Build and No Build					
Minor Arterials	0.034	35.00	0.034	32.00	0.000
Collectors	0.035	30.00	0.036	27.00	-0.001
Other Local Roads	0.033	25.00	0.033	22.00	0.000
TOTAL EMISSIONS	**0.102**		**0.103**		**-0.001**
Assuming no speed change between Build and No Build					
Minor Arterials	0.034	35.00	0.034	35.00	0.000
Collectors	0.035	30.00	0.035	30.00	0.000
Other Local Roads	0.033	25.00	0.033	25.00	0.000
TOTAL EMISSIONS	**0.102**		**0.124**		**0.000**

Table 5-25f: 2010 Horizon Year VOC Emissions Outside TDF Modeling Area

	Build		No Build		VOC (Build vs. No Build) tons per day
ROAD TYPE	**Emissions (tons/day)**	**Congested Speed**	**Emissions (tons/day)**	**Congested Speed**	
Assuming a three miles congested speed reduction between Build and No Build					
Minor Arterials	0.036	35.00	0.037	32.00	-0.001
Collectors	0.039	30.00	0.040	27.00	-0.001
Other Local Roads	0.050	25.00	0.050	22.00	0.000
TOTAL EMISSIONS	**0.125**		**0.127**		**-0.002**
Assuming no speed change between Build and No Build					
Minor Arterials	0.036	35.00	0.036	35.00	0.000
Collectors	0.039	30.00	0.039	30.00	0.000
Other Local Roads	0.050	25.00	0.050	25.00	0.000
TOTAL EMISSIONS	**0.125**		**0.125**		**0.000**

Table 5-25g: 2020 Horizon Year VOC and NO_x Emissions for TDF Modeling Area

	NO_x (tons/day)		VOC (tons/day)		Build vs. No Build	
ROAD TYPE	**Build**	**No Build**	**Build**	**No Build**	**NO_x**	**VOC**
External	0.18	0.18	0.28	0.28	0.00	0.00
System-to-system Ramp	0.21	0.21	0.28	0.27	0.00	0.00
Minor Arterial	2.15	2.28	2.89	3.18	-0.13	-0.29
Major Arterial	4.67	5.26	6.38	7.42	-0.58	-1.05
Ramp	0.49	0.51	0.65	0.67	-0.02	-0.02
Interstate	4.38	4.45	4.95	5.23	-0.07	-0.28
Freeway	2.26	2.50	2.51	2.86	-0.25	-0.35
Expressway	0.00	0.00	0.00	0.00	0.00	0.00
Collector	1.38	1.60	1.93	2.33	-0.22	-0.41
Centroid	1.45	1.48	3.06	3.13	-0.03	-0.07
Local	0.01	0.01	0.01	0.01	0.00	0.00
HOV	0.36	0.19	0.40	0.23	0.17	0.17
TOTAL EMISSIONS	**17.53**	**18.66**	**23.32**	**25.61**	**-1.13**	**-2.29**

Table 5-25h: 2020 Horizon Year NO_x Emissions Outside TDF Modeling Area

	Build		No Build		NO_x (Build vs. No Build) tons per day
ROAD TYPE	**Emissions (tons/day)**	**Congested Speed**	**Emissions (tons/day)**	**Congested Speed**	
Assuming a three miles congested speed reduction between Build and No Build					
Minor Arterials	0.014	35.00	0.014	32.00	-0.0002
Collectors	0.014	30.00	0.015	27.00	-0.0003
Other Local Roads	0.013	25.00	0.013	22.00	0.0000
TOTAL EMISSIONS	**0.042**		**0.042**		**-0.0005**
Assuming no speed change between Build and No Build					
Minor Arterials	0.014	35.00	0.014	35.00	0.0000
Collectors	0.014	30.00	0.014	30.00	0.0000
Other Local Roads	0.013	25.00	0.013	25.00	0.0000
TOTAL EMISSIONS	**0.042**		**0.124**		**0.0000**

Table 5-25i: 2020 Horizon Year VOC Emissions Outside TDF Modeling Area

	Build		No Build		VOC (Build vs. No Build) tons per day
ROAD TYPE	**Emissions (tons/day)**	**Congested Speed**	**Emissions (tons/day)**	**Congested Speed**	
Assuming a three miles congested speed reduction between Build and No Build					
Minor Arterials	0.019	35.00	0.020	32.00	0.000
Collectors	0.021	30.00	0.021	27.00	-0.001
Other Local Roads	0.029	25.00	0.029	22.00	0.000
TOTAL EMISSIONS	**0.069**		**0.070**		**-0.001**
Assuming no speed change between Build and No Build					
Minor Arterials	0.019	35.00	0.019	35.00	0.000
Collectors	0.021	30.00	0.021	30.00	0.000
Other Local Roads	0.029	25.00	0.029	25.00	0.000
TOTAL EMISSIONS	**0.069**		**0.069**		**0.000**

Table 5-25j: 2030 Horizon Year VOC and NO_x Emissions for TDF Modeling Area

	NO_x (tons/day)		VOC (tons/day)		Build vs. No Build	
ROAD TYPE	**Build**	**No Build**	**Build**	**No Build**	**NO_x**	**VOC**
External	0.14	0.16	0.27	0.28	-0.02	0.00
System-to-system Ramp	0.14	0.15	0.24	0.27	-0.01	-0.03
Minor Arterial	1.59	1.76	2.75	3.28	-0.17	-0.53
Major Arterial	3.19	3.86	5.61	7.23	-0.67	-1.62
Ramp	0.34	0.38	0.57	0.67	-0.04	-0.10
Interstate	3.27	3.48	4.73	5.15	-0.21	-0.43
Freeway	1.53	1.80	2.17	2.79	-0.27	-0.62
Expressway	0.00	0.00	0.00	0.00	0.00	0.00
Collector	1.04	1.36	1.89	2.23	-0.32	-0.35
Centroid	1.04	1.20	2.94	3.09	-0.16	-0.15
Local	0.00	0.00	0.01	0.01	0.00	0.00
HOV	0.23	0.19	0.32	0.30	0.04	0.02
TOTAL EMISSIONS	**12.52**	**14.34**	**21.50**	**25.30**	**-1.82**	**-3.80**

Table 5-25k: 2030 Horizon Year NO_x Emissions Outside TDF Modeling Area

	Build		No Build		NO_x (Build vs. No Build) tons per day
ROAD TYPE	**Emissions (tons/day)**	**Congested Speed**	**Emissions (tons/day)**	**Congested Speed**	
Assuming a three miles congested speed reduction between Build and No Build					
Minor Arterials	0.0112	35.00	0.0113	32.00	-0.0002
Collectors	0.0118	30.00	0.0120	27.00	-0.0003
Other Local Roads	0.0110	25.00	0.0110	22.00	0.0000
TOTAL EMISSIONS	**0.0340**		**0.0344**		**-0.0004**
Assuming no speed change between Build and No Build					
Minor Arterials	0.011	35.00	0.011	35.00	0.0000
Collectors	0.012	30.00	0.012	30.00	0.0000
Other Local Roads	0.011	25.00	0.011	25.00	0.0000
TOTAL EMISSIONS	**0.034**		**0.124**		**0.0000**

Table 5-25l: 2030 Horizon Year VOC Emissions Outside TDF Modeling Area

	Build		No Build		VOC (Build vs. No Build) tons per day
ROAD TYPE	**Emissions (tons/day)**	**Congested Speed**	**Emissions (tons/day)**	**Congested Speed**	
Assuming a three miles congested speed reduction between Build and No Build					
Minor Arterials	0.017	35.00	0.018	32.00	0.000
Collectors	0.019	30.00	0.019	27.00	-0.001
Other Local Roads	0.028	25.00	0.028	22.00	0.000
TOTAL EMISSIONS	**0.064**		**0.065**		**-0.001**
Assuming no speed change between Build and No Build					
Minor Arterials	0.017	35.00	0.017	35.00	0.000
Collectors	0.019	30.00	0.019	30.00	0.000
Other Local Roads	0.028	25.00	0.028	25.00	0.000
TOTAL EMISSIONS	**0.064**		**0.064**		**0.000**

5.8 Finding of Conformity

It is a requirement of Federal and State Conformity Regulations that the projected mobile source emissions for the Non-attainment Area for the pollutants should be lower than the Budgets contained in the State Implementation Plans.

For CO, the projected net mobile source emissions described in Section 5.5 are compared with the Mobile Source Emissions Budgets set out in the September 6, 2006 amendment to the *"Carbon Monoxide State Implementation Plan for the Las Vegas Valley Nonattainment Area" Clark County Board of Commissioners, August 2000*. For PM_{10}, the projected emissions resulting from the process described in Section 5.6 are compared with the Mobile Source Emissions Budgets set out the *"PM_{10} State Implementation Plan for Clark County, Nevada"*. For O_3, the projected emissions resulting from the process described in Section 5.7 are compared with the "No Build" scenario as defined in 40 CFR Part 93.

As shown in Table 5-26, these tests of conformity are satisfied for all pollutants.

Table 5-26: Conformity Test Summary

Year	CO (tons/day)		Conformity Requirement	PM10 (tons/day)		Conformity Requirement
	Emissions	Emissions Budget		Emissions	Emissions Budget	
2006	409.23	623.00	*Satisfied*	87.51	141.44	*Satisfied*
2010	424.60	690.00	*Satisfied*	78.96	141.44	*Satisfied*
2020	425.69	817.00	*Satisfied*	102.77	141.44	*Satisfied*
2030	470.35	817.00	*Satisfied*	114.72	141.44	*Satisfied*
Year	**NOx (tons/day)**		**Conformity Requirement**	**VOC (tons/day)**		**Conformity Requirement**
	Build	**No Build**		**Build**	**No Build**	
2008	44.51	44.68	*Satisfied*	41.57	41.88	*Satisfied*
2010	38.84	39.02	*Satisfied*	38.86	39.42	*Satisfied*
2020	17.53	18.66	*Satisfied*	23.32	25.61	*Satisfied*
2030	12.50	14.34	*Satisfied*	21.50	25.30	*Satisfied*

Based on the foregoing analysis, the projects and programs contained in the draft the Regional Transportation Plan FY 2006-2030 and related amendments to Transportation Improvement Program FY 2006-2008 for Clark County are found to be in conformity with the requirements of the Clean Air Act Amendments of 1990, the relevant sections of the Final Conformity Rule 40 CFR Part 93 and the procedures set forth in the Clark County Transportation Conformity Plan.

5.9 Transportation Control Measures

A second component of a conformity determination is an assessment of the progress in implementing TCMs. These measures are intended to reduce emissions or concentrations of pollutants from transportation sources by reducing vehicle use or otherwise reducing vehicle emissions.

As part of the conformity process, the RTC must certify that TCMs identified in the SIPs are being implemented on schedule and that no Federal funds are being diverted from these projects in such a way as to delay their timely implementation. Due to the length of the text and the level of detail associated with the control measures discussion for both CO and PM_{10}, the RTC has located the detailed portions of the TCMs in Appendix III. Table 5-27 is provided to specifically demonstrate that the required TCMs are in place, either programmed or as part of an ongoing implemented process like oxygenated fuels, and on schedule according to the commitments in the SIPs.

5.9.1 Statement of TCM Progress

As required by 23 CFR, Part 450.324, n(3), in non-attainment areas, the TIP must describe the progress in implementing any required TCMs, including any reasons for significant delays in the planned implementation and strategies for ensuring their advancement at the earliest possible time. The following table provides the existing status of TCMs from both the CO and PM_{10} SIPs.

Table 5-27: Status of Adopted Mobile Source Transportation Control Measures

Carbon Monoxide		
Control Measures from 2000 CO SIP	**Emission Reduction**	**Status**
Cleaner Burning Gas	9.80%	Implemented within the Las Vegas Valley
Voluntary Transportation Control Measure/TDM	0.08%	Ongoing; the RTC's TDM program is described in detail in Section 4
Technician Training	2.95%	Implemented/ongoing at area smog check and repair stations
Alternative Fuels Program for Government Fleets	0.12%	Ongoing; local government committed to alternative fuels program
Previously Adopted Enforceable Control Measure	**Adoption Date**	**Status**
Oxygenated Fuels	1991/1995	Ongoing
Reduced RVP Gasoline	1995	Ongoing
Motor Vehicle Inspection & Maintenance Program	1978	Ongoing
Fleet Over	1967	Ongoing

Particulate Matter 10 Microns or Less (PM10)	
Control Measures from 2001 PM10 SIP	**Status**
Paving of Unpaved Roads	Ongoing contracts with member entities for paving; funds programmed into the TIP.
Stabilize Narrow Roadway Shoulders	Approved and programmed into the TIP.
Transportation Construction - Rules 90-94	Ongoing; all transportation construction projects must conform. All transportation construction contracts, regardless of funds source, include the requirement to conform to Rules 90-94.

5.9.2 Transportation Control Measure Certification

The RTC of Southern Nevada certifies that TCMs identified in the both the 2000 CO SIP and the 2001 PM_{10} SIP are being implemented on schedule and that no Federal funds are being diverted from these projects in such a way as to delay their timely implementation.

5.10 Conformity Analysis Index

5.10.1 Plan and TIP Status

Indicate the date that the MPO has officially adopted, accepted or approved the transportation plan and/or program and has made a conformity determination.

- RTP: Fiscal Years 2006-2030 and Air Quality Conformity Determination - adopted July 13, 2006, effective September 6, 2006.

- TIP: Fiscal Years 2006-2008; Originally adopted August 11, 2005. Amended to incorporate projects from the 2006-2030 RTP July 13, 2006, effective September 6, 2006.

Indicate that the transportation program is financially constrained consistent with 23 CFR 450.

- Attested to in the TIP and RTP resolutions of adoption and documented in Section 6 and financial summary spreadsheets.

Indicate that the transportation program complies with all applicable conformity requirements of implementation plans.

- Attested to in the TIP/RTP resolution of adoption, and the signed conformity determination appearing at the beginning of this document.

Indicate that the transportation program includes all federal and non-federal regionally significant projects expected in the non-attainment area.

- The RTP and the TIP includes all regionally significant projects, regardless of funding source(s), plus all other regionally significant, non-federal projects funded through the RTC.

Indicate that the content of the transportation plan meets the content requirements of 93.106(c), to the extent it has been the previous practice of the MPO.

- The RTP and the TIP meet the content requirements of the EPA's Conformity Regulation, to the extent that it has been the past proactive of the RTC including:

- o Planning horizon years are no more than 10 years apart.
- o The first horizon year is no more than 10 years from the base year
- o The second analysis year is at least 5 years beyond the first analysis year
- o All mandated years serve as horizon years
- o The last horizon year is the last year of the Plan's forecast period.

For each horizon year:

- Table 2-5 of the RTP/TIP quantifies and forecasts demographic and employment factors used in the air quality conformity analysis

The assumed highway and transit system scenario for each horizon year is described in Appendix II.

5.10.2 Non-Attainment Area Designation

Discuss the applicable pollutants and precursors for which the area is classified as non-attainment.

- The Las Vegas Valley, as defined by Hydrographic Basin #212 which is fully included in the adopted metropolitan planning area boundary is designated as being a "serious" non-attainment area for particulate matter (PM_{10}) and is designated as a "serious" non-attainment area for CO.
- On September 15, 2004 the EPA designated about 60 percent of Clark County as non-attainment for O_3. The area extends from the Las Vegas Valley south and east to the Colorado River. VOC and NO_x are precursors for O_3.

5.10.3 SIP Status

Provide a status of any control strategy SIP and any findings related to submittal, completeness, approval or disapproval by the EPA.

- CO: In August of 2000, the State of Nevada submitted the Clark County 2000 Serious Area Carbon Monoxide State Implementation Plan to Region IX, EPA. The series of control measures are defined in this document. All measures have been implemented, continue in application and are duplicated directly from the 2000 CO SIP. The EPA published final approval of the CO SIP revision on August 7, 2006, with an effective date of September 6, 2006. A SIP revision dated October 2005, as amended in May 2006, revised the budgets utilizing the MOBILE6 model. The conformity determination performed in support of this Plan utilizes those budget numbers for each of the horizon years.

- PM_{10}: In September of 2001, the State of Nevada submitted the 2001 Serious Area PM_{10} SIP to Region IX, EPA. The EPA has provided positive adequacy determinations for the mobile source emission budget and completeness. Final EPA approval of the PM_{10} SIP was effective July 9, 2004.

Document, if applicable, where EPA in an incompleteness or disapproval finding notes that the control strategy SIP is considered complete or approved for conformity purposes.

- Not Applicable

List all TCMs and their implementation status in a control strategy implementation plan submitted, but not yet approved by EPA.

- TCM status is presented in detail in Section 5 and in Appendix III of this document.

Document, if applicable, whether an EPA promulgated FIP includes a mobile source emissions budget for each applicable precursor or pollutant.

- Not Applicable

5.10.4 Conformity Criteria and Procedures – General Requirements

Document the latest planning assumptions and sources.

- Population and Employment: Control Totals adopted in 2004. Projections provided to the RTC, Clark County and the Southern Nevada Water Authority by the Center for Business and Economic Research - University of Nevada at Las Vegas, REMI Model. This cooperative effort is managed through interlocal planning agreements.

- Travel Model: TranPlan 1140 zonal structure; adopted in 1998 and amended in 2002 by the RTC's Travel Demand and Model Forecasting Subcommittee. Accepted and approved by the RTC in March of 2002.

- VMT: Socioeconomic control totals adopted in 2004; source Planning Variables.

Document the use of the latest emissions model, the date that the conformity analysis was started, and the type of other air quality models and transportation models.

- The EPA's Mobile6.2 is used along with the RTC's regional travel demand (TRANSCAD) model. The conformity analysis was conducted in March of 2006.

Document the fulfillment of the consultation procedures specified in 93.105(a)(2), 93.105(c)(1) and 93.105(e) and public involvement procedures consistent with 23 CFR 450.

- This document was developed through the RTC's continuing, cooperative and comprehensive regional transportation planning process, and included input provided by the NDOT, each of the local entities and the general public, including the Executive Advisory Committee, the Citizens Advisory Committee, the Older Americans with Disabilities Subcommittee. Further, the procedures for noticing, eliciting, acceptance of oral and written comments provided for in the RTC's adopted Public Participation Plan in Section 6 were followed. Per the Plan, the document was posted on the RTC web site for public access. Public comments and responses are included in Appendix VI.

List all TCMs in an EPA approved SIP or promulgated FIP and indicate their schedules. Discuss their status in terms or implementation consistent with the schedules in the applicable implementation plan and indicate that nothing interferes with implementation.

Table 5-28: CO Mobile Source Emission Related TCMs

Measure	Status	Delays
Cleaner Burning Gas	Implemented	None
TDM (voluntary)	Implemented	None
Technician Training	Implemented	None
Alternative Fuels for Government Vehicles	Implemented	None

Table 5-29: PM_{10} Mobile Source Related TCMs

Measure	Status	Delays
Paving of Unpaved Roads	Implemented	None
Stabilize Shoulders < 28 feet in width	Programmed in TIP/RTP with CMAQ funds (see Chapter 6)	None
Highway Construction Rules 90-94	Rules 90-94: Applies to all highway construction	None

List any delayed TCMs in the applicable implementation plans and describe the measures being taken (commitments, approvals, resources, staffing, etc.) to overcome obstacles to implementation.

- Not Applicable. No implementation delays

List all projects, programs, or activities which require a regulation in order to be implemented and the date that the regulation was adopted or the date of an opt-in to a federally enforced program approved by EPA.

- Not Applicable

Identify the date of the last conforming transportation plan and program by the FHWA and FTA.

- March 15, 2004.

5.10.5 Interim and Transitional Period Requirements

Provide a table that shows for each pollutant and precursor, whether the interim, transitional, control strategy or maintenance period criteria apply to conformity.

- These differentiations are no longer relevant under the revised conformity regulations issued by EPA in August, 1997.

If the interim period applies, document whether the EPA Regional Administrator or the Director of the State air agency has made a finding that transportation-related precursor emissions within the non-attainment area are a significant contributor to the PM_{10} non-attainment problem.

- No such finding has been issued by the EPA and/or the Nevada Division of Environmental Protection.

If the interim or transitional period criteria apply, provide in a table the conformity analysis according to 93.123 and 93.126

- No interim period applies.

If the transitional, control strategy or maintenance period criteria apply, provide in a table the conformity analysis according to 93.119.

- See Table 5-26 for the Conformity Finding overview.

If a control strategy SIP was not required, provide in a table the conformity analysis according to 93.136.

- Not Applicable

Document that the regional transportation-related emissions analysis was done according to 93.130(a) and 93.130(c).

- Analytic approach documented in Chapter 5 - Modeling Assumptions.

5.10.6 Specific Consultation

Discuss the consultation with the EPA Regional Office and document responses to any concerns from EPA.

- The EPA's Regional Office was provided with the analytic approach that was to be used for the document's conformity determination. Additionally, the RTC held a Conformity Working Group meeting in March, 2006, to discuss assumptions and findings for conformity (CO and PM_{10}), as specified by the 1999 Conformity SIP. The EPA was a participant at this meeting.

Discuss the consultation with the State and local air quality agencies and the date that the documentation was sent to these agencies and document responses to any concerns from the State and/or local air quality agencies.

- The consultation process occurred in an open forum at the Conformity Working Group meeting in March, 2006, where the state and local air agency were primary participants. After review, the RTC received concurrence by these two agencies on the approach process. The document uses this same analytical approach.

Document all agreements with public and private entities related to consultation on the transportation plan and program.

- MPO Planning Agreements with member entities in 1998. Consultation on the conformity process and finding included; the Executive Advisory Committee, the Citizens Advisory Committee, the Older Americans with Disabilities, the Metropolitan Planning Subcommittee, and the Travel Demand and Model Forecasting Subcommittee.

- Transportation Conformity SIP - signatures include, the State DEP, the Air Quality Management Department. The Conformity Working Group met and consulted on conformity at its meeting in March, 2006.

State that the public involvement procedures developed by the MPO as required under 23 CFR 450 were fully carried out and document any responses to concerns from the public.

- Preparation of the Transportation Plan and TIP were carried out in accordance with the Public Participation Plan adopted by the RTC. All comments were responded to and are include for review in Appendix VI of this document.

5.10.7 Projects in the Transportation Plan and Program

List all projects in the transportation plan or program that require mitigation to determine conformity of the transportation plan or program.

- None

List all projects in the transportation plan or program that are exempt from regional analysis.

- Projects funded under the STP Enhancement Program and the STP Safety and Hazard Elimination categories, as well as various locally-funded intersection traffic capacity enhancement projects, have been considered as exempt from the regional air quality conformity analysis.

List all projects that have not completed a major step as defined in 93.102(c) and state that these projects have been included in the action scenario for one transportation plan and program conformity determination.

- None

List all projects not from a conforming transportation plan or program.

- No federal or non-federal regionally significant projects are included in this Plan which are not part of 2006-2030 Regional Transportation Plan.

List any projects where there are PM_{10} construction impacts and the PM_{10} implementation plan identifies construction-related fugitive dust PM_{10} as a contributor to the non-attainment problem.

- All new roadway construction projects within the Las Vegas Valley, due to soil and environmental conditions, have the potential to contribute to localized, short duration releases of fugitive dust. Construction grading permits are required by the Clark County. A copy of the approved PM_{10} regulations (rules 90-94) can be obtained from the DAQEM.