CONFORMITY DETERMINATIONS:

APPENDIX E TO THE

VISION 2020 - THE METROPOLITAN TRANSPORTATION PLAN

AND THE

1998 - 2000 TRANSPORTATION IMPROVEMENT PROGRAM

FOR THE

HOUSTON-GALVESTON TRANSPORTATION MANAGEMENT AREA

OCTOBER, 1997

REVISED DECEMBER, 1997

HOUSTON-GALVESTON AREA COUNCIL
TRANSPORTATION DEPARTMENT

Executive Summary

The Houston-Galveston Area Council (H-GAC) has conducted an analysis of the conformity of the *Vision 2020: The Metropolitan Transportation Plan* and *1998-2000 Transportation Improvement Program* with the State Implementation Plan's ozone Rate-of-Progress and attainment requirements for the Houston-Galveston ozone nonattainment area. The analysis, undertaken in accordance with procedures established under federal and state regulation and guidance, comprised the estimation of projected vehicular emissions for the region for various future time periods. The purpose of the analysis was to demonstrate that future transportation plans are consistent with the state's air quality goals for the region.

The results of the conformity analysis, shown in Figure 1 and Table 1, indicate that the transportation projects outlined in the *Vision 2020: The Metropolitan Transportation Plan* and *1998-2000 Transportation Improvement Program* adhere to regional air quality targets and requirements. The graph provides data for the years required for conformity analysis, as well as for scenarios for "Action", representing a full-build scenario, and "Baseline", representing a very limited-build scenario. This data also shows the relationships of each of the scenarios to the Motor Vehicle Emissions Budget for the region and to 1990 emissions levels. As the data illustrate, the emissions levels predicted in the Action scenarios for each year of analysis are less than the emissions predicted in the Baseline scenarios and are below the 1990 emissions levels, meeting two of the three conformity criteria. In addition, the emissions in each of the Action scenarios are less than the emission budget of 127.82 tons VOC per day, meeting the other conformity criterion.

The results of the conformity determination show that *VISION 2020: The Metropolitan Transportation Plan* and the *1998 - 2000 Transportation Improvement Program* for the Houston-Galveston Transportation Management Area meet the requirements of the State Implementation Plan, the Clean Air Act (42 U.S.C. 7504, 7506 (c) and (d)) as amended on November 15, 1990 and the final conformity rule (40 CFR Parts 51 and 93).

Figure 1.

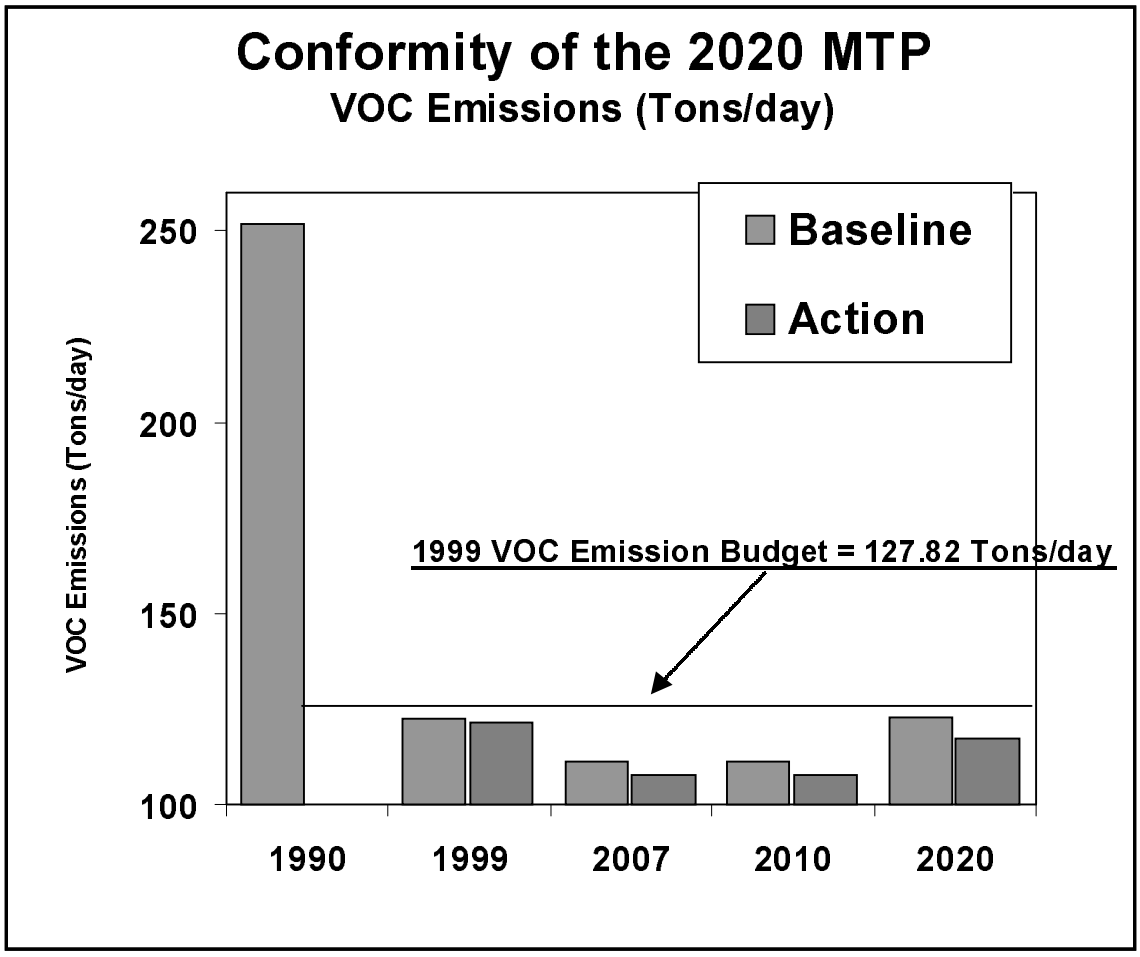

Table 1

Conformity Analysis Summary, by Milestone Year

	VOC Emissions, tons per day	
Scenario Year	Action	Baseline
1990	N/A	251.70
1999	125.50	126.29
2007	111.29	114.46
2010	111.03	116.18
2020	120.45	126.68

Source: H-GAC, December, 1997.

I. Introduction and Background

With the signing of the Clean Air Act Amendments of 1990 (CAAA) into law, the Houston-Galveston region was designated non-attainment for exceeding the National Ambient Air Quality Standard (NAAQS) for the pollutant ozone. On a scale ranging to marginal to extreme, the Houston-Galveston region was labeled as "Severe-II" and given until the year 2007 to attain the ozone standard. The CAAA requires each state to submit a state implementation plan (SIP) to the U.S. Environmental Protection Agency (EPA). The SIP is a legally binding document that defines the structure through which emissions will be reduced and the ozone standard will be attained. As the central focus of the air quality planning process, the SIP ties in transportation planning through the conformity provisions in the CAAA. These provisions verify that federal actions on transportation projects are consistent with the air quality objectives contained in the SIP. In many cases, transportation-related control measures identified in the SIP are contained and funded in the metropolitan transportation plan (MTP) and the transportation improvement program (TIP).

Section 176(c)(4) of the CAAA required EPA to promulgate rule-making on conformity determinations for transportation plans and programs. In response to this requirement, the EPA published its Criteria and Procedures for Determining Conformity to State or Federal Implementation Plans of Transportation Plans, Programs, and Projects Funded Under Title 23 U.S.C. or the Federal Transit Act in the *Federal Register* on November 24, 1993. This conformity rule requires metropolitan planning organizations (MPOs) and the U.S. Department of Transportation to make conformity determinations on metropolitan transportation plans and transportation improvement programs (TIPs) before they are adopted, approved, or accepted in air quality non-attainment areas. EPA has promulgated two separate amendments to the conformity rule, most recently in August of 1997. Most aspects of the August 1997 amendments do not become effective until the State of Texas proposes revisions of its Conformity State Implementation Plan to the EPA.

Special provisions are described in the final conformity rule for MPOs to conduct conformity determinations on their plans and TIPs. These criteria and procedures vary according to the pollutant for which the area is designated nonattainment and also according to the time period in which the determination is conducted. The conformity rule requires that conformity analysis adhere to a number of requirements:

- The analysis process must use the most recent planning assumptions in force at the time of the conformity determination and employ the latest available emissions model;
- The transportation plan and TIP must provide for the timely implementation of transportation control measures (TCMs) from the applicable implementation plan;
- A regional emissions analysis must be conducted for significant air quality milestone years and the MTP horizon year;
- The analysis must be performed for a Baseline and an Action scenario, roughly representing existing and future transportation networks, for each analysis year, and demonstrate that Volatile organic compounds (VOCs) emissions from each Action scenario would be less than the emissions predicted for each Baseline scenario; and
- The regional analysis must show that the Action scenario contributes to a reduction in emissions from 1990 baseline emissions levels and must also provide for consistency with the motor vehicle emissions budget established in the SIP.

The CAAA specifies in Section 182(b)(1) that NOx emission reductions would not apply in an ozone nonattainment area if a state could demonstrate that NOx reductions would not contribute to attainment of the ozone standard for the area. Pursuant to this provision, the Texas Natural Resource Conservation Commission (TNRCC) submitted preliminary technical analysis to the EPA indicating that NOx reductions would not be beneficial to the attainment of the standard. On this basis, EPA granted a temporary NOx waiver for the Houston-Galveston nonattainment area; the NOx waiver is scheduled to expire December 31, 1997.

The Houston-Galveston Area Council (H-GAC), serving as the MPO for the Houston-Galveston Transportation Management Area, is responsible for conducting the regional transportation planning process. The H-GAC provides technical support and staff assistance to the Transportation Policy Council (TPC) and its technical committee, which compose the MPO policy-making structure. As MPO, H-GAC is required to review the transportation plan and determine its conformity with the 1993 Texas 15% Volatile Organic Compounds (VOC) Reduction SIP for Ozone Attainment for the Houston-Galveston Ozone Nonattainment Area, in accordance with the EPA's final conformity rule published in the *Federal Register* on November 24, 1993.

Demonstration of Conformity

To demonstrate conformity as defined by EPA's final rule, analysis of transportation plans and TIPs must address the following criteria:

- Are the MTP and TIP consistent with the most recent estimates of on-road mobile source emissions?
- Does the MTP and TIP provide for expeditious implementation of transportation control measures (TCMs) in the applicable SIP?
- Does the MTP and TIP contribute to annual emissions reductions consistent with Section 182(b) and Section 187(a)(7) of the CAAA?

Adherence to the third criterion, specifically, is demonstrated by meeting three tests, regarding "action" and "baseline" scenarios. An Action scenario represents the future transportation system with proposed projects or investments. The Baseline scenario is the existing transportation system plus committed projects. This Baseline system is assumed to remain static over time, without investments. Regarding the third criterion above, the following must be shown:

- Emissions from each Action scenario of projects must be LESS than the 1990 emissions inventory,

- Emissions from each Action scenario of projects (Build) must be LESS than emissions from a Baseline (No Build) network of projects, and

- Emissions from an Action scenario of projects must be LESS than a specified emissions "budget" from the SIP, when available.

Each of the criteria as well as the conformity tests are discussed below.

II. Consistency with Recent Mobile Source Emissions Estimates

Estimates of on-road mobile source emissions are based on recent model runs of H-GAC's travel demand forecasting models and the EPA's Mobile Emissions Factor Model, MOBILE5a_h. The travel demand modeling procedures rely on up-to-date projections of population, employment,

travel and congestion. Emissions estimation procedures use input data that reflect controls in place or expected to be in place by the year of evaluation in the 1990 Base Year, 1999, 2007, 2010 and 2020 scenarios.

Procedures for analyzing emissions during the transitional phase specified by the final conformity rules were developed by the Texas Mobile Source Modeling Technical Working Group. The Technical Working Group includes representatives of the U.S. Department of Transportation (DOT), U.S. Environmental Protection Agency (EPA), Texas Natural Resource Conservation Commission (TNRCC), Texas Department of Transportation (TxDOT), transit agencies and MPOs from nonattainment areas across Texas.

II. A. Travel Demand Modeling Procedures

Population and Employment Forecasts

The 1990 Census Summary Tape File 1 (STF1) is the source of the 1990 Base Year population data for each of the eight counties and their respective census tracts. The 1990 MPO Abstract Tape (MPOAT) acquired from Dun's Marketing Services, a subsidiary of Dun & Bradstreet, is the source of 1990 base year place of work employment data at the county and census tract levels.

In late 1995, the Houston-Galveston Area Council (H-GAC) adopted a new set of demographic forecasts for the year 2020. For purposes of transportation planning, intermediate year forecasts in five-year increments from the Base Year (1990) to the forecast year (2020) were also developed. These intermediate estimates were adjusted to reflect 1995 Census population estimates, as well as Bureau of Economic Analysis and Texas Employment Commission data. Forecasts of households and employment for the other analysis years (i.e., 1999 and 2007) were produced by interpolation between the appropriate five year forecast. These forecasts serve as the basic input data, along with transportation system descriptions (e.g., networks), to the travel demand analysis process.

Forecast preparation involved a two-step process: development of regional forecasts (which serve as "control" totals) and the subsequent allocation of these forecasts to various geographical subareas, ultimately leading to traffic analysis zone (TAZ)-level forecasts. Regional forecasts of population, households, and employment were prepared using econometric and cohort component techniques. These techniques tie the regional forecast to statewide and

national economic trends and also integrate employment opportunities with the available labor force. These forecasts then become the "control" totals for subsequent, subarea allocations.

The first subarea allocation involved allocation of the regional forecasts to 199 subareas called Regional Analysis Zones (RAZs). Using an established allocation modeling process, subareas compete with each other for development based on land availability, land use development patterns, accessibility, market forces and historical development trends. This approach incorporates the interaction of land use and transportation activities. The RAZ-level forecasts were subsequently allocated to census tracts and then to TAZs using a procedure which utilizes estimates of vacant, usable and developed land at both the census tract and TAZ level.

Table 2 below presents the 1990 estimates (which were the basis for the forecast) as well as forecasted 1999, 2007, 2010 and 2020 population, households and employment for the eight-county non-attainment area.

TABLE 2
REGIONAL HOUSEHOLDS AND EMPLOYMENT ESTIMATES AND FORECASTS
1990, 1999, 2007, 2010 and 2020

	YEAR				
	1990	1999	2007	2010	2020
Households	1,338,775	1,666,837	1,908,407	1,994,114	2,207,275
Employment	1,809,856	2,140,746	2,480,490	2,620,592	3,061,134

Source: H-GAC, March, 1997

Scenario Development and Modeling

To address the conformity tests, baseline and action networks were developed for the years 1999, 2007, 2010, and 2020. Results from the 1990 base year network, developed for previous emissions inventory and conformity analyses, were also used for comparison.

- Base (1990) Scenario

Using the 1990 household and employment forecasts for the eight county TMA, trip generation (i.e., production and attraction) estimates were developed for each of six trip purposes:

Homebased Work (HBW), Homebased School (HBSCH), Homebased Shop (HBSHP), Homebased Other (HBO), Non-Homebased (NHB), and Truck-Taxi Trips (TRTX). The trip production models used to produce these estimates are cross-classification models based on household size and income, while the attraction models are based on employment. The 1990 external-local and external-through trip tables were based on 1990 external station (cordon) volumes.

Table 3 details the resulting person and vehicle trip estimates by purpose for the year 1990. The HBSCH, HBSHP, and HBO trips have been summed to a Homebased Non-Work (HBNW) total.

TABLE 3
INTERNAL TRIPS BY PURPOSE
FOR THE 8 COUNTY TRANSPORTATION PLANNING REGION

Purpose	1990	% of Total
HBW Person Trips	2,200,543	17.1
HBNW Person Trips	6,155,066	48.0
NHB Person Trips	3,806,188	29.6
TRTX Vehicle Trips	675,625	5.3
Total Internal Trips	12,837,422	100.0

Source: H-GAC, October, 1997.

Using a 1990 highway network and a set of F-factors calibrated to the year 1985 and validated to the year 1990, person trips by purpose as well as the Truck-Taxi and External-local vehicle trips were distributed using the Dissaggregate Trip Distribution Model (the Atomistic Model) of the TxDOT Trip Distribution Package (TTDP). Table 4 details by a general facility type structure the 1990 network which was used in the trip distribution as well as the assignment phases of this scenario analysis.

TABLE 4
1990 NETWORK
FOR THE 8 COUNTY TRANSPORTATION PLANNING REGION

Miles	Freeway/Tollway	Arterials	Collector	HOV Lanes[A]
Centerline	510	2,930	2,245	44
Lane	2,848	9,676	4,624	44

Source: H-GAC, October, 1997. [A] Excluding ramp structures

Transit mode shares were estimated based upon METRO's 1990 Transit On-Board Survey. Following the estimation of transit mode share, the Mezzo-level High Occupancy Vehicle (HOV) carpool model of the TTDP was utilized to account for and estimate the level of usage of the HOV lane system by carpools and to convert the person trip tables to vehicle trip tables. Based upon the transit mode share estimates produced by the METRO and the auto occupancy estimates from the H-GAC 1984 Regional Travel Survey (subsequently revised based upon the 1990 Nationwide Personal Transportation Survey (NPTS)), the HOV carpool demand on the 1990 HOV lane system was estimated.

Following the conversion of the person trip tables to vehicle trip tables, the vehicle trip tables were factored by trip purpose to represent the time periods desired for the estimation of time-of-day travel demand. The procedure used by H-GAC to factor trip tables relies on time-of-day trip table factors by trip purpose and the trip table factoring procedures of the TTDP. The trip table factors were developed based on an analysis of the 1984 H-GAC Regional Travel Survey data. Because the Regional Travel Survey contained no data on truck/taxi and external travel, survey data from other urban areas was used to develop trip table factors for those trip purposes.

In addition to factoring the 24-hour trips to represent the desired time period, the trip tables are converted from production-to-attraction orientation to origin-destination orientation. The factors used to perform this step are also based on the H-GAC Regional Travel survey.

Time-of-Day Trip Table Factors

Based on analyses of the trip table factors developed in 30 minute intervals, the daily vehicle trip tables were separated into the following time periods:

AM Peak	-	6:30 AM to 8:30 AM
Mid-day	-	8:30 AM to 3:30 PM
PM Peak	-	3:30 PM to 6:30 PM
Overnight	-	6:30 PM to 6:30 AM

Following the separation of the 24-hour trip tables by purpose for each of the four time periods, the trip tables for each trip purpose were summed to develop a single time-of-day trip table (e.g., AM Peak trip table). Each time-of-day trip table was then assigned to the appropriate 1990 time-of-day network. The time-of-day networks are the 1990 network with capacities reflective of the appropriate time-of-day. For example, the facilities represented in the 1990 AM peak network have 2-hour peak period capacities which vary by facility type, number of lanes, and area type.

The resulting time-of-day link volume estimates were then input to H-GAC's post-assignment speed model to develop link-level time-of-day speed estimates. The post-assignment speed model is based on procedures recommended in the report entitled *Highway Vehicle Speed Estimation Procedures For Use in Emissions Inventories* prepared by Cambridge Systematics for the U.S. Environmental Protection Agency in September 1991.

The speed estimation model relies primarily on the speed estimation techniques described in the *Highway Capacity Manual* (HCM). The HCM relationships are used to estimate the speeds for estimated volume-to-capacity ratios from zero to one. The extensions of the models for volume-to-capacity ratios exceeding one are based on the traditional Bureau of Public Roads (BPR) impedance adjustment function. The methods rely on the estimated volume-to-capacity ratio as a key measure of congestion for estimating the congested speed based on the constrained equilibrium volume of a link. Separate procedures are used for freeways and non-freeway streets.

The speed model was developed and calibrated using the 1985 AM and PM peak-period assignments for the Houston-Galveston region and comparing the modeled directional speeds to more than 8,000 observed directional link speeds encoded in the link data. The models were also validated to year 1990 observed directional speeds.

The centroid connectors in the Houston-Galveston TMA networks represent local street facilities that provide access to higher-level roadway facilities. Local streets are generally relatively low volume uncongested streets. Since there is not a one-to-one correspondence between centroid connectors and the local streets (i.e., a single centroid connector usually represents more than one local street) and since local streets generally operate without significant congestion, the speed models were not used to estimate the centroid connector speeds. The estimated speeds for the vehicle miles traveled (VMT) represented on centroid connectors were estimated based on the area type of the zone which is connected to the roadway network by the centroid connector and the length of the centroid connector. The estimated speed for intrazonal VMT (travel within a zone) is developed from the average of the centroid connector speeds for the zone.

The estimated level of travel (VMT) and congestion (speed) by link serve as inputs to the emissions model.

- Action Scenarios

Using the household and employment forecasts for 1999, 2007, 2010, and 2020, trip generation (i.e., production and attraction) estimates were developed for each of six trip purposes; Homebased Work (HBW), Homebased School (HBSCH), Homebased Shop (HBSHP), Homebased Other (HBO), Non-Homebased (NHB), and Truck-Taxi Trips (TRTX). The trip production models used to produce these estimates are cross-classification models based on household size and income, while the attraction models are based on employment. Trip generation estimates for the external-local and external-through vehicle trips for the 2010 scenario were provided by the TxDOT. Trip generation estimates for external-local and external-through vehicle trips for all other action scenarios were developed by applying a growth rate based on a smoothed trend between 1985 and 2010.

Table 5 summarizes the resulting person and vehicle trip estimates by purpose for the years 1999, 2007, 2010, and 2020. The HBSCH, HBSHP, and HBO trips have been summed to a Homebased Non-Work (HBNW) total.

TABLE 5
INTERNAL TRIPS BY PURPOSE
FOR THE 8 COUNTY TRANSPORTATION PLANNING REGION

Purpose	1999	% of Total	2007	% of Total	2010	% of Total	2020	% of Total
HBW Person Trips	2,697,740	17.4	3,065,613	17.4	3,205,223	17.5	3,508,626	17.4
HBNW Person Trips	7,346,395	47.3	8,261,710	47.0	8,609,885	46.9	9,363,924	46.5
NHB Person Trips	4,729,783	30.4	5,366,771	30.5	5,604,861	30.5	6,152,081	30.6
TRTX Veh. Trips	767,620	4.9	893,958	5.1	939,461	5.1	1,093,856	5.4
Total Trips	15,541,538	100.0	17,588,052	100.0	18,359,430	100.0	20,118,487	100.0

Source: H-GAC, October, 1997.

The regional roadway networks used in the "Action" scenario analyses represent the system of roadways assumed to be operational in each of the four analysis years. Therefore, the 1999 Action roadway network represents current roadways, plus roadways under construction, plus roadways expected to be operational by the end of FY 1999. The 2007 Action network includes all roadways in the 1999 Action roadway network plus all roadways expected to be operational by the end of FY 2007. The 2010 Action roadway network includes all roadways in the 2007 Action network plus all roadway expected to be operational by the end of FY 2010. The 2020 Action roadway network includes all roadways in the 2010 Action roadway network plus all remaining projects in the Houston-Galveston Metropolitan Transportation Plan *VISION 2020*. Table 6 summarizes the regional roadway networks for 1999, 2007, 2010 and 2020. Appendix E.1 of this document contains a listing of roadway projects by scenario. Appendix E.2 contains a link-level listing of the roadway modeling networks used in the analysis.

TABLE 6
ACTION ROADWAY NETWORKS
FOR THE 8 COUNTY TRANSPORTATION PLANNING REGION

	Miles	Freeway/ Tollway	Arterials	Collector	HOV Lanes[A]
1999	Centerline	602	4,107	1,484	86
	Lane	3,523	13,174	3,112	92
2007	Centerline	640	4,227	1,504	147
	Lane	3,993	14,235	3,181	159
2010	Centerline	704	4,435	1,544	151
	Lane	4,514	15,614	3,376	196
2020	Centerline	726	4,474	1,765	176
	Lane	4,685	16,181	4,091	277

Source: H-GAC, October, 1997. [A] Excluding ramp structures

Using the Action years' highway networks and a set of F-factors calibrated to the year 1985 and validated to the year 1990, the estimates of person trips by purpose as well as the Truck-Taxi and External-local vehicle trips were distributed using the Dissaggregate Trip Distribution Model (the Atomistic Model) of the TTDP.

Transit mode share data for the 1999 and 2020 Action scenarios was developed by METRO using the appropriate Action years' demographics, trip tables, and roadway systems, along with the appropriate Action year transit system . Transit mode shares for the 2007 and 2010 Action scenarios were developed through interpolation of the 1999 and 2020 shares. Following the estimation of transit mode shares, the HOV carpool model of the TTDP was utilized to estimate the level of usage of the HOV lane system by carpools and to convert the person trip tables to vehicle trip tables. Based upon the transit mode share estimates as well as auto occupancy estimates based upon the H-GAC 1984 Regional Travel Survey (subsequently revised based upon the 1990 NPTS), the HOV carpool demand on each of the Action years' HOV lane system was estimated. This model was also used to prepare the non-work vehicle trip tables for assignment.

The level of HOV lane carpool demand is based on minimum HOV lane occupancy and the capacity of the HOV lane. For purposes of this analysis, the current peak-period minimum occupancy requirements of 3+ and 2+ are assumed to continue as a means to manage the demand for HOV lanes. It is expected that variable minimum occupancy requirements will become more widely used if the priced or managed facilities contained in *VISION 2020* are implemented.

Following the conversion of the person trip tables to vehicle trip tables, the vehicle trip tables were factored by trip purpose to represent the same four time periods (AM Peak, Mid-day, PM Peak, and Overnight) as in the Base Year analysis. Following the separation of the 24-hour trip tables by purpose to time-of-day trip tables by purpose, the trip tables by purpose were summed to develop a single time-of-day trip table (e.g., AM Peak trip table). Each time-of-day trip table was then assigned to the appropriate Action scenario time-of-day network. Four time-of-day networks for each Action scenario were created to correspond to the four time-of-day trip tables for each Action scenario. These networks were created using the same time-of-day capacities that were used in the base year analysis.

The assigned time-of-day link volumes were then input to H-GAC's post-assignment speed model to develop link-level time-of-day speed estimates. The estimated speeds for the VMT represented on centroid connectors were based on the area type of the zone which is connected to the roadway network by the centroid connector and the length of the centroid connector. The estimated speed for intrazonal VMT was developed from the average of the centroid connector speeds for the zone.

- Baseline Scenarios

The regional roadway networks used in the "Baseline" scenario analyses include any projects from the first three year of the previously conforming MTP (*ACCESS 2010*) and TIP or which have completed the NEPA process and are assumed to be operational by the year of analysis. Therefore, the 1999 Baseline roadway network represents current roadways, roadways under construction, roadway projects contained in the first three years of the previously conforming MTP and TIP, and roadways projects which have completed the NEPA process. All Baseline network facilities are expected to be completed by the end of FY 1999. The 2007, 2010 and 2020 Baseline roadway networks are defined in a similar manner. Table 7 presents the configuration of the Baseline roadway networks by general facility types. Appendix E.1 of this document

contains a listing of roadway projects by scenario. Appendix E.2 contains a link-level listing of the roadway modeling networks used in the analysis.

TABLE 7
BASELINE ROADWAY NETWORKS
FOR THE 8 COUNTY TRANSPORTATION PLANNING REGION

	Miles	Freeway/ Tollway	Arterials	Collector	HOV Lanes[A]
1999	Centerline	602	4,107	1,484	86
	Lane	3,523	13,174	3,112	92
2007	Centerline	623	4,141	1,493	138
	Lane	3,777	13,521	3,136	145
2010	Centerline	623	4,141	1,493	138
	Lane	3,777	13,529	3,136	150
2020	Centerline	623	4,141	1,493	143
	Lane	3,777	13,529	3,136	150

Source: H-GAC, October, 1997. [A] Excluding ramp structures

The process utilized to estimate travel and congestion relative to the Baseline scenarios was the same as that used for the Action scenarios with the exception of the highway networks.

The Baseline network was used in the distribution of trips for all Baseline scenarios. The transit mode shares used for the 1999 and 2020 Baseline analyses were developed by METRO based upon an analysis of 1999 and 2020 demand on a Baseline transit system. Transit mode share estimates for the 2007 and 2010 'Baseline" scenarios were developed through interpolation of the 1999 and 2020 mode shares. A Baseline system of HOV lanes and the Baseline mode share estimates were used in the estimation of Baseline HOV carpools and the conversion of person trip tables to vehicle trip tables.

Finally, the estimates of time-of-day travel (VMT) and time-of-day congestion (speed) were developed from the assignment of the Baseline version of the appropriate years' time-of-day trip tables to the Baseline time-of-day highway networks. The process used to develop the time-of-

day trip tables and networks was the same as that used in the creation of the various Action scenario analyses and the Base Year analysis.

Table 8 presents a summary of the results from the mode share and person to vehicle trip conversions for the 1990, the Baseline and Action scenarios. The data show that transit mode share and HOV lane carpool demand increases over time as transit and transitway facilities/services become operational.

TABLE 8
SUMMARY STATISTICS - INTERNAL TRIPS[A]
FOR THE 8 COUNTY TRANSPORTATION PLANNING REGION

Scenario	Person Trips	Percent Transit[B]	HOV Lane Carpool Demand	HOV Lane Carpool Avg. Auto Occupancy[C]	Vehicle Trips
1990	12,501,209	4.18%	16,129	2.19	9,554,669
1999 Baseline	14,773,918	3.97%	41,237	2.56	11,277,356
1999 Action	14,773,918	3.97%	41,237	2.56	11,277,356
2007 Baseline	16,694,094	3.82%	79,029	2.56	12,736,582
2007 Action	16,694,094	3.85%	100,700	2.55	12,696,337
2010 Baseline	17,419,969	3.71%	81,565	2.56	13,306,076
2010 Action	17,419,969	3.82%	104,577	2.55	13,253,903
2020 Baseline	19,024,634	3.52%	110,499	2.55	14,525,877
2020 Action	19,024,634	3.72%	134,226	2.55	14,473,063

Source: H-GAC, October, 1997.

[A] Excluding TRTX trips
[B] Includes both transit and school bus trips.
[C] Minimum HOV lane carpool occupancy requirement of 2+.

- Transit and Toll Pricing Policies and Assumptions

In September of 1994 a fare increase was approved by the Metropolitan Transit Authority (METRO) Board of Directors. Prior to September of 1994, there had been no transit fare increase since the previous conformity determination of the MTP. Prior to and following the period since the last conformity analysis in November 1995, transit ridership levels were stable

overall, with very slight declines in certain markets. However, since the summer of 1997, ridership levels have risen. Although a complete understanding of the reasons for the increase are pending the analysis of marketing/survey data, it appears that revised fare structures and increased marketing efforts have played a role.

Assumptions regarding the level of transit service for the conformity determination of the MTP are consistent with METRO's 2020 Regional Transit Plan (HORIZON 2020). Transit fares were assumed to remain at existing levels throughout the analysis period.

Both existing and future toll facilities were evaluated assuming currently reflected toll pricing would remain at a fixed amount.

- Travel Model Results

The results from the travel models reflect the expected demographic trends in the region over the next couple of decades, as shown in Table 9. VMT is expected to climb almost 38 percent from 1999 to 2020 to a total of 161 million per day in the region. The growth is sharper initially, about 1.9 percent per year to 2007, and slower thereafter, roughly 1.3 percent annually. In the Action scenario, speeds would be expected to improve slightly to an average of 46 miles per hour region-wide, whereas they would be expected to decline slightly under the Baseline scenarios, to over 44 miles per hour. The vehicle miles of travel and average speed results for each county and facility type for each of the scenario years as well as the 1990 base year are presented in Appendix E.4.

TABLE 9
SUMMARY STATISTICS – TRAVEL MODEL RESULTS
FOR THE 8 COUNTY TRANSPORTATION PLANNING REGION

Scenario	Vehicle Miles of Travel (Million VMT)	Average Speeds (mph)
1990	92.4	37.7
1999 Action/Bsln	117.3	45.4
2007 Baseline	136.7	45.6
2007 Action	136.0	46.1
2010 Baseline	142.2	44.9
2010 Action	140.7	45.9
2020 Baseline	161.0	44.7
2020 Action	161.4	46.1

Source: H-GAC, December, 1997.

The level of travel (VMT) under the Action and Baseline scenarios is comparable. The comparison does reveal that the Baseline scenarios are more congested than the Action scenarios, as reflected in the average daily speeds.

II. B. Transit Bus VMT

Transit bus vehicle miles of travel are not directly addressed by the H-GAC travel models. Estimates of bus VMT were provided for each year for each scenario by METRO. Estimates of bus VMT are produced as part of METRO's analysis of each of the Baseline and Action scenarios for each analysis year.

II. C. Highway Performance Monitoring System Adjustments

As part of the process of developing emissions inventories for the EPA, H-GAC is required to adjust the estimates of vehicle miles of travel from the H-GAC travel demand models to be consistent with the VMT estimates collected for the Highway Performance Monitoring System (HPMS), a national standard. With the development of the revised emissions estimates for the revised Rate-of-Progress State Implementation Plans, H-GAC began a practice of developing and

applying an HPMS adjustment factor for both regionally significant (non-local) roads and local streets. Table 10 below presents updated HPMS non-local and local adjustment factors.

TABLE 10

HPMS ADJUSTMENT FACTORS

DEVELOPED FROM 1995 VMT ESTIMATES

Road Type Group	HPMS Adjustment Factor
Non-local	1.0062
Local	1.0777

Source: Houston-Galveston Area Council, March 1997.

A more detailed explanation is provided in the technical memorandum regarding the HPMS adjustment process in Appendix E.4.

II. D. Emissions Procedures

Time-of-day mobile volatile organic compound (VOC) emissions estimates for ***VISION 2020*** *The Metropolitan Transportation Plan* and the *1998 - 2000 Transportation Improvement Program* conformity analysis were developed from the link-based travel demand VMT and speeds estimates, and from vehicular emission factors. Rates for each link speed were obtained and multiplied by the link VMT to give VOC emissions for each link. Total emissions for each scenario were then obtained by aggregating the link-level results over a 24-hour period.

Emission Rates

Emission rates or factors were developed using the Environmental Protection Agency MOBILE5a_h mobile emissions model and procedures developed during the revisions to the Rate-of-Progress State Implementation Plans (SIP) in 1996[1]. "Registration" emission factors, representing the emissions rates of vehicles based on their county of registration, were calculated using MOBILE5a_h, a modified version of the original MOBILE5a to account for updated inspections/maintenance program credits, and POLFAC5B, a program developed by the Texas Transportation Institute to run MOBILE5 at multiple speeds. The inputs to the MOBILE5a_h

[1] See Appendix C for MOBILE5a_h inputs and outputs.

model were the same as those used in the development of recent emissions inventory reports[2], with adjustments made to address the different scenario years and the rolling window of vehicles subject to the Harris County inspections/maintenance program.

"Commute" emission factors, or emission rates effectively representing the traffic in the counties at any one time of day, were then obtained using another TTI program, RATEADJV.[3] Essentially, the registration emission factors were combined according to the percentages of travel commuting in to a particular region from the other regions within the 8-county nonattainment area. This process is undertaken to ultimately yield emissions that are representative of the traffic at any one place at any one time.

Highway Network Emissions

Emissions were then obtained using a third TTI program, IMPSUMA, which assigns emission factors to network links based on link speeds. The program then multiplies the emission factors by the link VMT and then aggregates the link emissions to county-level totals.

Bus Emissions

Emissions attributable to transit buses are estimated by time-of-day and for freeway and non-freeway road types for Harris County only. Buses are assumed to operate at the average operational speeds specific to the time and facility. Bus (HDDV) emissions are estimated by multiplying VMT by the appropriate emission factor. The resulting emissions are added to the Harris County HDDV emissions totals and, hence, the regional highway emissions totals.

Emissions from Nonrecurring Congestion

Non-recurring congestion consists of any non-routine congestion resulting from accidents or other random incidents. Although the travel demand modeling and speed estimation processes

[2] See the H-GAC reports *Revised Rate-of-Progress State Implementation Plan On-Road Mobile Source Emissions Inventories,* August 1996, and the *Revised On-Road Mobile Source Emissions Inventory Estimates in Support of the Vehicle Miles of Travel Offset State Implementation Plan*, June 1997.

[3] See Appendix for excerpt from the August, 1996 H-GAC report regarding the development of "commute" factors.

used by H-GAC account for delay associated with recurring congestion, they do not allow for the estimation of delay caused by non-recurring congestion. To address non-recurring congestion, H-GAC uses a delay-based procedure to estimate the emissions which would result from the delay caused by non-recurring congestion on Harris county freeways[4].The procedure to estimate the effects of non-recurring congestion is based on research presented in "Urban Freeway Congestion: Quantification of the Problem and Effectiveness of Potential Solutions" by Jeffrey A. Lindley, ITE Journal, January 1987. Lindley suggested that freeway delay could be characterized as follows:

Total Freeway Delay = 1/3 Recurring Congestion + 2/3 Nonrecurring Congestion

Therefore, for a typical freeway,

Nonrecurring Congestion = 2(Recurring Congestion)

Where recurring delay represents to difference in vehicle hours of travel at hypothetical free-flow speeds and at estimated scenario freeway speeds. The delay associated with non-recurring congestion is estimated as twice the recurring delay and added to the recurring and uncongested delay to establish a new estimated of freeway delay. By dividing the new estimate of freeway VHT to the estimate of travel on freeways (VMT), the average travel speed on freeways is re-estimated to include the effects of non-recurring congestion. The percent increase in emissions is developed by estimating the emissions due to freeway travel at the speed which does not account for non-recurring congestion and the emissions due to freeway travel at the speed which does consider non-recurring congestion.

H-GAC performed this calculation by time of day for freeway travel in Harris County and summed the differences to establish a percent daily change in emissions. An example calculation using data from the AM Peak Period is provided below.

$$VHT_F = VHT_U + VHT_C + VHT_N$$

where,

VHT_F = vehicle hours of travel on freeways

VHT_U = vehicle hours of travel occurring under uncongested conditions.

[4] By convention, it has been assumed that Harris County freeways bear the vast majority of the incidents that result in non-recurring congestion.

VHT_C = vehicle hours of travel occurring under recurring congestion.
VHT_N = vehicle hours of travel occurring under non-recurring congestion.

$VHT_F = 95,700 + 28,900 + 0$

$VHT_F = 124,600$

With an estimated VMT of 5,979,000, the 124,600 VHT equates to approximately 48 mph. Incorporating non-recurring delay is as follows:

$VHT_F = 95,700 + 28,900 + 57,800$
$VHT_F = 182,300$

Using the same estimate of travel and the new estimate of delay of 182,300 the estimated speed including non-recurring delay is 33 mph. The increase in emissions is simply estimated by applying the appropriate emission factors for each speed to the estimated freeway VMT. The above calculation was repeated for each of the four time periods for which Harris County freeway VMT was estimated, with the estimated emissions summed for each scenario (not including and including non-recurring delay). The difference was calculated for a day and applied to the emissions total as a percent change.

Using this procedure H-GAC has estimated that the daily VOC emissions total should be adjusted upward by the amounts shown in Table 11 to account for non-recurring congestion. These adjustments were made to the travel model highway results.

TABLE 11
NON-RECURRING CONGESTION EMISSIONS ADJUSTMENT

Scenario	1999	2007	2010	2020
Action	4.92%	5.96%	4.87%	6.66%
Baseline	4.92%	7.65%	9.02%	10.48%

Source: H-GAC, December, 1997.

III. Expeditious Implementation of Transportation Control Measures

The Clean Air Act Amendments of 1990 required regions in nonattainment for one of the criteria pollutants to make enforceable commitments to implement, maintain and monitor transportation control measures (TCMs). Pursuant to regulation, the Texas Natural Resource Conservation Commission requires an annual report on the status of regional TCMs included in the State Implementation Plan (SIP). The report contains an evaluation of categories of transportation control measure projects for which implementation agencies have committed in post-1990 SIP amendments to implementation magnitude and schedules and for which the Metropolitan Planning Organization (MPO) has committed to the funding and projected emission reductions. Accordingly, the evaluation focuses on the collective magnitude, timing, funding and air quality benefits of the projects by category.

A summary of the of the current status of TCMs are shown in tables 11a-11c. The summary provides the SIP magnitude and emissions commitments, as well as the categories' schedules status.

TABLE 12a

TCM Category Status for 1996 SIP Milestone Year Commitments[5]

SIP Category	Commitments in SIP		Current Status of Categories (as % of Magnitude)		
	Magnitude	VOC Rdctns (lb/d)	Mileage/Other, % Let	Mileage/Other, % Operational	% Operational by 1996
1. Signalization	2.9 mi	2.14	100 %	100%	100 %
2. High-Occupancy Vehicle (HOV) Lanes	14.7 mi	317.73	100 %	100 %	100 %
3. Park & Ride Lots	3,745 spcs	52.00	100 %	100 %	100 %
4. Arterial Traffic Management System (ATMS)	41.0 mi	57.58	100 %	100 %	100 %
5. Computerized Traffic	22.2 mi	126.83	100 %	100 %	100 %

Source: H-GAC, October, 1997.

TABLE 12b

TCM Category Status for 1999 SIP Milestone Year Commitments

SIP Category	Commitments in SIP		Current Status of Categories (as % of Magnitude)		
	Magnitude	VOC Rdctns (lb/d)	Mileage/Other, % Let	Mileage/Other, % Operational	% Operational by 1999
1. Signalization	49.3 mi	23.05	100 %	100 %	100 %
2. Bicycles	263.7 mi	199.18	0 % [6]	0 %	100 %
3. HOV Lanes / Vanpool	3.5 mi 225 vans	6.99 145.10	100 % 100 %	100 % 96 %	100 % 100 %
4. Park & Ride Lots	1,643 spcs	91.49	100 %	100 %	100 %
5. Arterial Traffic Management System	65.8 mi	92.51	100 %	100 %	100 %
6. Computerized Traffic Management System (CTMS)	70.3 mi	320.11	100%	100 %	100 %
7. Accident Investigation Sites	3.2 mi	50.94	100 %	100 %	100 %

Source: H-GAC, October, 1997.

[5] For each milestone year, "commitments" refers to new/additional projects expected to be open for service prior to the milestone. Therefore, for example, the amounts listed in Table 1b represent quantitative indicators associated with the total of all projects in each SIP category anticipated to be open for service between October 1996 and October 1999.

[6] Over 97% of SIP bike projects are expected to be let in 1998 and completed by 1999, per City of Houston, 11/97.

TABLE 12c

TCM Category Status for 2007 SIP Milestone Year Commitments

SIP Category	Commitments in SIP		Current Status of Categories (as % of Magnitude)		
	Magnitude	VOC Rdctns (lb/d)	Mileage/Other, % Let	Mileage/Other, % Operational	% Operational by 2007
1. Arterial Traffic Management System (ATMS)	1.5 mi	1.71	100 %	0 %	100 %
2. Computerized Traffic Management System (CTMS)	59.5 mi	339.33	0 %	0 %	100 %
3. Accident Investigation Sites	30.0 mi	221.59	17%	0 %	100 %

Source: H-GAC, October, 1997.

IV. Annual Emissions Reductions Estimates

The third main conformity criterion regards the consistency of the Metropolitan Transportation Plan and the Transportation Improvement Program with the ozone standard attainment demonstration and reasonable further progress requirements under the State Implementation Plan. Consistency with the SIP, as stated earlier, is demonstrated by meeting the three conformity tests: "budget", "build/no-build", and "below the base year maximum".

To address this criterion, H-GAC has developed the following evaluation components:

- Base year inventory - A base estimate of emissions -- namely the base year 1990.

- Baseline (No/Build) Scenarios. Scenarios were constructed for the years 1999, 2007, 2010, 2020, representing the hypothetical outcome if the transportation system were to develop no further than the Baseline transportation system[7]. The Baseline transportation system includes the existing system as well as proposed facilities from the first three years of the previously conforming MTP (*ACCESS 2010*) and TIP (1997 – 1999 TIP) and proposed facilities which have completed the NEPA process. These proposed facilities are placed into the appropriate analysis year based on the assumed operational date of the facility.

[7] The conformity rule which nonattainment areas in the state currently operate under contains a requirement that the first analysis year in ozone nonattainment areas to be no later than 1996. However, a memorandum issued by Peter A. Lombard, Director of Planning and Program Development, FHWA Region 6, October 21, 1996, stated that conformity analysis and determinations occurring in 1997 do not have to address the requirements of the conformity rule pertaining to the analysis of 1996.

- Action (Build) Scenarios. Scenarios were constructed for the years 1999, 2007, 2010 and 2020, representing the outcome if the projects beyond the Baseline scenario contained in ***VISION 2020*** are constructed. As with the Baseline scenarios proposed facilities are placed into the appropriate analysis year based upon the assumed operational date of the facility.

The scenarios were developed to evaluate mobile source VOC emissions, as stated in the background section. As there currently exists no requirement to evaluate NOx, no analysis is presented herein with regard to NOx.

The results of the emissions analysis is shown in Table 13.

Table 13
CONFORMITY FINDING OF THE VISION 2020 MTP
VOLATILE ORGANIC COMPOUNDS EMISSIONS ANALYSIS
(tons per day)

CATEGORY	VOLATILE ORGANIC COMPOUNDS								
	1990 Base	1999 Baseline	1999 Action	2007 Baseline	2007 Action	2010 Baseline	2010 Action	2020 Baseline	2020 Action
Highway Emissions	251.70	129.60	129.60	117.38	115.66	119.04	115.23	131.52	127.88
Emissions reductions from Non-Added-Capacity (N-A-C) projects:									
CMAQ projects	N/A	3.25	4.04	2.78	4.23	2.71	4.06	3.20	5.80
Alternative Fuel Programs	N/A	N/A	N/A	0.08	0.08	0.08	0.08	0.08	0.08
Bus Conversions to Natural Gas	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.48	1.48
I/M Remote Sensing	N/A	0.06	0.06	0.06	0.06	0.06	0.06	0.07	0.07
Total emissions after N-A-C adjustments	**251.70**	**126.29**	**125.50**	**114.46**	**111.29**	**116.18**	**111.03**	**126.68**	**120.45**
1999 SIP Budget:		127.82	127.82	N/A	127.82	N/A	127.82	N/A	127.82

Source: H-GAC, December, 1997. Source for 1990 estimates: "Final 1990 Base Year Ozone State Implementation Plan On-Road Mobile Source Emissions Inventory", H-GAC, May 1993. Totals may not sum due to rounding.

IV. A. Highway Emissions Estimates

As described earlier, emissions estimates are calculated using travel demand model data and EPA mobile source emission rates. The results are shown in the first line of Table 13, indicating that transportation emissions continue to decline through the designated ozone attainment year for the region.

IV. B. Emissions Reductions Measures

Congestion Mitigation and Air Quality Projects and Transportation Control Measures

Under the Congestion Mitigation and Air Quality Improvement (CMAQ) Program the non-added-capacity transportation projects are eligible for CMAQ funds in nonattainment areas. The projects funded with CMAQ funds are aimed at reducing mobile source emissions. In addition, the conformity analysis attempts takes into account any other transportation control measures (TCMs). Example of CMAQ and/or TCM projects in this analysis include:

- Regional Computerized Traffic Signal System (RCTSS)
- Arterial Traffic Management Systems (ATMS)
- Intersection improvements
- Park-and-ride lots
- High Occupancy Vehicle Lanes (HOV)
- Transit service projects

Methodologies for estimating the emissions reductions relating to CMAQ/TCM projects as well as the actual CMAQ/TCM projects used in the plan's emissions reduction analysis are discussed in detail in Appendix E.4.

The 1999 “Baseline” contains all existing and committed non-added-capacity roadway projects from the 1996 TIP that will be operational by the end of FY 1999 and meet the baseline criteria. For the CMAQ/TCM evaluation, a project meeting the baseline criteria must either be under construction or it was listed in the first 3 years of the previously conforming plan and/or TIP. The

projects were analyzed with 1999, 2007, 2010 and 2020 emission factors to determine the level of emission reductions that would occur in the respective calendar year.

The 1999 "Action" scenario contains all projects from the 1999 baseline as described above plus any non-added-capacity projects with an estimated letting date between FY 1996-1998 that will be operational by FY 1999, but do not meet the baseline criteria.

The 2007 "Baseline" includes projects from the 1999 baseline plus projects with a letting date between FY 1999-2006 that will be operational by the end of FY 2007 and meet the baseline criteria. The 2007 "Action" includes all projects from the previous baseline and action scenarios. In addition, this scenario includes projects with an estimated letting date between FY 1998-2006 and are expected to be operational by FY 2007, but do not meet the baseline criteria.

Projects in the 2010 "Baseline" include all previous projects baseline from the previous baseline scenarios plus projects with an estimated letting date between FY 2007-2009 that will be operational by FY 2010 and meet the baseline criteria. The 2010 "Action" contains projects from the previous baseline and action scenarios, in addition to projects with a letting date between FY 2007-2009, but do not meet the baseline criteria. These projects are assumed to be operational by the end of FY 2010.

The 2020 "Baseline" scenario is composed of all projects from the baseline scenarios previously described. In addition, projects having an estimated letting date between FY 2010-2019 that will be operational by the end of FY 2020 are also included. These projects are also subjected to meeting the baseline criteria. The 2020 "Action" contains projects from the previous baseline and action scenarios, in addition to projects having a letting date between FY 2010-2019 that will be operational by FY 2020, but do not meet the baseline criteria.

Pertinent calendar year emissions factors were applied for each analysis year. To determine total net emissions, the emission estimates were then subtracted from the emissions resulting from the roadway "Action" and "Baseline" scenarios for each analysis year. A listing of all CMAQ projects is contained in Appendix E.4 of this document.

Bus Conversions to Natural Gas Evaluation Procedures

All transit and school bus fleets of 15 or more vehicles within the nonattainment area are mandated by both State and Federal statutes to convert to an alternative fuel. Natural gas, in either gaseous or liquid form, is the alternative fuel of choice for several large bus fleets, including METRO, Brazos Transit, and Galveston Island Transit. Emissions benefits for natural gas powered bus conversions were based upon estimated natural gas heavy-duty emissions factors, required bus conversion schedules and estimated annual average bus miles traveled .

Clean Fuel Programs

The Clean Fuel Programs incorporate both the Texas Alternative Fuels Fleet Program (TAFF) and the Houston-Galveston Alternative Fueled Vehicle (AFV) Program as well as the Federal Clean Fuel Program. The TAFF mandates that a certain percentage of vehicles in private and public fleets of 15 or more (a vehicle is defined as all light-duty vehicle and trucks less than 8,500 lb. gross vehicle weight) use an alternative fuel (e.g., gaseous and liquefied natural gas, methanol or methanol/gasoline blends, ethanol or ethanol/gasoline blends, reformulated gas, and electricity); all conversions must meet the low emission vehicle (LEV) standard. The AFV Program will support the efforts of local and state governments in complying with the SB200 by providing funding to local governments for conversions.

The emission benefits for all alternative fuel programs were based on comparing the total evaporative and tail pipe emissions from the affected fleet vehicles to the emissions which the same number of conventional vehicles would produce in the absence of the fleet program. Emission estimates were generated for the two cases in order to evaluate the potential VOC and NOx emission reduction benefits from the SB200. First, the baseline/action emission standards were estimated assuming that covered fleet vehicles met the applicable federal standard (Tier 1). Second, emissions were estimated assuming that covered fleet vehicles met LEV emissions standards. The difference between the two emission estimates represented the emissions reductions benefit of the SB200 and AFV Fueled Program relative to the federal program.

In terms of Alternative Fuel Programs emission reductions shown in Table 13, the AFV program has the effect of accelerating the emissions benefits of the SB200. For all other Action and Baseline scenarios, the emission reductions shown in Table 13 are a result of the SB200 program.

IV. C. The Conformity Tests

As indicated by Table 13, the conformity analysis of the *Vision 2020: The Metropolitan Transportation Plan* and the *1998-2000 Transportation Improvement Program* demonstrates that the required conformity tests are passed. That is,

- In no scenario year are the emissions from the Action scenario expected to exceed those from the Baseline scenario.

- In no scenario year are the emissions from the Action scenario expected to exceed the Motor Vehicle Emissions Budget of 127.82 tons VOC per ozone day.

- In no year are the emissions from the Action scenario expected to exceed those of the base year (1990).

Hence, the tests for the plan and the TIP have been met.

V. Conclusion

Mobile source emissions estimated for ***VISION 2020*** and the *1998-2000 TIP* are consistent with the most recent projections of population, employment, travel and congestion available. ***VISION 2020*** demonstrates attainment of TCM targets established in the SIP and provides for expeditious implementation of additional measures designed to reduce congestion and vehicular travel demand.

H-GAC believes that it is both necessary and appropriate to take credit for emissions reductions due to the implementation of CMAQ/TCM projects, Bus Conversions to Natural Gas and the Texas Alternative Fuel Fleet (TAFF) Programs, given current analysis methodologies and knowledge of the programs.

VOC emissions estimates from all the Action scenarios, shown in Tables Z, are lower than those estimated for the 1990 Base Year. Additionally, VOC emissions are lower than the VOC budget established by the 1996 SuperSIP. Finally, emissions from Action (Build) scenarios are consistently lower than Baseline (No-Build) scenarios for all analysis years. ***VISION 2020****: The*

Metropolitan Transportation Plan and the *1998 - 2000 Transportation Improvement Program,* therefore, pass all three conformity tests required under EPA's Final Conformity Rule. The transportation improvements in ***VISION 2020*** MTP and the *1999 - 2000 TIP* are in conformity with both the SIP and the Clean Air Act, as amended.

APPENDIX E.1

PROJECT LIST

APPENDIX E.2

MODELING NETWORKS

LINK LIST

APPENDIX E.3

MOBILE5a_*h* SETUPS

APPENDIX E.4

- **CMAQ PROJECT LISTING AND METHODOLOGY**
- **HPMS ADJUSTMENT TECHNICAL MEMORANDUM**
- **COMMUTE ADJUSTMENT METHODOLOGY FOR EMISSION FACTORS**
- **VMT TABLES**
- **VMT AND SPEED FORECASTS**