4.0 TRANSPORTATION DEMAND

In order to develop an understanding of future needs for the transportation system in Fort Collins, the City's comprehensive TransCAD transportation demand model was used. This model uses land use, population, and employment data about Fort Collins and the region to estimate trips, travel patterns, mode choices, and traffic volumes. This information is in turn used to estimate street congestion, transit ridership, vehicle miles traveled (VMT), air quality impacts, and other measures of transportation system performance. To properly consider travel between Fort Collins and nearby communities, the travel model covers an area including Fort Collins, Loveland, Greeley, and smaller cities in the North Front Range region.

Considerable effort has been taken to ensure that the model conforms to industry standards and uses methodology that is considered "Best Practice." During the federal funding application process for the Mason Transportation Corridor, the Fort Collins model was scrutinized and accepted by some of the country's top modeling experts. Separately, efforts were undertaken to ensure consistency with a similar model used by the North Front Range Metropolitan Planning Organization (NFRMPO). This stringent quality control process has ensured that the model is a reliable, defensible tool.

The model was used to support a variety of analyses completed for the *Fort Collins Transportation Master Plan 2004*. The first step in using the model was to update it with the most current socioeconomic information that was developed by the *City Plan* team. The model was refined by adding a capacity analysis tool that provides level of service (LOS) outputs at the link and intersection level. Once the demographic data was input into the model, three scenarios were developed to portray different combinations of land use and transportation networks. Based on the results of the model, four questions were developed to define how the City decides to address improvements to the transportation network.

Other analyses included sensitivity testing for potential changes to the Master Street Plan (MSP) and the performance of the transportation system under the fiscally constrained capital improvement plan (CIP), and the effectiveness of regional transit connections. Sensitivity testing was also used to identify the street capacity required to provide level of service E or better on all facilities in 2025. This unconstrained modeling analysis assumed that all of the streets were able to carry as much traffic as wanted to use the street. Finally, the most current version of the Environmental Protection Agency's (EPA) air quality model (MOBILE6) was used in cooperation with the model to evaluate air quality results for the various scenarios.

Additional documentation on the model is included in **Appendix C**.

4.1 MODEL INPUTS

To generate travel forecasts, the transportation model requires input data that represents the Fort Collins and North Front Range community. To model travel demand, employment and housing data (i.e. socioeconomic data) is required. For the current year, this data is collected from the US Census and from state and local employment records. For future year travel forecasts, land use, and socioeconomic growth projections developed for *City Plan* were used. For the future analysis, a 2025 horizon year was chosen. The socioeconomic information is used by the model to estimate the number of trips made by residents and workers in the region. The trip making characteristics of the North Front Range communities are based on results of national, regional, and local travel surveys.

4.2 CAPACITY ANALYSIS

To predict future congestion levels, the capacity on the transportation network is compared with the demand for travel. Congestion is measured by the level of service (LOS) the roadway facility provides to the public. LOS is a rating system used in traffic engineering to measure the operational conditions of freeways, roadways, interchanges, and intersections. The variables considered in this rating system include speed, travel time, vehicular delay, traffic interruptions, and freedom to maneuver. For this capacity analysis each street segment is given a LOS score indicating its ability to serve forecasted traffic volumes. The LOS analysis was also calibrated to provide intersection LOS. The LOS score is based on the ratio of peak-hour volume to peak hour capacity (V/C). There are six LOS categories ranging from “A” to “F”. LOS A through C represent uncongested streets, LOS D and E represent facilities that are becoming congested, and LOS F represents congested streets. This analysis was used to assess the performance of the transportation system for different scenarios. On the accompanying figures, streets in green represent uncongested streets, streets in yellow represent facilities that are becoming congested, and streets in red represent facilities that are congested.

4.3 SCENARIO ANALYSIS

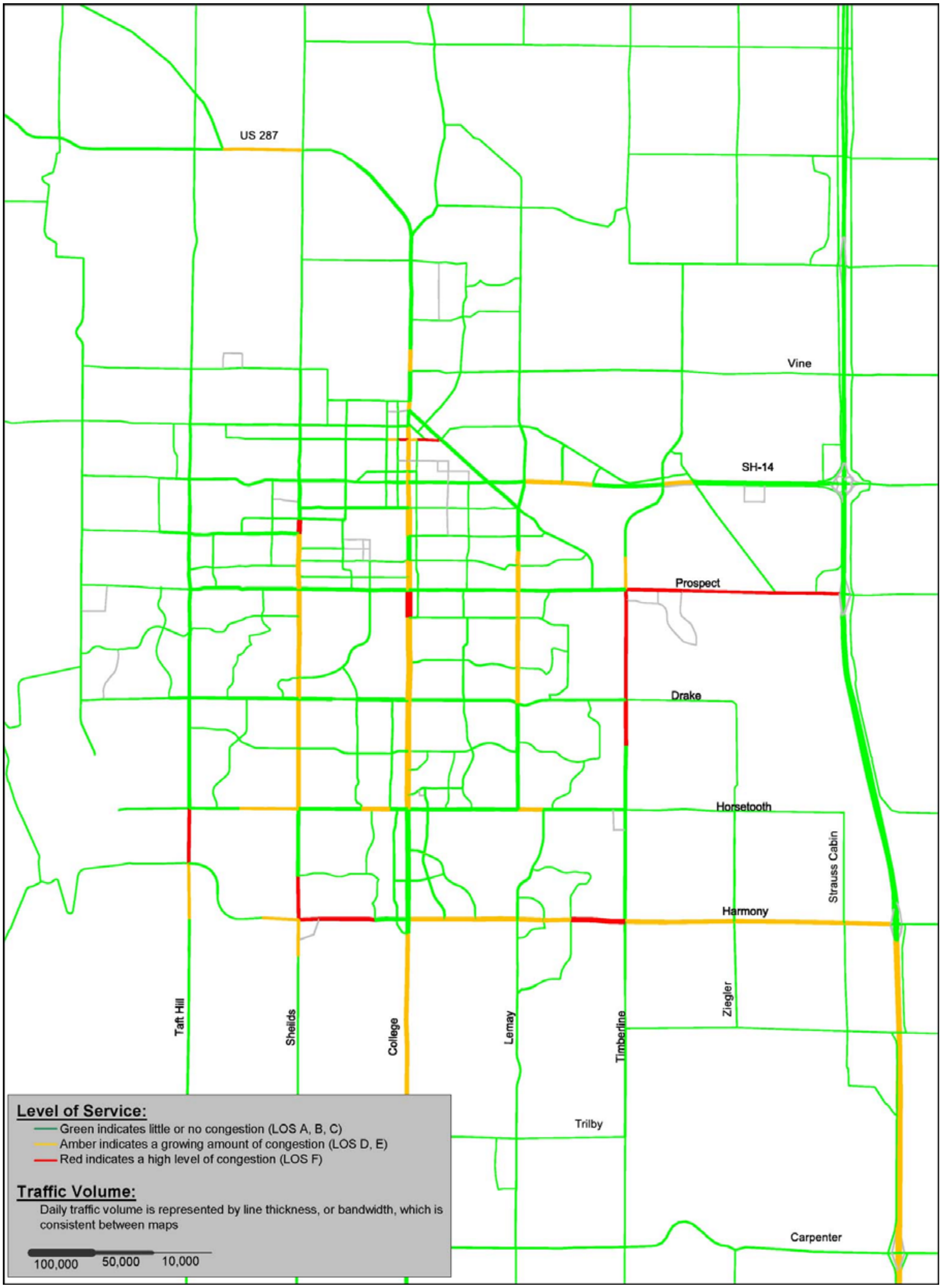
To gain a better understanding of the transportation system's current and future needs, three potential scenarios were modeled; Existing, Existing and Committed, and the Vision Plan. The scenarios represent different combinations of land uses and transportation networks.

The Existing Scenario shown in Figure 4.1 reflects conditions experienced by Fort Collins residents and visitors today. It assumes the current land uses and existing transportation network. As expected, there is heavy congestion on Prospect, Timberline, Harmony, College, and in the Old Town Business District, as well as more moderate congestion on Shields, and Lemay.

The Existing and Committed (E+C) Scenario shown in Figure 4.2 demonstrates the effects of future socioeconomic growth on today’s street and transit system. In this scenario, 2025 population and employment forecasts are modeled against a transportation system with very few improvements. The only additions assumed in the E+C transportation system are street projects that have already been funded. No transit improvements are assumed beyond current service. The result of this analysis is an extremely congested street network and an inadequate transit system. In this case, nearly all Fort Collins arterials are heavily congested.

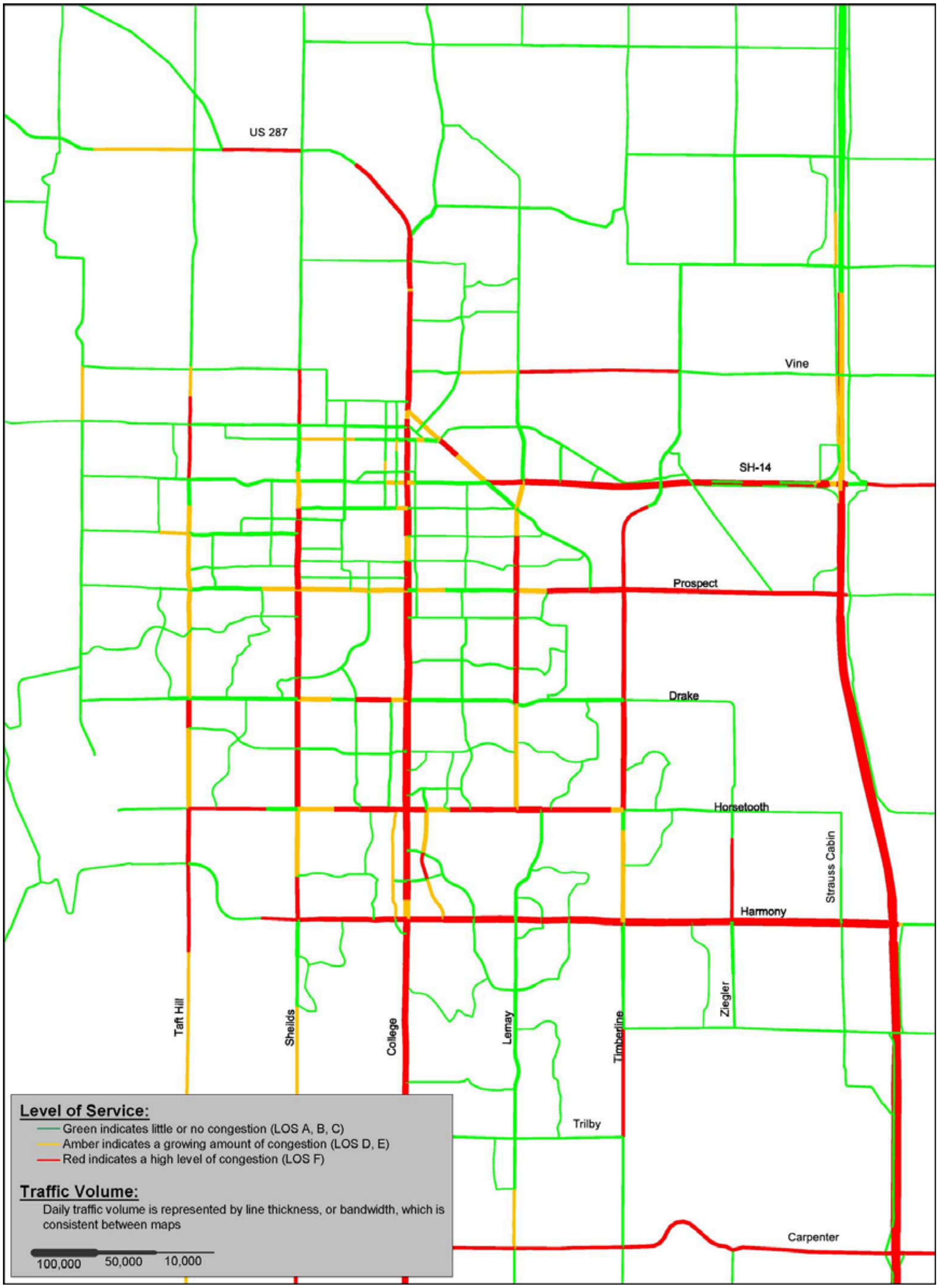
The third scenario represents the Vision Scenario and is shown in Figure 4.3. In this case, all street projects in the current MSP are assumed to be built and all phases of the Transfort Strategic and Long Range Plans are included. When modeled with forecasted 2025 socioeconomic data, results show a significant improvement over the E+C scenario. However,

Figure 4.1
Existing Scenario



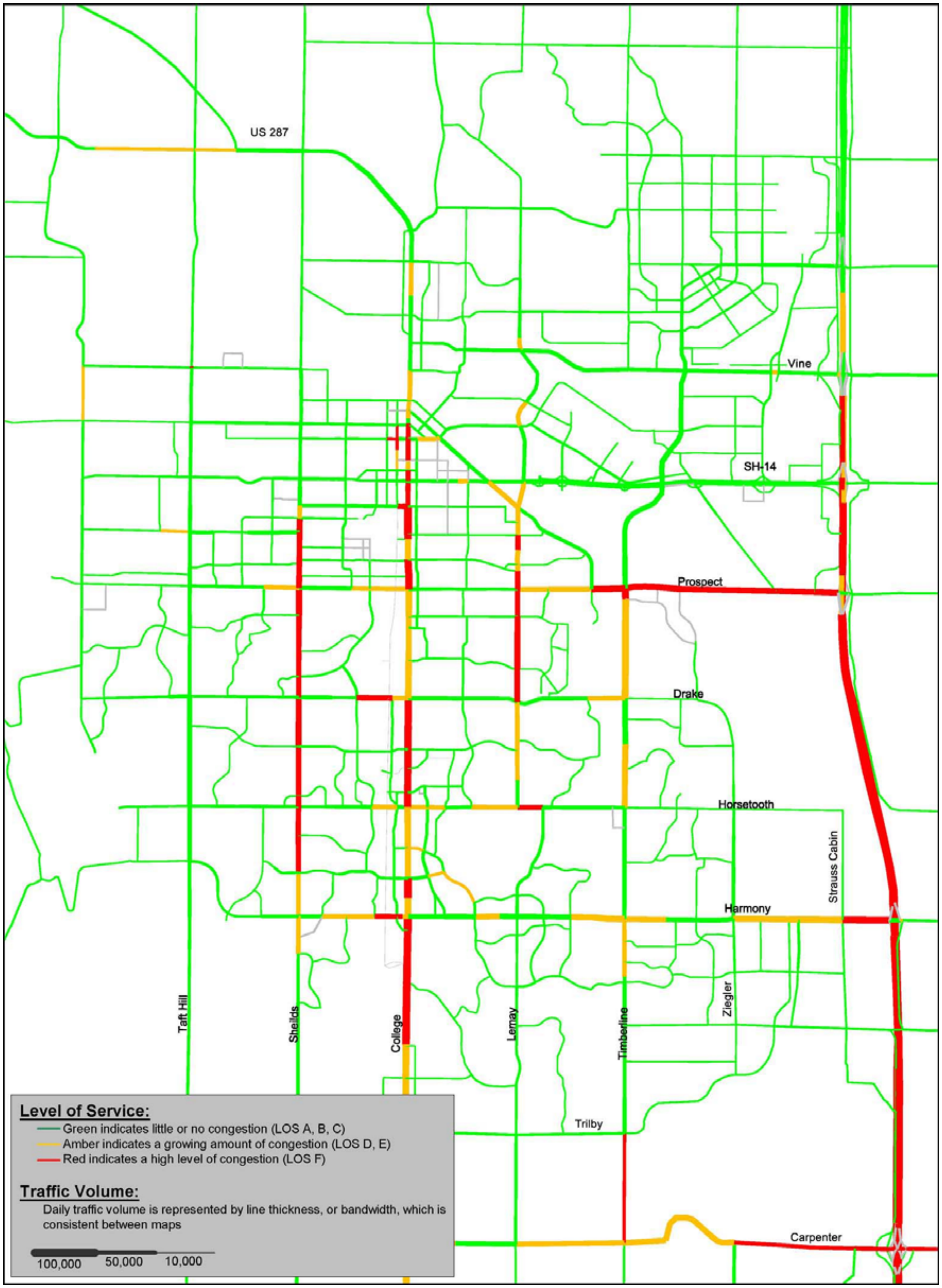
Note: The existing scenario assumes current socioeconomic data, and the existing street network.

Figure 4.2
Existing and Committed (E+C) Scenario



Note: The E+C Scenario assumes forecasted 2025 socioeconomic data based on City Plan Update, the existing street network plus funded projects through the next 2-3 years, and the existing Transfort service plan.

Figure 4.3
Vision Plan Scenario



Note: The Vision Plan Scenario assumes forecasted 2025 socioeconomic data based on City Plan Update, Master Street Plan street network, as adopted, and the Long Range Transfort service plan.

congestion in the Vision Scenario is noticeably worse than today, with corridors such as College, Prospect, Lemay, Shields, and Carpenter Road experiencing a significant increase in congestion.

Increased traffic volumes on connections to I-25 are demonstrative of a marked increase in regional travel. Due to heavy regional growth, more people are expected to travel between Fort Collins and the surrounding area. While congestion is reduced in some areas due to street and transit improvements, the overall congestion in Fort Collins increases.

The results of the scenario analysis were used to solicit discussion on four defining questions.

1. Should we focus solely on adding lanes to streets to mitigate congestion (i.e. College, Prospect, Shields, etc.)?
2. Should we consider accepting some greater level of congestion? Currently 4.5 percent of Fort Collins arterial and collector lane miles are congested.
3. Should we reconsider land use and development assumptions to help address congestion?
4. Should we consider pursuing development of a balanced transportation system that provides travel options via a number of modes including automobile, transit, bicycle, and pedestrian choices?

These questions were presented to City Council on July 22, 2003 for feedback at a study session and the resulting discussion recognized that trying to build enough road capacity to alleviate congestion was not an idea that Council was interested in. Section 4.4 shows the magnitude of what it would take to build out of congestion and an example of how that would look on a facility like College Avenue.

A greater level of congestion is a strong possibility given the desire to maintain many of the characteristics the community desires and the push to potentially define maximum street and intersection geometric features. With higher levels of congestion, the need for other viable and dependable transportation choices including transit, bicycle and pedestrian becomes an even more important focus for Fort Collins.

As part of the *City Plan* update, the balance between land use and transportation was examined and it was felt that opportunity for redevelopment and infill provided some opportunities to maximize the transportation facilities adjacent to those areas with redevelopment potential.

Council also agreed that the balanced transportation system that provides a number of modal options is still the direction they would like to see for transportation in the City.

4.4 SENSITIVITY TESTING

A variety of analysis was conducted using the transportation demand model to test the sensitivity of certain changes to the transportation network. These analyses included:

- Testing the potential for modifying the Growth Management Area (GMA) boundary
- Evaluating the effects of building out of congestion

- Evaluating the benefits of modifications to the MSP
- Testing the benefits of regional and interregional transit connections
- Evaluating the performance of the fiscally constrained CIP

Each of these tests were performed to gain a better understanding of how the transportation system performs with respect to potential transportation and land use changes that may be desirable to Fort Collins.

4.4.1 Modification to the GMA

The potential of modifying the GMA boundary was tested to support the analysis that was being conducted by the *City Plan* team. The result of the analysis concluded that modifying the GMA boundary had little to no effect on the rate of VMT in the region. This illustrates the fact that development will continue to occur in the North Front Range region, regardless of a GMA boundary shift. The rate of VMT increase is more related to the location and proximity of major origin and destination points that dictate where trips travel to and from on a regional scale. As long as Fort Collins continues to be an economic leader in the North Front Range, VMT will continue to increase, regardless of growth management boundaries.

4.4.2 Unconstrained Capacity

The levels of congestion seen in the fiscally unconstrained Vision Scenario raise an interesting question regarding what additional improvements would be required to significantly reduce congestion in Fort Collins by 2025. To help answer this question, the model was run with unconstrained capacity. The unstrained capacity analysis was developed by allowing the model to assign trips based on 2025 land use, population, and employment figures to the street facilities under without regard to existing or planned street classification (2-lane, 4-lane, etc.). This allowed the model to predict where people would travel if there were unlimited capacity – with no congestion – on every road in the North Front Range region. The resulting volumes were used to determine the number of lanes that would be required to maintain LOS E or better throughout the City. As shown in Figure 4.4, maintaining this LOS would require, in addition to the improvements included in the MSP, improving Shields, Prospect, and Carpenter Road to six-lanes. Lemay near Prospect and College north of Mulberry would also require six-lanes. Harmony Road would need eight-lanes, as it nears I-25, as would College South of Trilby. College between Trilby and Mulberry would need eight to ten-lanes. This analysis was completed to gain an understanding the true capacity needs from the roadway perspective based on the forecasted socio-economic data. While it is not intended to direct future MSP amendments, it can be used as a discussion point with decision makers to establish maximum roadway width and intersection geometries. An example of what College would look like as an eight to ten lane facility is shown in Figure 4.5.

Figure 4.4
Laneage Required to Provide LOS E

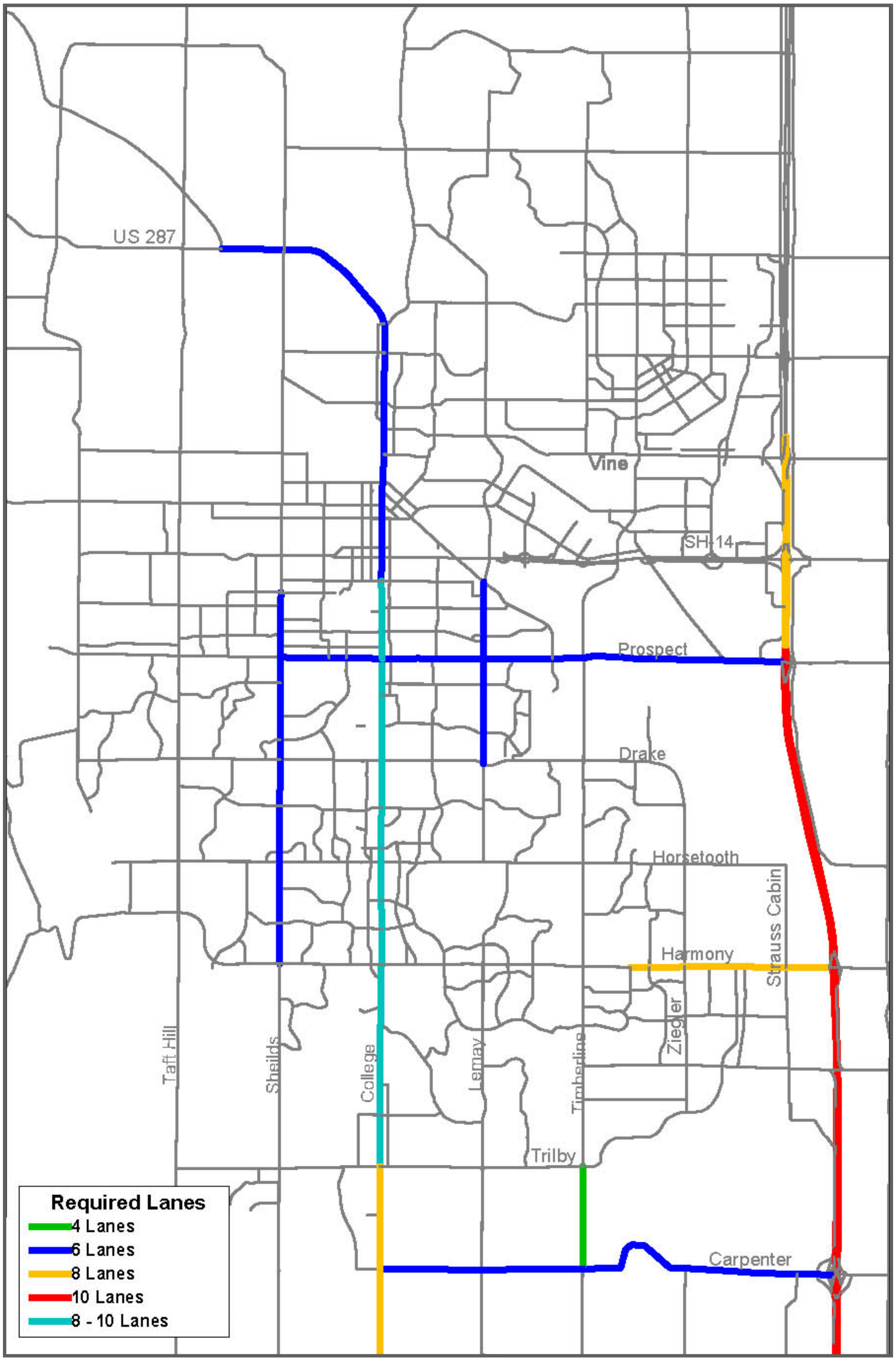
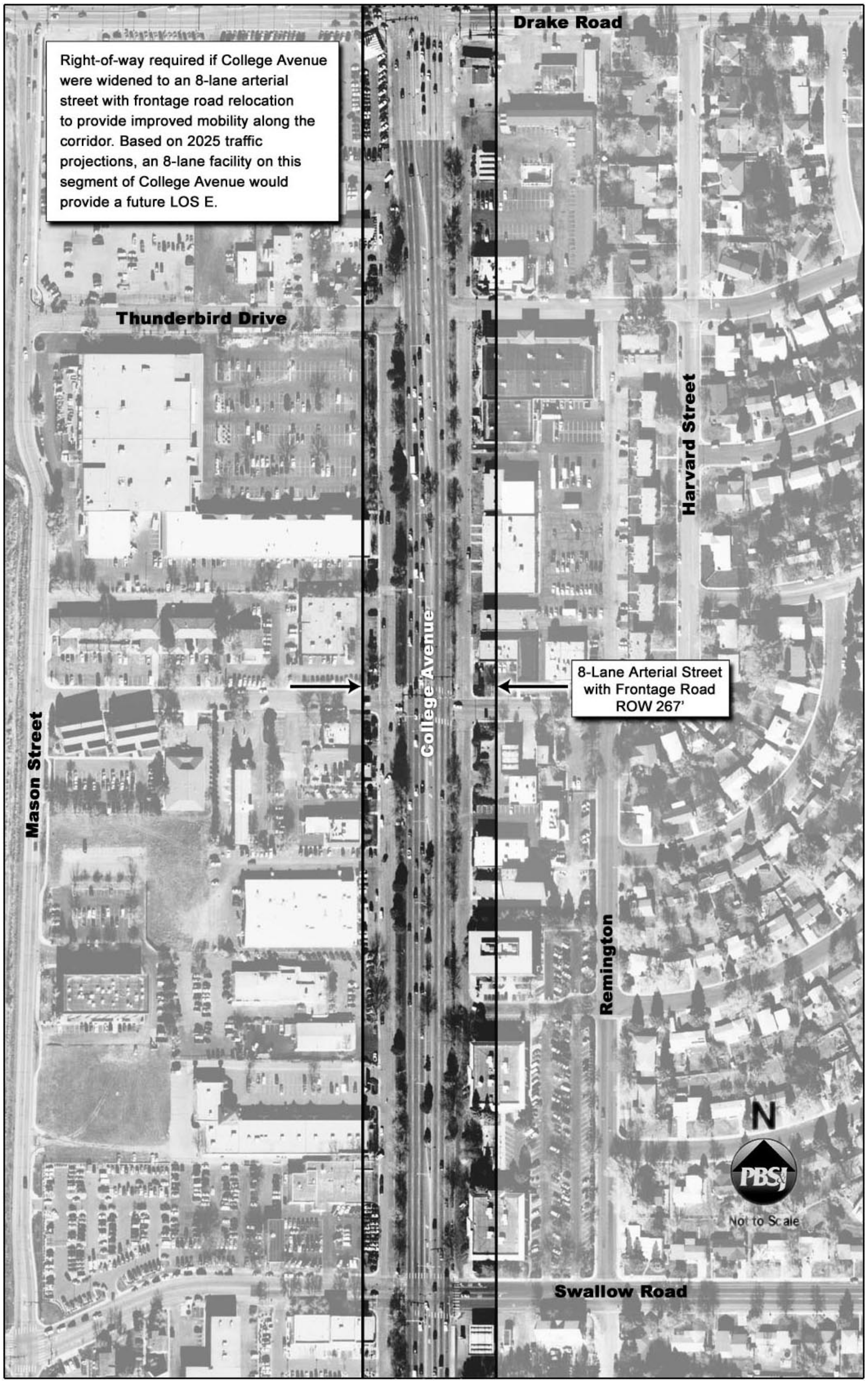


Figure 4.5
Impacts of an Eight-Lane College Avenue



4.4.3 Modification to the MSP

Modifications to the MSP were tested by evaluating the congestion improvements on the facility that was tested and the potential impacts to adjacent facilities. These analyses are included in **Appendix C** and discussed in Chapter 5. An example of the analysis is included in reference to potential improvements to I-25. The existing MSP defines I-25 as a four-lane divided highway – as it is today. This facility is maintained by the Colorado Department of Transportation (CDOT), so a recommendation for improvements is outside the scope of this plan. However, analysis of the effects of a six-lane I-25 are shown in Figure 4.6 indicates that there would be very little impact on the transportation system within Fort Collins. North/South arterials such as Timberline and College experience little relief as a result of improvements to I-25, likewise for the east-west gateways into Fort Collins at Carpenter and Harmony Roads. Such an improvement would primarily benefit those traveling to or from Fort Collins, other cities in the region, and beyond, but would not substantially improve operations within the City.

4.4.4 Regional and Interregional Transit

The City identified potential transit routes providing service from Fort Collins to other regional activity centers. These potential transit routes were coded into the transit model network and tested to determine the relative attractiveness of regional routes, if service were provided. The analysis results indicated that regional transit between Fort Collins, Windsor, and Greeley has a relatively high transit capture potential. Based on these results, it is recommended that further analysis be conducted to establish a more detailed approach to providing some form of regional transit service between these three areas in the future. Further discussion of regional and interregional transit can be found in Chapter5.

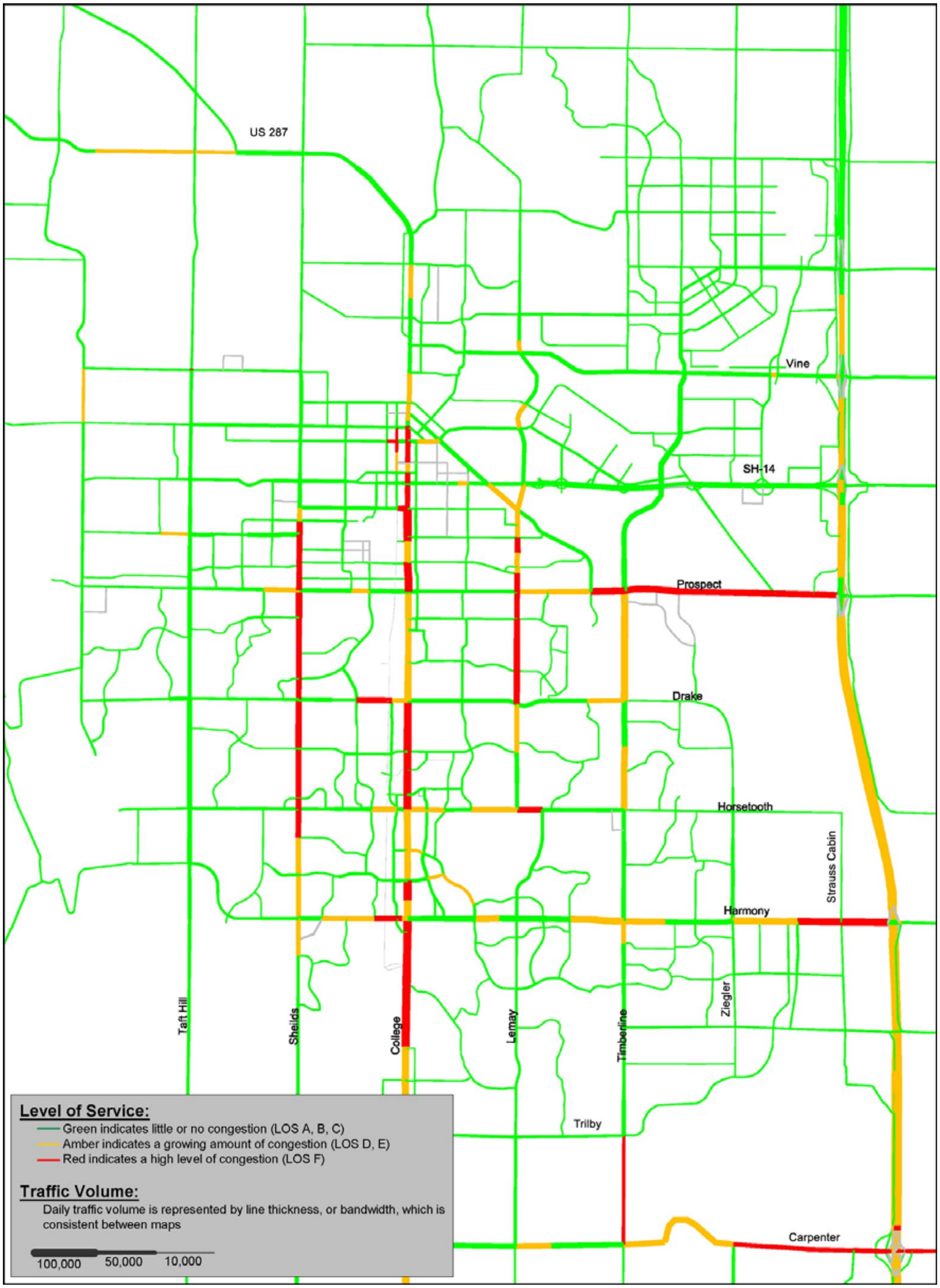
4.4.5 Fiscally Constrained Capital Improvement Plan

The Fiscally Constrained Capital Improvement Plan (CIP) was analyzed using the travel demand model to demonstrate the system wide value of the proposed transportation improvements. This evaluation assumed year 2025 socioeconomic data, the existing street network plus the proposed street, and transit improvements proposed in the Fiscally Constrained CIP. The model results indicate that while the fiscally constrained improvements effectively reduce congestion on several arterial corridors, many other corridors still show high congestion levels. Further discussion of the Fiscally Constrained CIP can be found in Chapter 7.

4.5 AIR QUALITY ANALYSIS

For each of the major scenarios tested, the most current EPA air quality model (MOBILE 6) was run to test the differences between the scenarios. This air quality model considers many factors affecting the emissions produced by motor vehicles. The analysis includes inspection and maintenance (emission testing) programs, reformulated gasoline, locally specific temperatures, elevation, travel speed, and congestion. Results of this model are applied to results of the transportation demand model to estimate emissions produced by vehicles traveling in and around Fort Collins. More detailed air quality model results are included in **Appendix C**.

Figure 4.6
Effects of a Six-Lane I-25



Note: The 6-lane I-25 Scenario assumes forecasted 2025 socioeconomic data based on City Plan Update, existing Master Street Plan street network, plus six lanes on I-25, and the Long Range Transfort service plan.

The mobile source emission models look at four major pollutant categories. These categories are Carbon Monoxide (CO), Ozone Precursors (volatile organic compounds and nitrous oxides), particulate matter (PM_{10} and $PM_{2.5}$) and Carbon Dioxide (CO_2). Carbon Monoxide is typically a concern in winter and is primarily produced by motor vehicles. The second type, ozone, reduces visibility and can damage lungs. Ozone results when volatile organic compounds (VOC) and nitrous oxides (NO_X) combine. Particulate matter consists of very small particles that can cause lung problems and reduce visibility. Particulate matter is a component of diesel vehicle exhaust, and to a lesser extent, gasoline vehicle exhaust. Brake and tire dust are also sources of particulate matter. Carbon Dioxide does not have immediate health effects, but is believed to contribute to long-term problems due to its status as a greenhouse gas. Due to its relatively recent introduction into EPA models, CO_2 is not modeled with as much detail as the other pollutants. Currently, Fort Collins is in compliance with EPA standards on each of these pollutants.

As shown in Figure 4.7 through 4.11, the results of the air quality analysis are promising. The air quality models predict that improvements in technology will outpace growth in congestion and VMT for all pollutants except CO_2. Even in the E+C scenario, emission of CO, VOC, NO_X, and particulates are expected to decrease by the year 2025. In the vision scenario, emissions decline even further. However, extreme congestion in certain areas may cause localized increases in emissions of these pollutants.

The travel demand modeling analysis shows a strong connection between the projected regional and local growth and the needs of the Fort Collins transportation system. If no action is taken, and transportation facilities remain as they are today, the result will be a level of congestion that is not acceptable. However, if carefully planned improvements are made in a timely fashion, congestion growth can be kept to a minimum. While improvements in technology may help to improve air quality, construction of adequate street and transit facilities can further reduce the emissions created by motor vehicles.

Figure 4.7
Carbon Monoxide (CO) Emissions

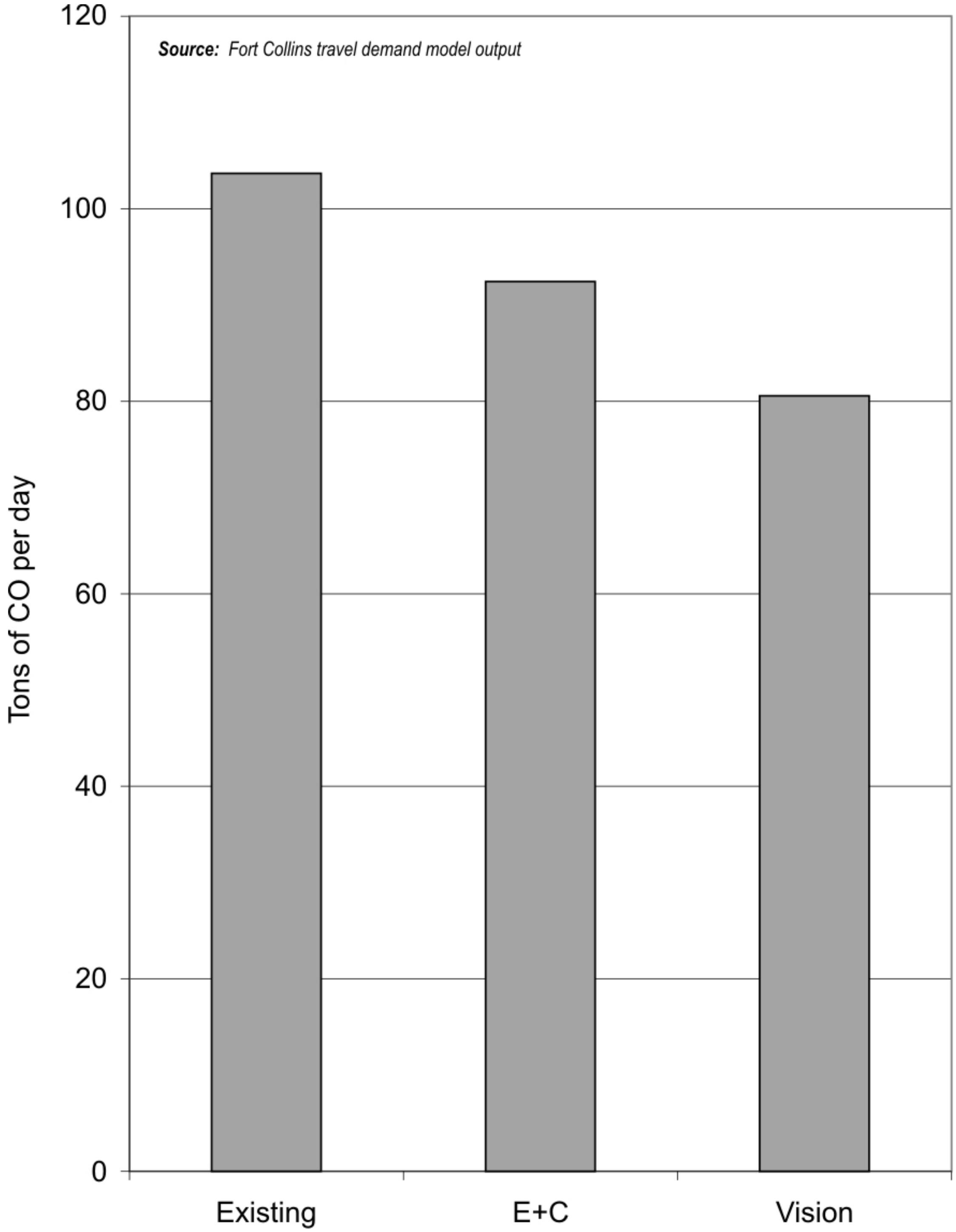


Figure 4.8a
Ozone Precursor (Nitrous Oxide [NOx]) Emissions

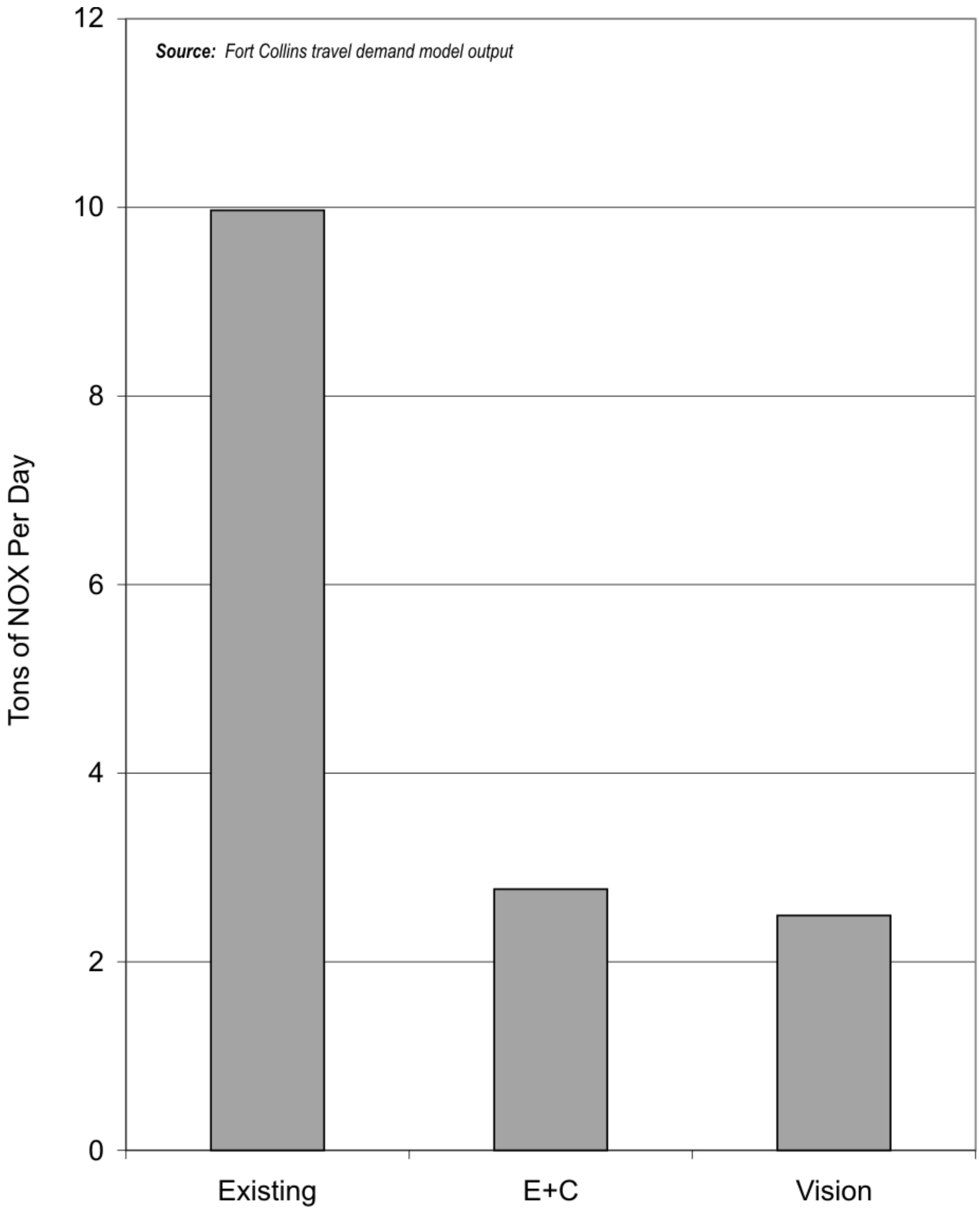


Figure 4.8b
Ozone Precursor (Volatile Compounds [VOC]) Emissions

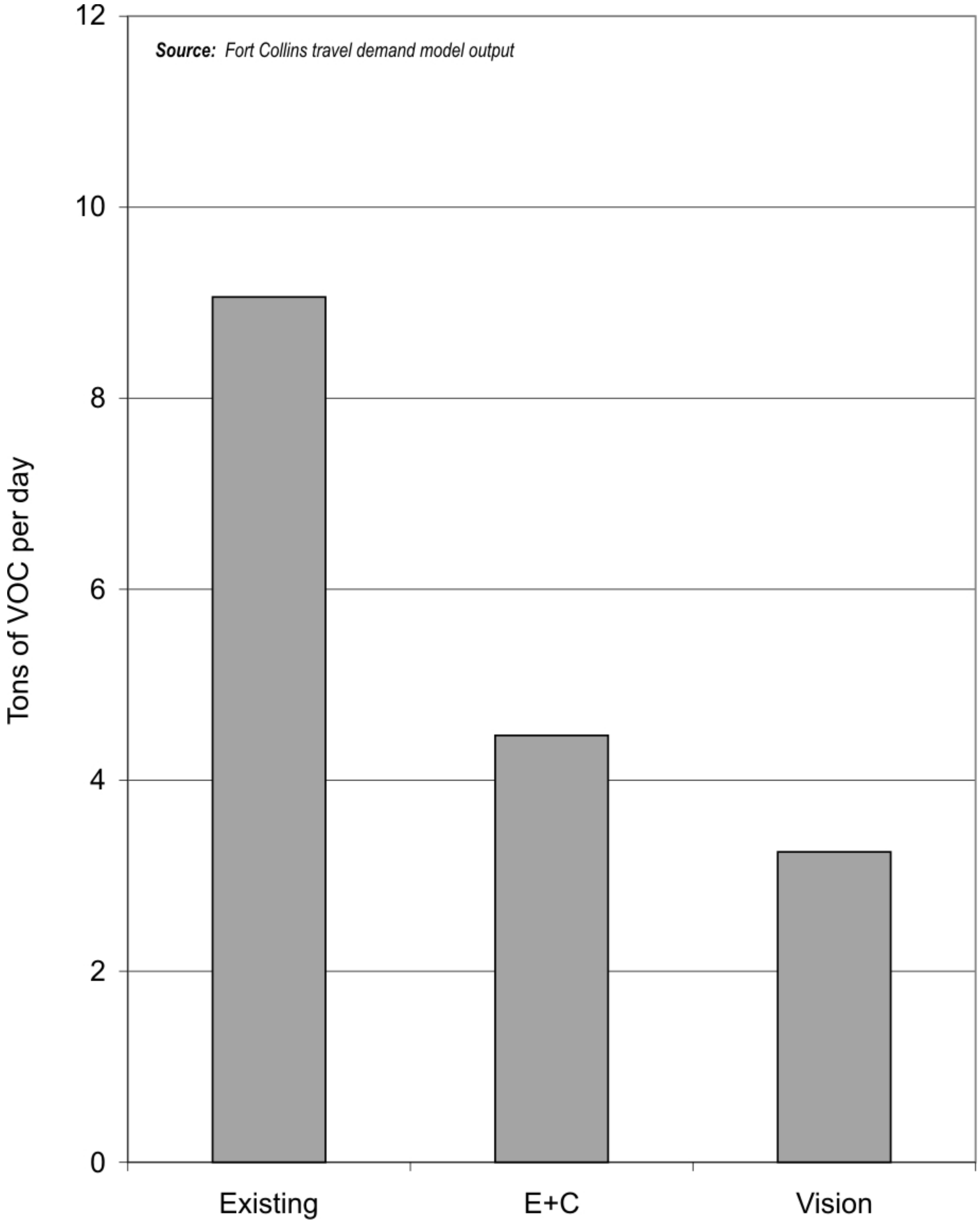


Figure 4.9
Particulate (PM10 and PM2.5) Emissions by Size

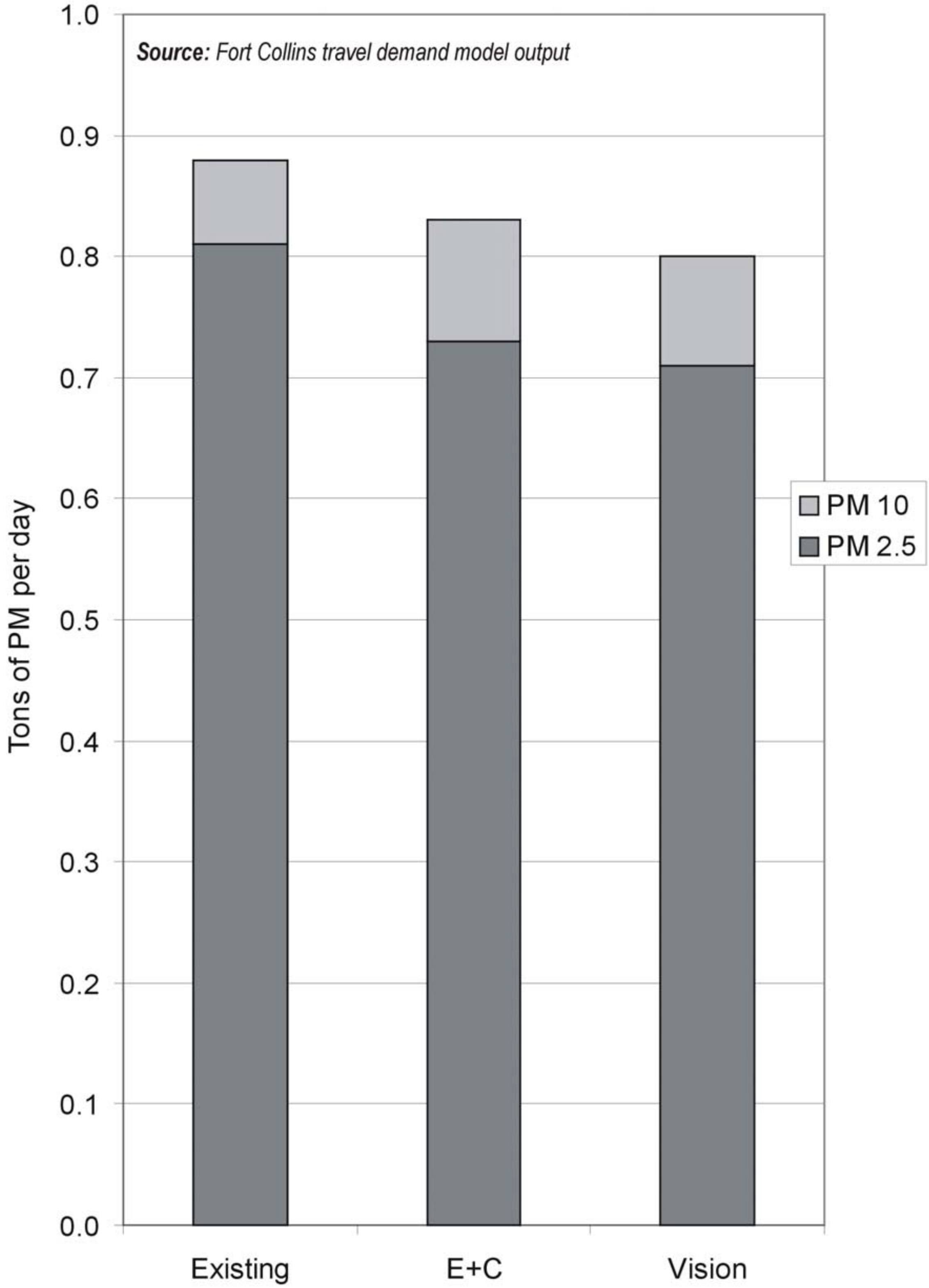


Figure 4.10
Particulate (PM10) Emissions by Type

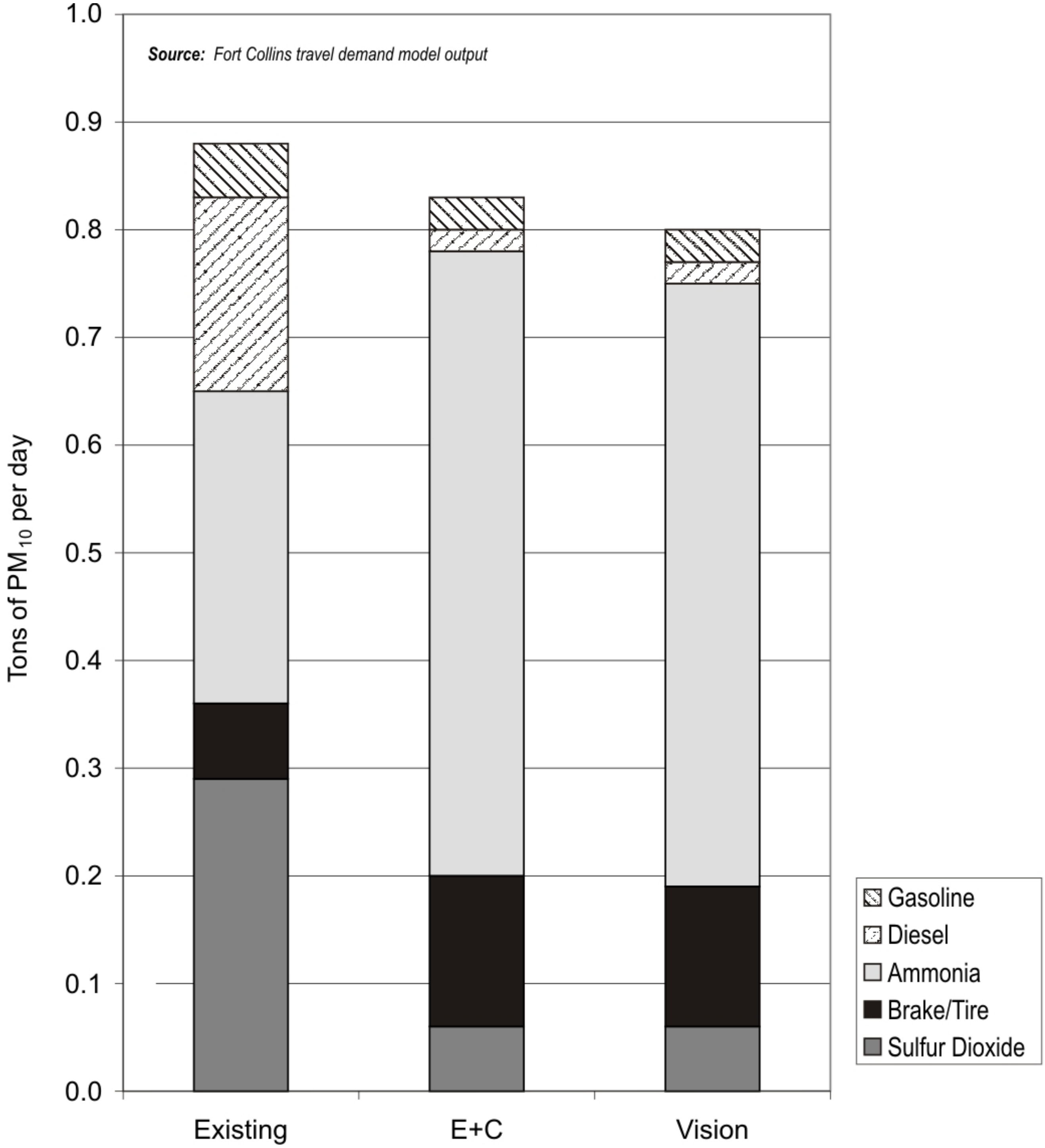


Figure 4.11
Particulate (PM2.5) Emissions by Type

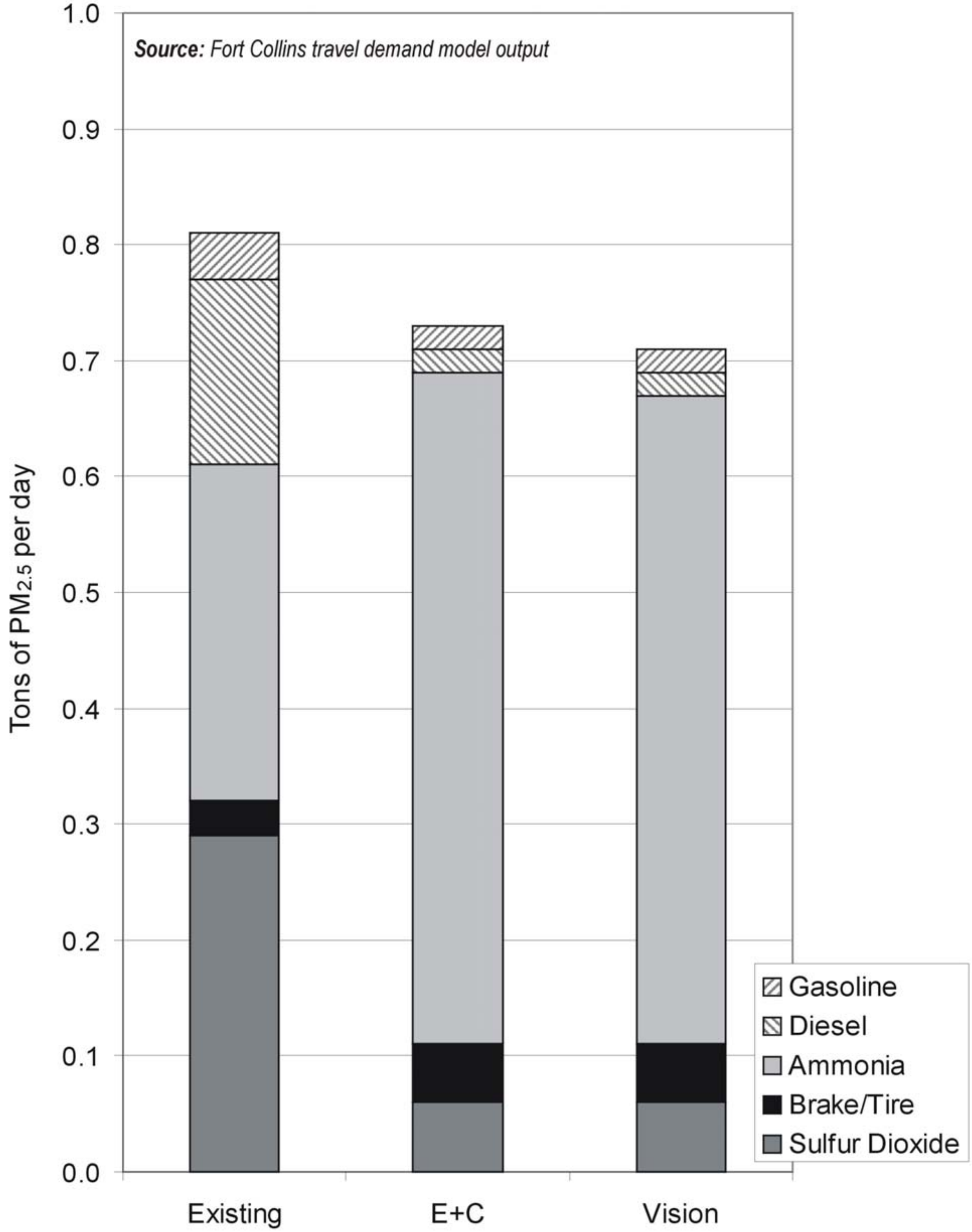


Table of Contents

List of Figures