6. TRAVEL DEMAND ANALYSIS

A. Overview

The NFRMPO prepares a regional travel demand model with projections based on socio-economic forecasts provided in Chapter 3 to evaluate the effects of growth upon the transportation system of the North Front Range and to meet the Clean Air Act (CAA) requirements. The NFRMPO has developed a regional travel demand model which provides estimates and forecasts for the following scenarios:

- **2009 Base Year** – Model calibrated to 2009.
- **2015 Interim Year** – Interim for Conformity testing (CAA), includes 2015 transportation network and 2015 socio-economic forecasts.
- **2025 Interim Year** – Interim for Conformity testing (CAA), includes 2025 transportation network and 2025 socio-economic forecasts.
- **2035 No Build** – 2009 transportation network and 2035 socio-economic forecasts.
- **2035 Build** – 2035 transportation network based on the fiscally constrained plan (as described in Chapter 8) and 2035 socio-economic forecasts, for Conformity testing (CAA).

It is important to recognize that transportation improvements, other than those for increasing highways capacity may result in a reduction of roadway travel demand. The 2035 model is a mode choice model, which means that transit is modeled on its own network and calibrated to transit surveys. This portion of the model allows for scenario testing not only with the roadway network but also with transit.

This section provides a summary of travel demand forecasting results focusing on the 2035 out year. The regional travel model output data is depicted for the North Front Range modeling boundary area, shown in Chapter 3, which is somewhat larger than the NFRMPO boundary.

B. Existing Travel Characteristics

As noted in Chapter 2, the NFRMPO conducted a household survey of residents within the NFRMPO boundary area (*The NFRMPO Household Survey of 2010*). The survey showed that the main reason for nearly 34 percent of traveling was for returning home from non-work activities (e.g., shopping). Other frequently reported reasons for traveling included for work (11 percent), routine shopping (9 percent), and attending class (6 percent). See **Table 6-1.**

Table 6-1 Primary Reasons for Traveling

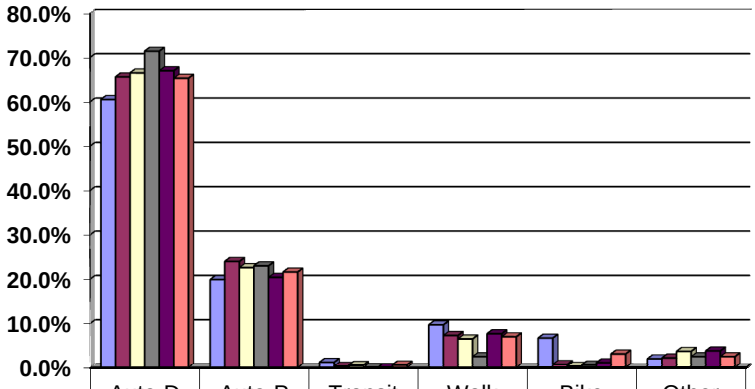
Main Reason for Traveling	Number of Trips	Percent	Avg. Trip Duration (min)
Working at home	127	0.90%	14.16
Shop at home	0	0.00%	--
On-line school at home	7	0.00%	8.8
Return home from non-work activities	4,920	34.00%	17.17
Work/job	1,637	11.30%	19.34
All other activities at work	70	0.50%	17.82
Attending class	790	5.50%	15.53
All other activities at school	92	0.60%	11.75
Change of mode/transportation	354	2.40%	15.43
Dropped off passenger from car	566	3.90%	12.95
Picked up passenger from car	557	3.80%	14.6
Drive through	88	0.60%	9.93
Other – travel related	37	0.30%	10.97
Work/business related	618	4.30%	20.36
Service private vehicle	160	1.10%	13.21
Routine shopping (groceries, clothing, etc.)	1,236	8.50%	12.5
Shopping for major purchases or specialty items	91	0.60%	18.35
Household errands (bank, dry cleaning, etc.)	475	3.30%	11.18
Personal business (attorney, accountant, etc.)	241	1.70%	16.86
Eat meal outside of home	577	4.00%	12.09
Health care (doctor, dentist)	224	1.50%	18.59
Civic/religious activities	196	1.40%	14.89
Outdoor recreation/entertainment	254	1.80%	23.18
Indoor recreation/entertainment	516	3.60%	16.42
Visit friends/relatives	435	3.00%	33.89
Loop trip	18	0.10%	38.74
Other	180	1.20%	14.33
Total	**14,467**	**100.00%**	**16.76**

Source: Front Range Travel Counts – NFRMPO Household Survey, weighted 2009 data.

Travel by Automobile

The majority of trips within the NFRMPO are trips in single occupancy vehicles (SOV), which are vehicles with only a driver as an occupant (identified as Auto-D in **Figure 6-1**). Auto-P in the figure refers to passengers in vehicles. The table also shows the differences in travel modes among different parts of the region. Approximately 10 percent of trips were made by non-motorized modes (7 percent walk and 3.1 percent bike), and less than one percent of reported trips were made by public transit.

Figure 6-1 Travel Modes by Area



	Auto-D	Auto-P	Transit	Walk	Bike	Other
Fort Collins	60.5%	19.9%	1.2%	9.7%	6.7%	2.0%
Greeley/Evans	65.6%	24.0%	0.3%	7.3%	0.7%	2.2%
Loveland	66.5%	22.6%	0.5%	6.5%	0.3%	3.7%
Larimer County	71.4%	23.0%	0.0%	2.5%	0.6%	2.5%
Weld County	67.0%	20.4%	0.0%	7.7%	1.1%	3.8%
Overall	65.3%	21.6%	0.6%	7.0%	3.1%	2.5%

Again, driving alone is the primary travel mode to work for most respondents. Non-motorized transport accounts for nearly 10 percent of work trips. Fort Collins leads the region in work trips made by bicycle, and Greeley has the highest percentage of work trips by pedestrians. Survey results also indicate that 13 percent of Greeley/Evans residents do not have driver's licenses, which may contribute to higher levels of walking. Household size also affects the number of trips per day. Households with higher numbers of workers also recorded higher numbers of trips.

Non-Motorized Travel

As stated above, nearly 10 percent of work and non-work related trips in the region are by non-motorized modes, either bicycle or pedestrian travel. These can either be stand-alone trips or they can augment transit trips (to and from transit stops). Generally, people make non-motorized trips more frequently to attend class (e.g., at Colorado State University or University of Northern Colorado) or non-work related activities. Fort Collins and Greeley have large college student populations, which likely contributes to the higher percentage of bicycling in those communities.

Survey data also indicate that about 70 percent of the households throughout the region have at least one bicycle, and half have two or more bicycles**.** More than 24 percent of survey respondents indicated that a household member walked or rode a bicycle to school or work at least once per week. The highest numbers were reported for Fort Collins and the lowest numbers were in non-urbanized areas of Weld County.

Transit Use

In the North Front Range, transit use accounts for less than one percent of work-related and other trips. A large portion of the region consists of rural areas that are not served by transit, which likely accounts for the low overall rate of transit use. Most transit users connect to transit by walking or bicycling. Nearly seven percent of travel survey respondents indicated that they use transit at least once per week. Transit use is highest in Greeley/Evans (12 percent) and lowest in non-urbanized areas of Weld County (2 percent).

Of the adult survey respondents, four percent reported having a transit pass**.** Highest levels were reported in Fort Collins (7.2 percent), which has the largest transit system in the region, and lowest levels were reported in non-urbanized Larimer County (0.5 percent). Less than two percent of survey respondents reported that their employers provide a transit pass.

The lack of available transit options and sustainable revenue sources are likely causes of low transit pass use. Another factor that could explain the low rates of transit use is the high percentage (nearly 95 percent throughout the region) of employers that provide free parking. Employees have fewer incentives to utilize other modes of transportation when they have unlimited free parking at their destination.

C. Travel Demand Growth

Roadways

Daily vehicle miles traveled (VMT), which is the total distance traveled by all motor vehicles each day, was used as a gauge to measure the forecast growth of travel in the region. **Table 6-2** shows the estimated VMT for 2009 and forecast VMT for 2035 for the region's three major urban areas and the region as a whole.

It should be noted that using a No-Build scenario does not always create realistic results in smaller areas of the region. This is due to significant levels of congestion in the forecast year without any improvements to the roadway system.

Table 6-2 Growth in Vehicle Miles of Travel

Area	Daily VMT		
	2009	2035 (No-Build)	Percent Growth (%)
Fort Collins Area	3,290,404	4,192,564	27.4%
Greeley Area	1,880,295	3,706,239	97.1%
Loveland Area	1,839,474	2,961,922	61.0%
Other Areas	5,026,701	8,988,548	78.8%
North Front Range	12,036,874	19,849,273	64.9%

Source: North Front Range 2009 Regional Travel Model, Model Process, Parameters and Assumptions, LSA and Associates, Inc., 2011

These forecasts show that VMT for the North Front Range region is projected to grow by 64.9 percent between 2009 and 2035. This growth assumes no roadway expansion into the future and only accounts for growth in households and employment. This also assumes that current patterns and travel trends are the same in the future. This VMT growth compares with household growth forecasts of 58.6 percent and employment growth forecasts of 63.9 percent for the same period.

Roadway Level of Service

A system-wide measure which is a good indicator of the impacts of growth on transportation is level of service (LOS), which is a qualitative measure which describes operating conditions, or traffic flow rates. LOS A represents a free flow condition and LOS F represents a breakdown of traffic flow with excessive congestion and delay. Levels of service have been calculated on all arterials, expressways, and freeways based on a generalized peak hour volume (a combination of the morning, midday, and afternoon peak periods) and planning level roadway capacities. Congestion, defined in the Congestion Management Program (see Chapter 9), is LOS E or F, with E nearing capacity and F over capacity.

Morning peak hour traffic on US 287 in Fort Collins

The percent of congested roadway lane miles (LOS E or F) during the average peak period in 2009 is 1.0 percent. It is anticipated to climb to 10.9 percent during the average peak period by 2035 with no roadway improvements. **Figures 6-2 and 6-3** depict the 2009 and future 2035 roadway levels of service, respectively. This LOS analysis is based on travel demand modeling results and does not explicitly account for intersection operations and delay.

Figure 6-2 2009 Level of Service

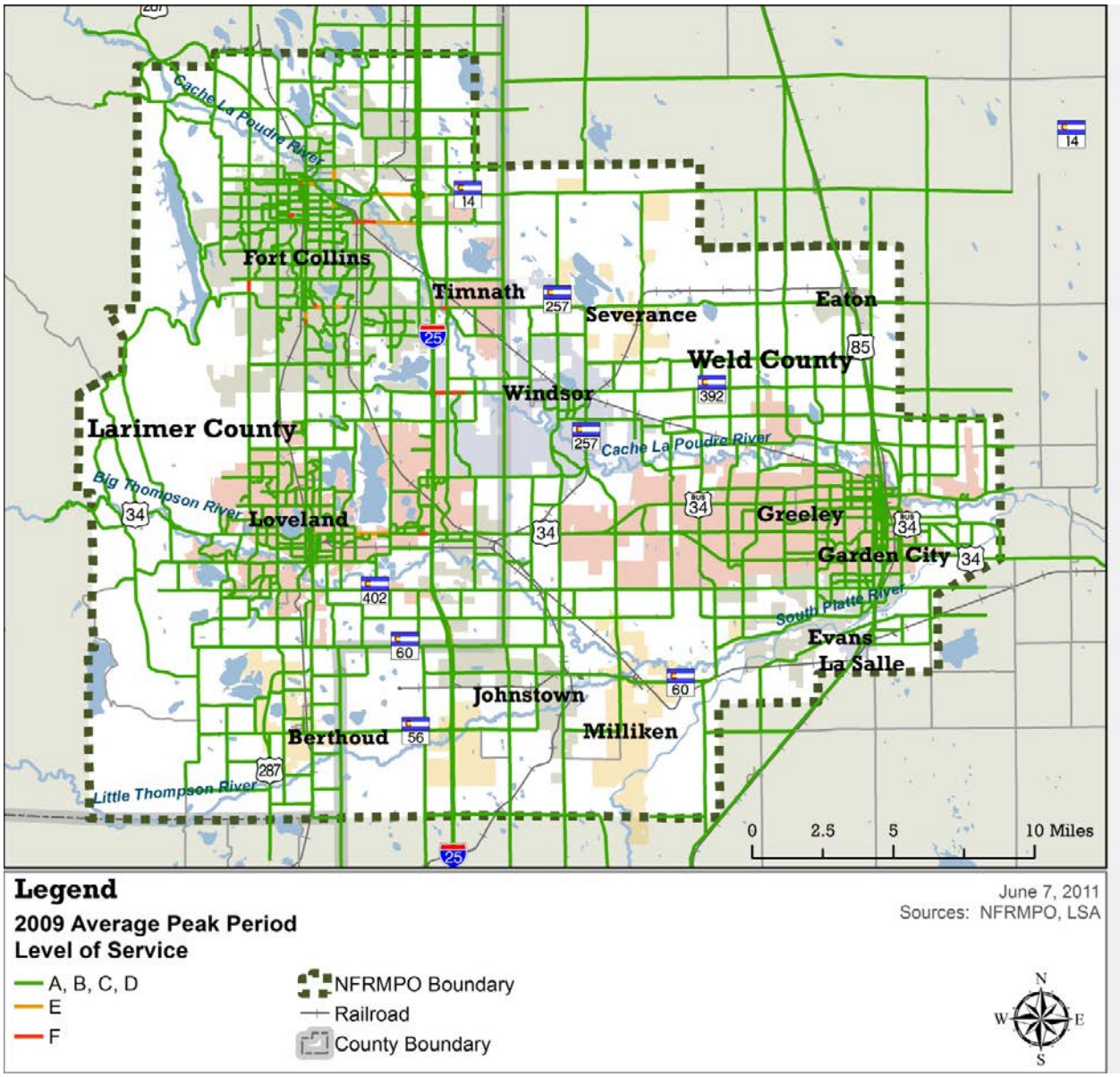
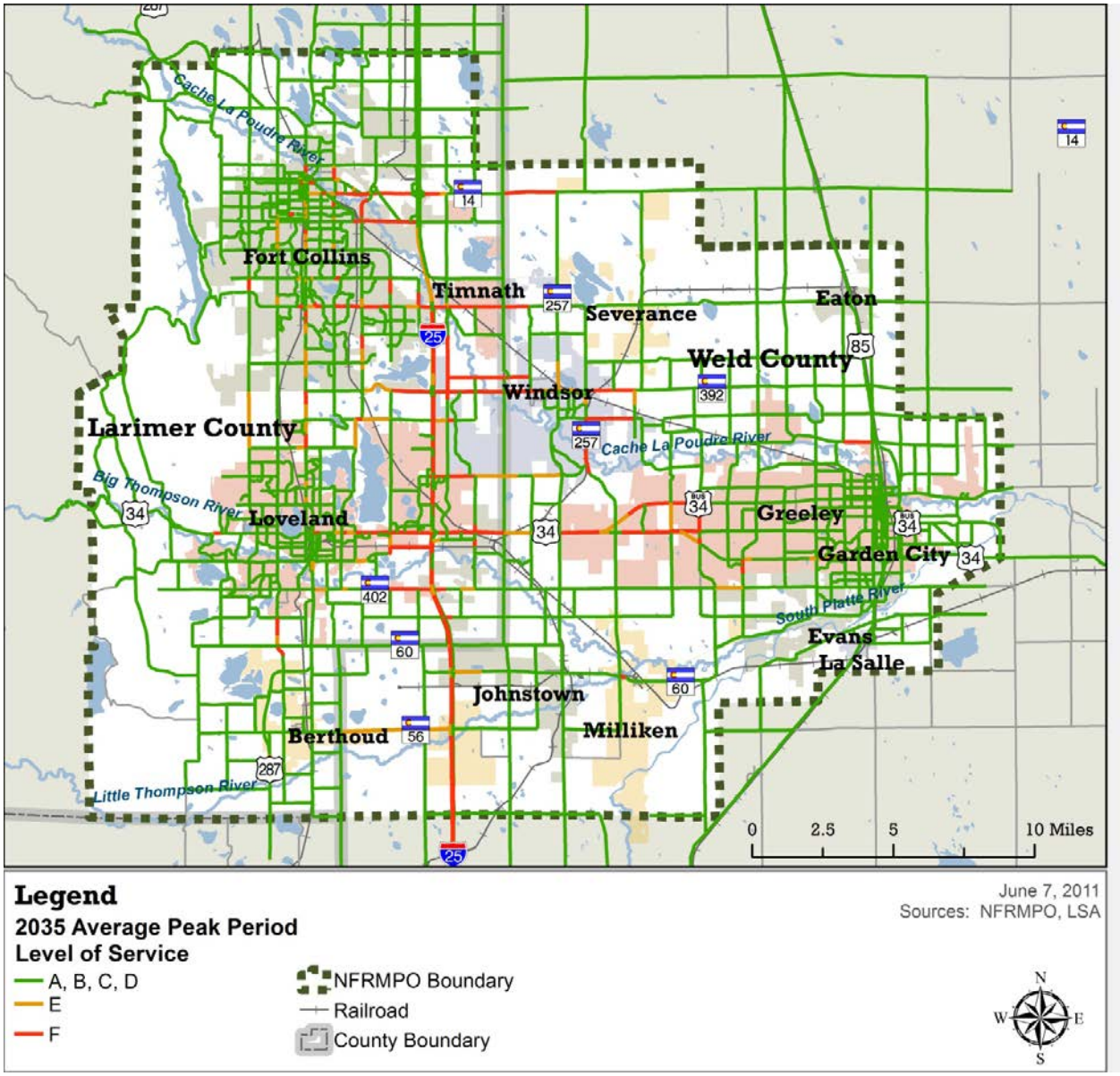


Figure 6-3 2035 Level of Service



Mode Choice

The 2035 travel demand model is a mode choice model. A mode choice model allows the user to also model transit systems. The NFRMPO first built the model with the mode choice capability for the 2005 model. Transit alternatives can now be tested both locally and regionally. Transit ridership is verified and calibrated for the base-year scenario through on board surveys that actually count the number of riders on any given route. This is similar to the calibration of the volumes on the roadways that are verified using traffic count data.

Regional Routes

The Regional Transit Element (RTE) 2011, a companion document to the 2035 RTP, describes in detail the demand analysis used to model potential regional transit routes, as depicted on **Figure 6-4**. The analysis of the regional routes used the NFRMPO travel demand model, base year 2005, and the combined NFRMPO and Denver Regional Council of Governments (DRCOG) model that was used in the development of the North I-25 EIS.

The RTE worked with the data in the NFRMPO travel model to develop an understanding of how the anticipated growth over the next 25 years will impact transit ridership in proposed regional corridors. The region was divided into 15 sub-areas that provide information on where trips originate and the regional corridors in which they are most likely to travel. The zones, along with detailed tables with calculations for each zone, are presented in the full RTE document.
The travel demand analysis included the following steps:

- Trip matrices were created for 2005, 2015, 2025, and 2035 showing the trip productions and attractions for each of the 15 zones.
- Each zone pair was analyzed in order to determine which (if any) regional corridor would collect trips from the zone pair. Each zone pair was color-coded to reflect the corridor. A percentage was assigned to reflect an estimated amount of the trips that would fall into the regional corridor.
- The external trips were also identified for each zone. As with internal trips, each pair was identified with a regional corridor, if applicable, and a percentage was assigned to reflect an estimated portion of the trips that would fall into the particular regional corridor.
- Multiplying the total trips in each zone pair by the percentage for each corridor resulted in the trips that would have the potential demand for transit services.
- A mode share of 0.5 - 2% was selected to determine a range for trips that might be likely to use transit. A higher percentage of work trips might switch to the transit mode and over time these percentages might increase, but this range is reasonable given the overall conditions in these corridors. It is also consistent with the most recent Household Travel Survey undertaken by the NFRMPO in 2010. The corridor comparison is shown in **Table 6-3**.

The evaluation of the zone-to-zone trips showed some important changes between 2005 and 2035:

- Overall trips nearly double in this time period. In 2005 the model estimates 2.2 million daily person trips, while in 2035 the model estimates 3.7 million daily person trips.
- Much of the growth is projected to occur in the middle of the region – from Timnath to Mead and Johnston to West Greeley.

Figure 6-4 Regional Transit Corridors for Evaluation

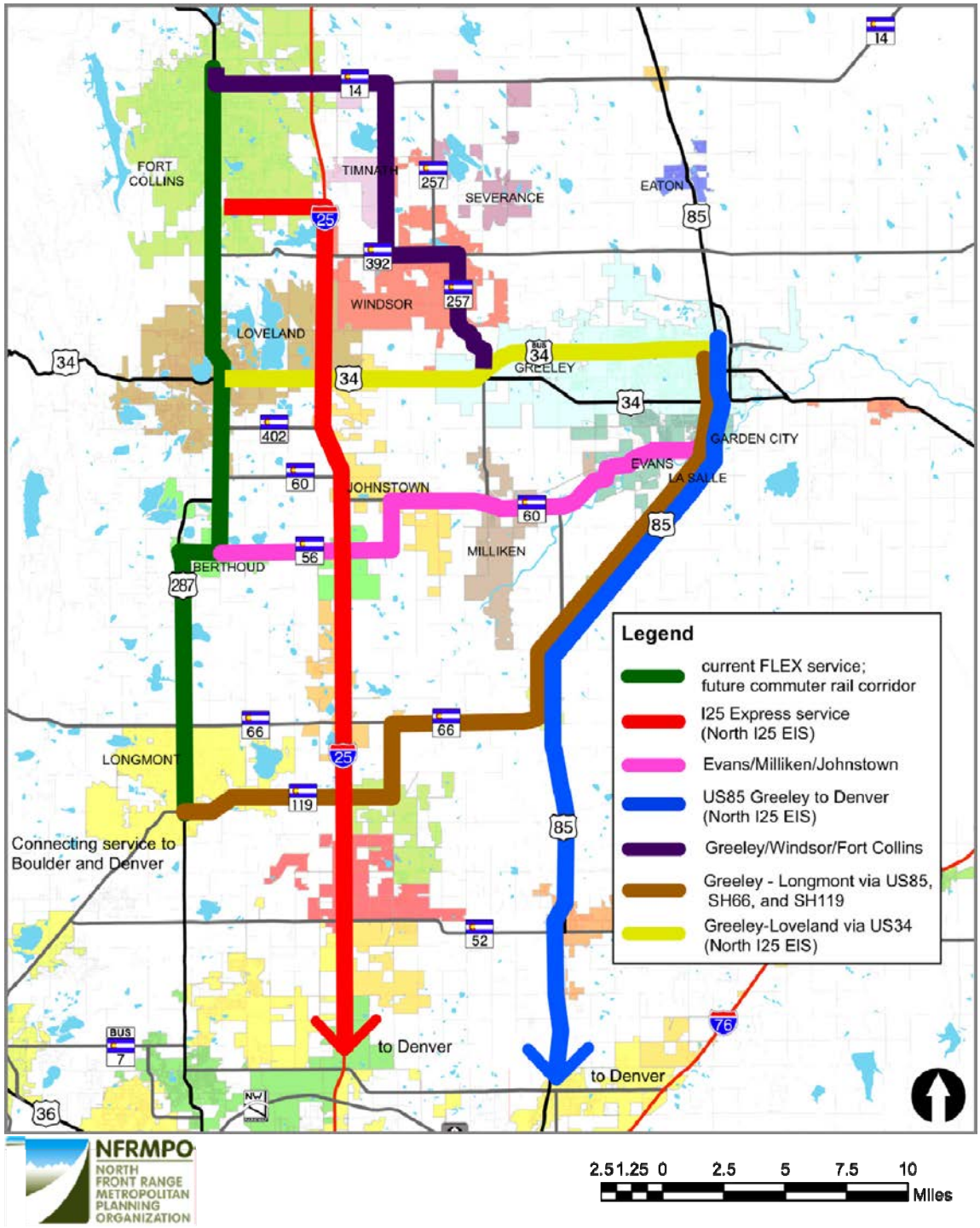


Table 6-3 Comparison of Transit Demand by Corridor

Corridor	North I-25 EIS 2030 Projection	NFRMPO Travel Model Analysis for 2035		
		0.5% of Trips	1% of Trips	2% of Trips
A: FLEX / Future US 287	1,400 – 2,175	542	1,085	2,170
B: I-25 Express Service		663	1,326	2,653
C: US 85 Greeley to Denver	725 – 1,175	58	115	230
D: Greeley - Longmont	N/A	26	52	104
E: Evans/Milliken/ Johnstown	200	44	87	175
F: Greeley-Loveland via US 34	2,500	207	415	830
G: Greeley/Windsor/ Fort Collins	260	130	260	519

Notes:

1. N I-25 EIS projections are for commuter rail, not bus service.
2. The Greeley/Longmont corridor was not included in the N I-25 EIS analysis.
3. The N I-25 EIS analysis did not connect corridor E to Evans – rather it operated only to Milliken.
4. Corridor G (Windsor) in the N I-25 EIS traveled north from Windsor on US 257 to Harmony Road, ending at the Fort Collins South Transit Center. In the NFRMPO travel model analysis the route travels north on Weld County Road 13 and east on SH 14 to the Downtown Transit Center.

Transit Level of Service

The level of service (LOS)[1] concept can be applied to the transit mode as well. LOS measures have been standardized for transit service networks for both fixed route and demand response services. They can be applied to corridors, systems, or individual stops, but for the purposes of this plan will be kept at the system level. The LOS measures address:

- **Availability of Service** – common measures are the frequency of service, hours in a day in which service is provided, and service area coverage; and
- **Comfort and Convenience** – common measures are on-time performance, missed or late trips (reliability), and convenience.

The fixed route systems in the region, Fort Collins, Greeley, and Loveland, are currently at a LOS of between D-E generally. This LOS would remain if there is no expansion to the system. However, as development continues to occur outside the area presently served by transit, the LOS for coverage would likely drop from E to F.

[1] The Transit Capacity and Quality of Service Manual published by Transportation Research Board of the National Academies as TCRP Report 100, Washington, DC 2003 identifies standard Level of Service measures for fixed route and demand responsive services.

With expansion included, it is anticipated that the LOS for coverage would generally increase by one letter grade as systems are expanded to serve a larger geographic area. In both Fort Collins and Greeley, implementation of their strategic plans would result in stronger grid systems, so convenience would also be improved. For regional services, further development of regional bus routes would improve the LOS for coverage and convenience as more areas would be served and it is anticipated that more frequent peak hour service would be provided in some corridors.

Greenhouse Gas Emissions

The federal government is interested in reducing greenhouse gas (GHG) emissions and may include a new requirement with transportation reauthorization. The FHWA has become more interested in the amount of energy consumed as part of regional transportation systems and the potential greenhouse effect of the energy use. The State of Colorado, under the FASTER legislation, is required to address the reduction in GHG emissions. To assist the state, a minimal technical analysis out of the travel demand model is included in this plan.

A greenhouse gas (GHG) in the atmosphere absorbs and emits radiation. GHGs are tied to the natural process or greenhouse effect, whereby they help capture radiant heat from the sun in the earth's lower atmosphere. The gasses that contribute most to the greenhouse effect are water vapor, carbon dioxide, methane, and nitrous oxides. Most greenhouse gases have both natural and human-caused sources. Transportation is the second largest source of GHG emissions, accounting for roughly 29 percent of all emissions (USDOT, April 2010).

As it relates to the transportation system, energy is directly consumed by the vehicles (automobiles, trucks, and buses) using the regional system and indirectly consumed by the equipment during the construction of transportation capital improvement projects. The GHG emissions quantified for this plan are based only on the direct energy (i.e., direct energy that is consumed by vehicles using the facilities). Transportation emissions from fuel combustion in vehicles are normally presented as the total carbon dioxide (CO_2) equivalent released, and they take into account the potential greenhouse effect of each gas. For example, motor vehicles emit small amounts of nitrous oxide (N_2O), which has greenhouse gas effect potential that is 310 times that of CO_2. Therefore, each ton of N_2O is equivalent to 310 tons of CO_2. The greenhouse gas emissions presented in this section are all presented as a CO_2 equivalent.

Table 6-4 compares the total mobile source on-road greenhouse gas emissions of the base year (2009) land use and transportation system and the 2035 forecasts with the fiscally constrained transportation system (2035 Fiscally Constrained). The energy calculations are based on vehicle miles traveled (VMT) projections generated by the regional travel demand model. By 2035, the direct energy consumption and greenhouse gas emissions associated with use of the transportation system is projected to increase by approximately 42 percent, less than the projected VMT increase of 64.9 percent.

Table 6-4 Mobile Source Greenhouse Gas Emissions

Area	Tons of CO_2 Equivalent		
	2009	2035 (Fiscally Constrained)	Percent Growth (%)
North Front Range	6,880	9,796	42.4%

Source: North Front Range 2009 Regional Travel Model, LSA and Associates, Inc., 2011

Note: Regional energy consumption, as measured in British Thermal Units (BTUs) is based on the estimated VMT multiplied by standard energy consumption factors for various vehicle classifications and fuel types. The greenhouse gas emissions are calculated from the BTU estimates multiplied by standard tons CO_2/million BTU conversion factors. Consistent factors have been used to calculate the base year and future energy consumption; no change in fuel efficiency is assumed in the calculation.

The NFRMPO has determined that further analysis and work in this area would be conducted in conjunction with new state or federal requirements.