CAMBRIDGE SYSTEMATICS

Colorado Statewide Freight Roadmap

final

report

submitted to

Colorado Department of Transportation

submitted by

Cambridge Systematics, Inc.

with

Felsburg Holt & Ullevig
PBS&J

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Colorado Department of Transportation Statewide Freight Roadmap

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1.0 Introduction

Freight movement in the State of Colorado is projected to increase significantly over the next 20 years. To address this issue, the Colorado Department of Transportation (CDOT) has conducted a number of freight-related studies in recent years (including the Freight Data Assessment, the Freight Data Synthesis, and the Freight Origin/Destination Pilot Study), with the plan being to consolidate what has been learned from all of the studies, and then conduct a strategic review, make an assessment, and develop a vision for freight movement and activities. This Colorado Statewide Freight Roadmap will serve to guide CDOT's activities toward a coordinated approach to freight system development.

The approach to developing the Roadmap consisted of the following three tasks:

1. Determining the current conditions of selected freight-related issues within the State, as well as areas in need of improvement.

2. Gaining consensus on a clear vision for a statewide freight program, and identifying goals to realize that vision.

3. Establishing a Roadmap to guide CDOT from the present freight environment to vision realization by identifying trends that have the potential to affect freight movement within the State; evaluating other freight programs, studies, and research; and proposing future freight activities.

This report is structured by describing the activities of this study in six chapters. This chapter serves as the introduction to the study. Chapter 2 describes the CDOT Vision and Goals for conducting freight planning. The Vision and Goals serve as a means for categorizing the previous and current freight planning efforts at CDOT (which are described in Chapter 3). The Vision and Goals are also used as a template to identify a set of balanced potential policy and program changes to consider relating to freight planning (as described in Chapter 4). Chapter 5 describes potential structural changes to consider for conducting freight planning at CDOT. Chapter 6 assembles each of the options into a set of three potential programmatic efforts for freight planning scaled to three potential resource investment levels.

This report is also supported by analyses and research that are provided in a separate appendix compilation. This compilation includes the following seven appendices:

- **Appendix A –** Catalog of Freight Plans in Other States;

- **Appendix B –** Sample Freight Advisory Council Structures Used in Other States;

- **Appendix C –** TRANSEARCH and Freight Analysis Framework2 Data Usage;

- **Appendix D –** Truck-Rail Diversion Activities;
- **Appendix E –** Freight Needs Assessment;
- **Appendix F –** Safety Analysis;
- **Appendix G –** Colorado Energy Development; and
- **Appendix H –** Definition of Freight-Related Terms.

2.0 Vision and Goals for Freight Planning

A freight vision for CDOT was developed through input from key transportation and freight partners in the State. The vision was originally crafted by the CDOT project team, and was fine-tuned based on input received at a Freight Summit held in July of 2009. The CDOT project team established six goals in support of the vision. These goals were presented to the partners at the Freight Summit, and the partners suggested modifications to the goals; many of which have been incorporated. Partners at the Freight Summit were also asked to identify objectives for each of the six goals that could serve as quantifiable performance measures to confirm that progress toward accomplishing the vision and goals is occurring. The CDOT project team refined the list of objectives to ensure that each objective is applicable, measurable, and achievable. The freight vision, goals, and objectives established through this process are presented below.

Vision

CDOT will be the statewide leader of freight planning and policy development, in collaboration with our freight partners.

2.1 Goals

Six goals were identified for freight planning in Colorado. One goal was developed for each of six primary topic areas: 1) Efficiency, 2) Safety, 3) Regulatory, 4) Education, 5) Economic Development, and 6) Environmental Stewardship. The goals are as follows:

- **Efficiency –** Enhance mobility and connectivity, provide reliability, and relieve congestion for freight movement;
- **Safety –** Develop and implement programs and projects to improve the safety of moving goods in a multimodal transportation system;
- **Regulatory –** Support, in cooperation with all freight partners, consistent policies and regulations which enhance the freight system;

- **Education –** Inform the general public, freight partners, and decision-makers of the importance of freight in the larger transportation system by providing information on how efficient goods movement benefits the daily lives of Colorado citizens and what programs exist to support the freight industry;
- **Economic Development –** Invest in and sustain a freight system to support state, regional, and local economic development goals; and
- **Environmental Stewardship –** Make freight-related decisions consistent with CDOT's commitment to protect the environment and quality of life for Colorado's citizens.

2.2 Objectives

The objectives that correspond with each of the six goals are as follows.

Objectives for Efficiency Goal

- Decrease truck travel time between key origins and destinations;
- Reduce nonrecurring delay due to incidents on key freight corridors;
- Reduce number of highway/rail at-grade crossings;
- Recognize and improve intermodal connector roads;
- Identify and reduce freight bottlenecks;
- Increase modal and routing options for moving goods; and
- Maintain a minimum pavement condition rating on key freight infrastructure.

Objectives for Safety Goal

- Reduce number of freight-related crashes;
- Reduce severity of freight-related crashes; and
- Reduce crashes (number and severity) at highway/rail at-grade crossings.

Objectives for Regulatory Goal

- Conduct a comprehensive review of existing state-level regulations;
- Identify and resolve inconsistencies with regulations of other states and agencies;

- Conduct annual meeting with freight industry to review regulatory issues; and
- Work with other regulatory agencies to improve and update regulations.

Objectives for Education Goal

- Develop joint public information campaign (CDOT and industry);
- Prepare annual freight activity report and informational brochure;
- Conduct annual public information meetings;
- Provide regular public service announcements;
- Develop and regularly update freight webpage;
- Incorporate freight issues in Statewide and Regional Transportation Plans (RTPs);
- Include freight partners in process of developing Statewide and RTPs; and
- Solicit regular feedback from freight partners.

Objectives for Economic Development Goal

- Identify freight-related component of state, regional, and local economic development needs;
- Increase value of freight moved from and to Colorado;
- Increase freight infrastructure accessible to new economic development; and
- Identify and pursue creative funding sources for freight infrastructure development.

Objectives for Environmental Stewardship Goal

- Reduce fuel consumption rate related to the movement of goods;
- Reduce freight-related noise pollution;
- Reduce vehicle emissions related to the movement of goods;
- Reduce hazardous material incidents;
- Increase use of alternative fuels for the movement of goods; and
- Reduce carbon footprint related to the movement of goods.

3.0 Highlights of CDOT Freight Planning Efforts

CDOT has engaged in several freight planning efforts that have helped to push forward the Vision and Goals described in Chapter 2. As part of the CDOT Statewide Freight Roadmap Study, additional analyses and documentation were developed to advance freight planning in the State. The highlights of the previous studies include:

- **Rail Relocation Implementation Study –** An analysis of potential rail alternatives for bypassing Colorado's Front Range including a determination of public benefits and railroad costs. The most recent report on this study was completed in January of 2009.

- **Freight Data Studies –** As noted in Chapter 1, a series of studies to determine freight data needs in the State, and to collect pilot truck origin-destination data.

- **Ports-to-Plains Corridor Development and Management Plan –** A coalition of state DOTs in Colorado, New Mexico, Oklahoma, and Texas conducted the study of this designated "High Priority" Corridor. The corridor begins in Denver, Colorado and runs southeast exiting the state at the Oklahoma border. It continues through Oklahoma to Texas where it connects with Amarillo, and ultimately ends at Laredo, Texas. The corridor also includes a spur that begins in Raton, New Mexico and ends in Dumas, Texas. The Corridor Development and Management Plan was completed in 2004. It was developed to gain an understanding of how to enhance the efficiency of the corridor, including widening 755 miles of two-lane roads to four-lane divided highways, adding amenities needed by commercial vehicle operators, improving or constructing connective interchanges, improving or constructing overpasses for railroad crossings, and integrating an intelligent transportation system (ITS).

- **Catalog of Freight Plans in Other States (Appendix A of this report) –** A description of freight plans and studies conducted in the states adjoining and nearby Colorado.

- **Sample Freight Advisory Council (FAC) Structures used in Other States (Appendix B of this report) –** A description of best-practice FACs from around the country, along with options for CDOT to consider in structuring its FAC.

- **TRANSEARCH and FAF^2 Data Usage (Appendix C of this report) –** A description of potential uses for TRANSEARCH and FAF^2 freight flow data in freight planning studies.

- **Truck-Rail Diversion Activities (Appendix D of this report) –** An estimate of the potential for truck-rail diversion in Colorado

- **Freight Needs Assessment (Appendix E of this report) –** A compilation of freight needs in Colorado based on operational data and previous studies.

- **Safety Analysis (Appendix F of this report) –** A scan of available safety data in the State, and a summary of truck-related crash data by region, crash type, and crash severity.

- **Colorado Energy Development (Appendix G of this report) –** A description of ongoing work at CDOT to estimate the amount, location, and transportation needs of the energy development sector.

- **Definition of Freight-Related Terms (Appendix H of this report) –** A list of freight-related terms and their definitions. The list includes terminology common to both the public and private sector.

Table 3.1 shows which of the six CDOT Freight Goals are advanced by each of the previous and current freight planning efforts described in this chapter. The table shows that some of the goals have received more attention than others. Specifically, the goal of education was advanced through 9 of the 10 studies described in this chapter. The goals of efficiency, safety, and economic development were also advanced in several studies. However, the environmental goal was advanced in only 3 of the 10 studies, and the regulatory goals were not advanced in any of the studies. This indicates that future efforts should build off of the momentum developed regarding education and efficiency; increase the amount of planning done in regards to safety and economic development; and develop concerted efforts to incorporate regulatory and environmental aspects into freight planning. The next two chapters explore possible opportunities within CDOT to meet these goals through 1) policy and program changes, and 2) structural framework changes.

Table 3.1 Categorization of Freight Planning Efforts into CDOT Freight Goals

Freight Planning Effort	Goals					
	Efficiency	Safety	Regulatory	Education	Economic Development	Environmental Stewardship
Rail Relocation Study	✓	✓		✓	✓	✓
Ports-to-Plains Corridor	✓	✓		✓	✓	✓
Catalog of Freight Plans in Other States				✓		
Sample of FAC Structures				✓	✓	
TRANSEARCH and FAF² Data Usage	✓			✓		
Truck-Rail Diversion Activities	✓			✓		
Freight Needs Assessment	✓	✓			✓	
Safety Analysis		✓		✓		
Colorado Energy Development	✓	✓		✓	✓	✓
Definition of Freight-Related Terms				✓		
Totals	**6**	**5**	**0**	**9**	**5**	**3**

4.0 Options for Freight Policies, Programs and Planning

4.1 Options to Broaden Role of Freight in Long Range Planning

Within the long-range transportation planning process, there are two primary levels of plans:

1. **RTPs (RTP) –** These "grassroots" multimodal transportation plans are prepared for 15 geographic regions comprising the entire State of Colorado. Five of these plans are prepared in urban areas by the Metropolitan Planning Organizations (MPO), and 10 of the plans are prepared for rural areas by the Transportation Planning Regions (TPR). These plans serve as the foundation for the Statewide Transportation Plan.

2. **Statewide Transportation Plan –** This plan uses the RTPs as building blocks and creates the Vision for the entire State. Hence, it assesses the "big picture," and it ensures the continuity of the Regional Plans.

Historically, there has not been much recognition of freight in any of these long-range plans. The RTPs typically include an inventory of highways with significant truck volumes and an inventory of railroads. They also include projected future year truck volumes. Several of the MPOs have incorporated freight-related policy statements in their regional plans, and they have attempted to include information on commodity flows and freight-related safety data. The Statewide Transportation Plan has included a Freight Technical Report, which provides a profile of freight in Colorado, an inventory of the freight system, and a summary of freight-related initiatives being undertaken in the State.

While the MPOs and the TPRs recognize the value of freight planning and wish to recognize it in their regional planning efforts, they have clearly stated their position that comprehensive freight planning can most effectively be conducted at the State level as a responsibility of CDOT.

Areas of Opportunity

In the context of regional and statewide long-range planning, the project team identified five areas related to freight which CDOT should focus on:

1. Data Collection;
2. Forecasting;
3. Assessment of Corridors;
4. Improvement Strategies; and
5. Involvement of Industry.

Data Collection

As identified in the Freight Data Assessment prepared by CDOT in 2005, the following types of data were identified as those which provide the most useful information for planning purposes:

- Truck Counts;
- Origin-Destination Data;
- Commodity Information;
- Classification of Vehicles
- Routing Information;
- Travel Time Data; and
- Rail Line Volume Information.

Some of these data are readily available through existing CDOT databases. Other freight data can be obtained from sources such as the Federal Highway Administration's (FHWA) Freight Analysis Framework2 (FAF2), the Bureau of Transportation Statistics Commodity Flow Survey, or the proprietary IHS Global Insight TRANSEARCH database. Other freight data will require a separate data collection effort.

In addition to these data types, roadway surface conditions, bridge sufficiency ratings, rail line conditions, and congestion levels are useful planning data, and this information is generally maintained through other CDOT databases.

To be of value to the MPOs and the TPRs, these data would need to be maintained on a statewide and a regional basis. If it is to fill the desired role of leadership in freight planning, CDOT should take on the responsibility for leading the effort in data collection, and for being the repository of these data.

It is also recommended that CDOT develop a Freight Data Management System. This system would assemble freight data across several different categories, and allow for one-stop shopping for freight data in the State.

Forecasting

Long-range plans typically address a planning horizon that is 20 to 25 years into the future. Therefore, it would be important for CDOT to be able to provide projected information on critical elements of the freight database. Future truck volumes, rail line activity, and commodity flow information would be most useful. CDOT has a methodology in place to project truck volumes, but rail activity will require input from the railroads. Commodity flow projections are available through both the FAF2 and TRANSEARCH database.

Assessment of Corridors

Because the RTPs and the Statewide Transportation Plan are built upon a corridor approach to transportation planning, it is important that freight considerations be taken into account when identifying, assessing, and tiering corridors. Further, such factors should also be incorporated into the corridor visions. These factors should include items, such as:

- Truck volumes (existing and projected);
- Rail activity (existing and projected);
- Existing and future land uses that generate freight activity;
- Roadway designation (e.g. intermodal connectors); and
- Relationship of the corridor to the national freight network.

Some guidance has been provided to the planning regions on how to consider freight in the development of corridor visions, but it has been limited and could be strengthened. Relating to the prioritization or tiering of the corridors, the North Front Range MPO has included freight as one of five measures to be used in the corridor tiering process. Although it simply measures truck volumes in its process, this could serve as a starting point upon which a more detailed approach could be developed.

Improvement Strategies

A key element of both the RTPs and the Statewide Transportation Plan is the identification of strategies applicable to meeting the goals and objectives established for each corridor. Examples of such strategies related to freight could include improving infrastructure (such as surface treatment, bridge repair or replacement); enhancing safety (such as geometric modifications, guardrail, widened shoulders, rumble strips, runaway ramps, off-road truck parking areas, grade crossing protection); improving mobility (such as major widening, auxiliary lanes, climbing lanes); or providing ITS strategies (such as

variable message signs, incident response systems, trucker information). CDOT could provide better guidance to the planning regions on the range of strategies, which would be beneficial to freight movement for use in developing their RTPs.

Involvement of Industry

As long-range transportation plans are under development, representatives of the freight industry should be given the opportunity to participate. However, the MPOs have indicated that their attempts to involve the freight industry in long-range planning in the past have not been successful because most freight industry representatives are typically occupied with issues that are more immediate than the 20-year future timeframe. Therefore, while everyone should be given the opportunity to comment on regional plans, more effective input could be achieved through a high-level group of industry and user representatives who are asked to help develop freight-related policy and framework issues for the Statewide Transportation Plan and the RTPs.

Recommendations

The following actions represent roles through which CDOT could broaden freight's role in long-range planning:

- Continue to compile and analyze truck volume data (existing and projected) on the state highway system. This is discussed in more detail in Chapter 5 as part of the Freight Data Library.

- Conduct the freight origin-destination (O/D) survey program recently piloted at CDOT and recommended by the results of the Freight Origin-Destination Pilot Study.

- Complete the establishment survey program piloted on the Freight Origin-Destination Pilot Study to compile better information on freight activity throughout the State.

- Development of a statewide truck model as part of a statewide travel demand model.

- Provide refined guidance to the planning regions on freight factors to be considered in the development of corridor visions and methodology to incorporate freight into a corridor-tiering process. This would include methods for routinely conducting an inventory of intermodal connectors in the region.

- Prepare for use by the planning regions a "tool box" of strategies, which would be appropriate for use in corridors where freight movement is significant. This "tool box" should include a description of the strategy, its benefits and its implications, and its cost.

- Develop a Statewide Freight Plan, which would become an element of the Statewide Transportation Plan, and would serve as a baseline for the development of freight elements of the regional plans.

- Establish as one of the roles of the FAC the responsibility for helping to develop freight-related policy statements to be incorporated into the Statewide Transportation Plan. The role of the FAC is elaborated upon in Chapter 5.

4.2 Advancing Environmentally Responsible Practices

There are two major areas of concern for CDOT relative to environmental issues in freight. The first is the high percentage of emissions that are generated by freight-related sources. The second is to ensure that freight is fully integrated into environmental studies that are conducted at CDOT with special emphasis on its inclusion into the National Environmental Policy Act (NEPA) process. Similarly, environmental issues should be fully-integrated into freight studies. These areas are described in the following two sections.

Reduce Freight-Related Emissions

Air quality is a significant concern for Colorado, especially for the Denver metropolitan region and the North Front Range. Figure 4.1 below shows that the U.S. Environmental Protection Agency (EPA) has designated the Denver/North Front Range region as the only nonattainment area for the eight-hour ozone standard. Therefore, gaining an understanding of the importance of freight transportation relative to air quality in the region will be an essential part of developing environmentally responsible practices for the State.

There is no freight-related emissions database for the Denver region. However, the FHWA report *Assessing the Effects of Freight Movement on Air Quality at the National and Regional Level* (FHWA 2005) discusses freight-related emissions in six metropolitan regions by mode and compares it to emissions from other mobile sources. The six metropolitan regions that were studied were: Baltimore, Chicago, Dallas, Detroit, Houston, and Los Angeles. The vast majority of freight-related oxides of nitrogen (NO_x) emissions, which is an ozone precursor pollutant, were typically from the truck mode, with the marine or rail modes running a distant second, depending on whether or not the metropolitan area had a major port. The vast majority of the NO_x emissions in each of these regions were also from freight-related sources. Similar results were found for Particulate Matter less than 10 microns in diameter (PM_{10}) in each of the metropolitan regions.

Based on the data in this report and assuming that Denver is likely to be similar to the nonport cities in the study, it would be reasonable to estimate the following emissions characteristics for the Denver region:

- Trucks account for more than 90 percent of the freight emissions in the region;

- At least 40 percent of the mobile source emissions in the region are likely to be freight related; and

- About one-third of the total NO_x and PM_{10} emissions in the region are likely related to freight.

Considering the significance of freight transportation on emissions as reflected by these characteristics, it would be important to consider a range of emission mitigation strategies targeted to freight transportation. These strategies can be grouped in two major categories:

1. Technological strategies, which modify a piece of equipment or its fuel to reduce emissions; and

2. Operational strategies, which change the way a piece of equipment is used, resulting in lower emissions.

As described in the FHWA report mentioned above, technological strategies focused on pollutant emission reductions are often summarized as the "Five Rs" – Retrofit, Repower, Refuel (with alternative fuels), Repair/Rebuild, and Replace. A description of these strategies is as follows:

- **Retrofit –** A retrofit typically involves the addition of an aftermarket mechanical device that removes emissions from the engine exhaust. Retrofits can be very effective at reducing emissions – eliminating up to 90 percent of pollutants in some cases. Many of the effective after-treatment devices require use of ultra-low sulfur diesel (ULSD) fuel.

- **Repower –** Repowering involves replacing an existing engine with a new engine. This strategy is most effective for use in equipment with a useful life longer than that of the engine. Repowering provides an opportunity to install a new engine that meets much lower emission standards than the original engine; often in conjunction with fuel economy benefits and lower maintenance costs.

- **Refuel –** A variety of alternative fuels can be used in freight vehicles and equipment. Some require little or no modification to the engine (such as emulsified diesel or biodiesel), while others (such as natural gas) require engine conversion or replacement.

- **Repair/Rebuild –** Major maintenance activity that can be used to upgrade a vehicle's engine using more modern, cleaner equipment that provides an immediate emission reduction benefit.

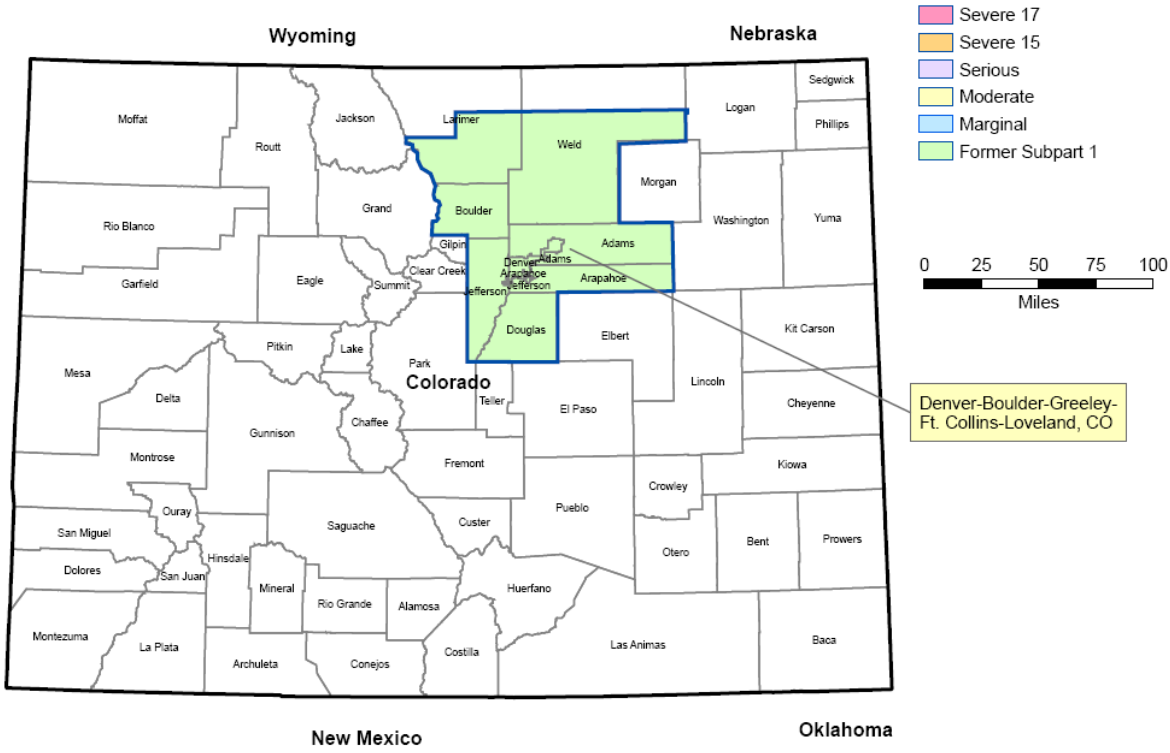
- **Replacement –** Selectively replacing older freight equipment can sometimes be the most cost-effective way to reduce the emissions of a fleet. In this way, older, higher polluting equipment is retired from service before it would otherwise be retired.

Newer equipment that meets more stringent emission standards is purchased to replace the retired equipment; sometimes in conjunction with retrofit devices or alternative fuels.

Operational strategies change the way that trucks, locomotives, ships, and aircraft operate; resulting in fewer pollutant emissions. Many of these strategies, though not all, reduce fuel use and result in lower operating costs for the equipment owner. Table 4.1 summarizes some operational strategies that can reduce emissions from freight transportation. A full description of these options can be found in the FHWA report, *Assessing the Effects of Freight Movement on Air Quality at the National and Regional Level*.

CDOT's role in addressing freight and air quality issues would be to take a stance in terms of the balance of technological and operational strategies to pursue at the statewide level. Additionally, CDOT could provide guidance to the Denver Regional Council of Governments (DRCOG), the North Front Range Metropolitan Planning Organization (NFRMPO), and the Upper Front Range Transportation Planning Region (UFR TPR) on mitigation strategies to pursue in their regions.

Figure 4.1 Eight-Hour Ozone Nonattainment Areas



Source: U.S. EPA web site, October 2009.

Note: Eight-Hour Ozone Nonattainment Areas in Blue Border.

Table 4.1 Operational Strategies for Reducing Freight Fuel Use and Emissions

Truck	Rail	Air
Reduce overnight idling	Reduce switchyard idling	Increase load factors
Reduce pick-up/drop-off idling	Reduce line haul speeds	Reduce vertical separation minimums
Improve port access	Reduce empty mileage	Reduce use of aircraft auxiliary power units
Reduce highway speeds	Increase double-tracking	Improve runway efficiency
Synchronize arterial signals	Improve train clearance	Increase use of continuous descent approach
Increase number of grade-crossing separations	Eliminate circuitous routings	Increase ground support equipment running off of electricity
Increase driver training		
Reduce empty mileage		

Source: *Assessing the Effects of Freight Movement on Air Quality at the National and State Level*, FHWA, 2005.

Integrating Freight into the Environmental Process

The FHWA is currently developing a handbook that outlines the steps to take to ensure that freight is fully-integrated into the NEPA process. This handbook outlines the freight issues to consider for each of the steps in the NEPA process. A summary of the freight issues related to Colorado are:

- **Stakeholder Involvement –** Ensure that freight stakeholders are involved from the beginning of an environmental study. Ensure that freight stakeholders include the proper balance of modal, logistical, and geographical representation.

- **Scoping/Purpose and Need –** Incorporate freight elements from previous planning studies, when possible. Understand when and how to collect new data/information to comprehensively scope a project, and to develop the Purpose and Need for a project.

- **Alternatives Development and Analysis –** Include freight considerations when developing alternatives and use available freight data during the alternatives analysis process.

- **Affected Environment –** The affected environment section of an environmental document should include a description of the existing freight facilities, the need for additional freight facilities, and identification of any plans for future freight facilities. The environmental consequences section of an environmental document should include how freight facilities will be impacted by the alternatives being considered. Additionally, there should be an understanding of freight's unique impact on each element in the affected environment for each alternative.

- **Mitigation –** Consulting with freight private sector interests is recommended to ensure that the full range of mitigation alternatives is considered.

CDOT should review its environmental practices to determine the extent to which freight is incorporated into each of its elements. Based on this review, CDOT can develop guidelines for ensuring that freight is incorporated into the environmental process. CDOT's December 2008 NEPA Manual should be updated to include guidelines and information for addressing freight during environmental studies.

4.3 Linking Freight and the Economy

One method for demonstrating the importance of freight is to describe the connection between freight and the economy. For Colorado, this can be done by describing the statewide economy, and then quantifying the relationship of each sector of the economy to freight. For example, economic activity is often divided into goods-producing sectors and services sector. The goods-producing sector is very directly related to the economy, as it requires input from other sectors and must move outputs to customers further downstream in their logistics chain. The services sector also relies on freight, but to a much lesser extent. The services sector receives supplies, sends parcel shipments, and on occasion sends much larger shipments. Each of these items adds demand to the freight system in Colorado.

A good place to start collecting data on Colorado's economy is the Bureau of Economic Census. This dataset includes comprehensive output data in dollar terms for sectors and subsectors of Colorado's economy. At a local level, the Census provides information at the metropolitan level for large and medium cities. However, at a more detailed subsector level, some of the data are suppressed to protect the privacy of companies which may have a large share of business within a particular subsector in the State. Another source of information on economic sectors is state governmental agencies and state trade groups. For example, the Colorado Department of Agriculture has detailed information on agricultural goods produced on a crop-specific basis, and often at a county level. The Colorado Mining Association has detailed information on the amount of goods that are mined, and where mining activity is occurring.

Another source of economic data is the TRANSEARCH database that CDOT maintains. The advantage of using the TRANSEARCH database is that it is comprehensive. It includes estimates of goods produced on a commodity-specific basis and a county-level

basis for the entire State. The TRANSEARCH database also includes comprehensive trade flow information. This allows for estimates to be made in terms of where inputs are coming from, and where outputs are going to, for flows within the State, outside of the State, and through the State. The disadvantage of the TRANSEARCH database is that it has pockets weakness, and the accuracy is not well-quantified or documented. The FHWA FAF2 data can be used as an alternative to TRANSEARCH, but it has similar strengths and weaknesses, and it does not have county-level detail.

A large component of freight activity is destined for final consumption by the general population. Therefore, understanding how long-term demographics will unfold in the State will be a positive step towards understanding how goods movement will evolve. CDOT should obtain the State's official long-term population forecast as a point of reference for developing freight forecasts for the State. One method to understand the correlation between population and freight is to perform a regression of current population and freight attracted and generated at the county level using Census and TRANSEARCH data. This analysis should be attempted on an aggregate economic basis and on a commodity-specific basis to identify which commodities are most directly tied to population. The long-term forecast of population can then be appropriately tied to specific commodity groups.

CDOT is best positioned to perform this economic analysis, because ultimately the purpose of the analysis is to make more informed decisions relating to the transportation system in the State. However, the Colorado Office of Economic Development and International Trade and the Colorado Chamber of Commerce should be provided the opportunity to comment on this analysis and the report. They should also be used as resources to identify specific economic sectors that are being targeted for business attraction and/or retention which should be analyzed in greater detail than other industries.

4.4 Disseminate Freight Information to Those Outside the Freight Industry

All too often, freight and its impacts are viewed as a burden on our quality of life. "There are too many trucks on the road," "The trains make too much noise and cause congestion in urban areas" or "Trucks make driving on our roads hazardous" are statements often heard. Yet most persons, unless linked to the freight industry, do not understand the value of freight transportation to Colorado's economy and to our standard of living.

As the leader in freight planning, CDOT has the opportunity to develop a program which would disseminate information about freight in Colorado to raise the awareness of its importance and its implications to everybody. Outside of the freight industry, there are at least four key audiences to which such a program should be targeted:

1. General public;
2. Consumers of logistics services (e.g. retail establishments);
3. Staffs of local government agencies and elected officials; and
4. Other agencies.

Recommendations

It is recommended that a program be developed within CDOT to establish as many as possible of the following action items to disseminate reliable, current, and relevant freight information to parties of interest outside the freight industry:

- Develop a freight component of the CDOT web site which would be accessible to any interested person. This web site could post a Colorado freight "fact sheet," frequently asked questions about freight in Colorado, all documents prepared by CDOT relating to freight in the State, and links to other sources of information regarding freight throughout the country.

- Annually prepare a Freight Activity Report for the State, which would address truck, freight rail and air cargo volume information, commodity flow information (to the extent possible), safety data, improvement projects, and any other ongoing freight-related activities in the State. This report could be posted on the web site and distributed to all freight planning partners.

- Prepare periodic "information pieces" on freight topics of current interest. Work with media outlets throughout the State to have these articles published or used as news briefs.

- Develop a speaker program on freight topics and offer speakers to schools, civic organizations, and business groups.

- Work with Colorado Counties, Inc. (CCI) and Colorado Municipal League (CML) to develop a training program for local staffs and elected officials to raise their awareness of the importance of freight to the welfare of communities, and to assist them in gaining a better understanding of freight impacts created by land use decisions. Provide assistance in projecting outcomes that may be caused by potential development.

- Establish a program to ensure that freight issues are addressed during the public outreach process in the development of the RTPs and the Statewide Transportation Plan.

- Update CDOT NEPA Manual to include guidance and information on freight for environmental studies.

- Develop Freight Data Library – develop a clearinghouse that stores, tracks, and disseminates freight data.

- Create and facilitate an interagency freight task force to discuss available freight data collected by each agency, and to coordinate freight-related activities being undertaken by each of the agencies. This task force could consist of representatives, in addition to CDOT, from the following agencies:

  – Department of Agriculture;
  – Department of Local Affairs;
  – Department of Natural Resources;
  – Department of Public Health and Environment;
  – Department of Revenue;
  – Public Utilities Commission; and
  – Office of Economic Development.

4.5 Additional Policy and Program Options Generated from Project Team

Throughout the Roadmap project, there were several new policies and programs that were developed by the Project Team. Many of these policies and programs have been discussed and incorporated into earlier sections of this Roadmap. This section is used to describe the remaining policies and programs that were developed by the Project Team. They are sorted by which of the six goals are advanced the most. It should be noted that many of the policies and programs actually advance multiple goals. Table 4.2 shows all of the goals that are advanced for each of the policies and programs identified throughout this study. Each policy and program also is given an activity identification number (e.g. A.1, A.2) to allow for easy identification in later sections of this report.

In Chapter 6, these ideas are organized into a series of alternative work programs that can be used as the basis of a freight program, depending on the amount of resources that are available to devote to freight planning and the structure that is chosen for conducting freight planning.

Efficiency

- **Reconfiguration of Truck Routes (A.1) –** Analysis of statewide truck routes to determine how well they match current land use patterns. Reconfiguration of truck routes, as needed (and where possible), for routes through incompatible land use types.

- **Railroad Relocation Program (A.2) –** A statewide inventory of the rail alignments in the State relative to current land uses, including rail-highway at-grade crossings. An analysis of rail relocation options that maximizes reduction in rail, truck, and auto delay; and improves the quality of life for Colorado residents. An estimate of costs for relocation to determine improvements with the highest cost-benefit ratios.

- **Rail Crossing Inventory Program (A.3) –** Formalize process for maintaining Federal Railroad Administration Database. Monitor system to collect better data for local users (e.g., safety, PUC).

- **Truckstop Improvements (A.4) –** Improve lighting, increase parking spaces, add wi-fi technology.

- **Develop Statewide Rail Plan (A.5) –** Work with CDOT's new Rail and Transit Division to develop a statewide rail plan that is compliant with the Passenger Rail Investment and Improvement Act (PRIIA) of 2008.

- **Work in Multi-State Freight Planning Efforts (A.6) –** Work with states that share common freight interests with Colorado on multi-state freight planning efforts. These efforts can include data collection, alternatives analysis, and CDOT's new Rail and Transit Division to develop a statewide rail plan that is compliant with the Passenger Rail Investment and Improvement Act (PRIIA) of 2008.

Safety

- **Wildlife Detection Systems (B.1) –** Identification of common wildlife crossing locations on major roadways and implementation of wildlife detection systems to inform travelers of potential hazard.

- **Passive Rail Crossing Improvement Grant (B.2) –** Create a grant program similar to SAFETEA-LU Section 130 Grants used for freight-related studies to purchase passive warning signs for rural crossings. Municipalities will apply for funds to purchase signs and will be rated similar to Section 130 requirements. Set annual cap at a given amount (e.g., $25,000).

- **Comprehensive Truck Safety Analysis (B.3) –** Work with Safety and Traffic Engineering Branch to conduct ongoing analysis of truck crash data including recommendations on specific safety improvements to implement.

Regulatory

- **Comprehensive Regulatory Review (C.1) –** Conduct a complete and thorough review of regulation and fees paid by freight industry at the Federal, state, and local levels. Estimate cost and operational impacts of regulations. Determine if fees adequately cover expense incurred by the State. Are the fees appropriately administered? Do fees

prohibit economic growth? Recommend solutions to improve system or policy positions to support.

Education

- **Develop Freight Newsletter (D.1) –** Develop informative newsletter to be sent to freight stakeholders on a regular basis to keep them informed about recent happenings related to CDOT's freight planning efforts

- **Truck Guide (D.2) –** Develop a comprehensive truck information booklet. Maintain and publish on a regular basis. Add survey for feedback.

- **Educate CDOT Regarding Freight Vision and Goals (D.3) –** Educate CDOT as a whole on the freight vision, goals, and objectives. Identify ways to weave into other CDOT projects and initiatives, similar to CDOT's Environmental Stewardship Principles.

Economic Development

- **Statewide Freight Zones (E.1) –** Define industry, resource, and economic zones throughout the State. This will allow freight to be understood in relationship to specific geographies and industries.

Environmental Stewardship

- **Electrification of Truckstops and Rest Areas (F.1) –** Provide electrical power access to truck drivers at truckstops or rest areas.

- **Encourage Participation in the FHWA Smartway Program (F.2) –** Provide incentives to increase private sector participation in transportation emissions reduction programs sponsored in the EPA/FHWA SmartWay program. The SmartWay program is a partnership among government, business, and consumers to reduce fuel consumption and improve air quality through an array of products and services that reduce transportation-related emissions.

4.6 Summary of Potential Freight Activities

This study identifies several potential freight activities for consideration by the Colorado DOT. Table 4.2 lists all of these activities and identifies which CDOT Freight Goals are advanced by each activity, including which goal is advanced the most. Additionally, the table provides an identification number for each activity that will allow activities to be

tracked throughout this report. The table also provides a reference for additional information on each activity.

Table 3.1 summarized CDOT Freight Goals that were met from previous freight planning activities. It was noted that these previous activities covered four of the goals with multiple activities, while having much less coverage for two of the goals: Regulatory and Environmental Stewardship. Table 4.2 demonstrates that the activities identified in this study fill both of these gaps with multiple potential activities. This indicates that there is balance in the activities identified in this study.

Table 4.2 Matching Potential Freight Activities to CDOT Freight Goals

Freight Activity	Activity ID	Location in Report For More Information	Goals					
			Efficiency	Safety	Regulatory	Education	Economic Development	Environmental Stewardship
Reconfiguration of Truck Routes	A.1	Section 4.5	✓	✓	✓		✓	✓
Rail Relocation Program	A.2	Section 4.5	✓	✓			✓	✓
Rail Crossing Inventory Program	A.3	Section 4.5	✓	✓			✓	
Truck Stop Improvements	A.4	Section 4.5	✓	✓			✓	✓
Statewide Rail Plan	A.5	Section 4.5	✓	✓	✓	✓	✓	✓
Work with other States on Multi-State Freight Planning Efforts	A.6	Section 4.5	✓		✓	✓	✓	
Conduct Truck Origin-Destination Surveys	A.7	Section 4.1	✓			✓		
Conduct Establishment Survey Program	A.8	Section 4.1	✓			✓		
Develop Truck Model	A.9	Section 4.1	✓			✓		
Develop Statewide Corridor Profiles for I-70 and I-25	A.10	Section 4.1	✓	✓			✓	✓
Provide Guidance to Planning Regions on Freight Factors for Corridor Visions	A.11	Section 4.1	✓	✓				✓
Prepare a "Tool Box" of strategies for Planning Regions for Freight Corridor Studies	A.12	Section 4.1	✓	✓			✓	✓
Inventory Intermodal Connectors	A.13	Section 4.1	✓	✓			✓	✓
Wildlife Detection Systems	B.1	Section 4.5		✓				✓
Passive Rail Crossing Improvement Grant	B.2	Section 4.5		✓				
Comprehensive Truck Safety Analysis	B.3	Section 4.5, Appendix F		✓				
Work with CDOT Regions to Improve Poor Roadway/High Truck Volume Locations	B.4	Appendix F		✓			✓	
Develop Truck Safety Estimation Methodology	B.5	Appendix F		✓				
Comprehensive Regulatory Review	C.1	Section 4.5		✓	✓		✓	
Develop Freight Newsletter and Website	D.1	Section 4.5				✓		
Truck Guide	D.2	Section 4.5				✓		
Educate CDOT Internally	D.3	Section 4.5				✓		
Create Freight Data Library	D.4	Section 4.1	✓			✓		
Develop Municipal Freight Training Program	D.5	Section 4.1				✓		
Develop Freight Data Management System	D.6	Section 4.1	✓			✓		
Update Freight Glossary	D.7	Appendix H				✓		

Table 4.2 Matching Potential Freight Activities to CDOT Freight Goals (continued)

Freight Planning Effort	Activity ID	Location in Report For More Information	Goals					
			Efficiency	Safety	Regulatory	Education	Economic Development	Environmental Stewardship
Establish Statewide Freight Zones	E.1	Section 4.5	✓				✓	
Develop Document Linking Freight to Economy	E.2	Section 4.3					✓	
Take Ownership of Operate Energy Development Impacts Model	E.3	Appendix G	✓	✓			✓	
Electrification of Truck Stops	F.1	Section 4.5					✓	✓
Encourage Participation in the FHWA Smartway Program	F.2	Section 4.5						✓
Reduce Freight-Related Emissions	F.3	Section 4.2						✓
Incorporate Freight into NEPA Manual	F.4	Section 4.2						✓
Identify Priority Freight Projects	G.1	Section 4.1	✓	✓	✓	✓	✓	✓
Identify Freight Funding Opportunities in Next Federal Transportation Reauthorization	G.2	Section 4.7	✓	✓	✓	✓	✓	✓
Number of Activities Primarily Directed Towards Goal			**13**	**5**	**1**	**7**	**3**	**4**
Number of Activities Advancing Goal			**18**	**18**	**6**	**14**	**17**	**15**

Note: An "✓" in bold indicates the primary goal advanced by the freight planning activity.

4.7 Funding Options for Potential Freight Planning, Programs, and Projects

This section provides an overview of existing Federal and state funding programs and financing tools that could be used to facilitate freight investments. These are programs that were specified in the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) legislation, which covered Fiscal Year (FY) 2005 to 2009. SAFETEA-LU is likely to be extended for at least one more year, leaving many of the programs in place. However, future transportation bills have the potential to significantly alter the transportation funding options. Additionally, this section provides an overview of other funding and financing tools – such as dedicated revenue sources,

public debt, and institutional arrangements – that have been used by states, local government, and the private sector to finance freight projects.

Funding Options

National Highway System (NHS) SAFETEA-LU Funding (FY 2005 to 2009): $30.5 Billion – The NHS program provides funding for roadways designated as part of the NHS, including intermodal connectors between the NHS and intermodal terminals. Eligible activities include construction, reconstruction, resurfacing, and rehabilitation on a roadway connecting the NHS with a truck-rail facility, port, pipeline terminal, or an airport.

Surface Transportation Program (STP) SAFETEA-LU Funding (FY 2005 to 2009): $32.6 Billion – The STP program provides flexible funding for projects on any Federal-aid highway, bridges on public roads, transit capital investments, and intracity and intercity bus terminals and facilities. Eligible freight projects include preservation of abandoned rail corridors, bridge clearance increases to accommodate double-stack freight trains, capital costs of advanced truck stop electrification systems, and freight transfer yards.

**Congestion Mitigation and Air Quality (CMAQ) Improvement Program – SAFETEA-LU Funding (FY 2005 to 2009): $8.6 Billion –** The CMAQ program funds transportation projects and programs that improve air quality by reducing transportation-related emissions in nonattainment and maintenance areas for ozone, carbon monoxide (CO), and particulate matter (PM_{10}, $PM_{2.5}$). CMAQ funds have been used for freight-related projects that improve air quality by reducing truck, locomotive, or other emissions. Examples of CMAQ-funded freight projects include construction of intermodal facilities for moving containers off of highways and onto rail, defraying barge operating costs, rail track rehabilitation, diesel engine retrofits, idle-reduction projects, and new rail sidings. Additionally, though previously eligible, SAFETEA-LU highlighted advanced truck stop electrification system at truck parking facilities, on-road diesel engine retrofits, and other cost-effective mitigation activities as CMAQ eligible projects. In addition, SAFETEA-LU provided new eligibility for nonroad diesel engine retrofit projects. CMAQ funds may be used to fund construction and other activities that could benefit a private entity, if it can be documented that the project will remove truck traffic on the Federal-aid system, or reduce other freight-related emissions, thus improving the region's air quality.

Highway Bridge Program – SAFETEA-LU Funding (FY 2005 to 2009): $21.6 Billion – The Bridge Program provides funding for replacement, rehabilitation, and systematic preventive maintenance of bridges. States must use a minimum of 15 percent of the funding for projects on off-system bridges (i.e., on non-Federal-aid eligible roadways).

Railway-Highway Crossings – SAFETEA-LU Funding (FY 2006 to 2009): $880 Million – Formerly a set-aside of the STP program, the Railway-Highway Crossings program provides funding for projects that improve safety at public highway-rail at-grade crossings through the elimination of hazards and/or the installation/upgrade of protective devices at crossings. SAFETEA-LU requires that states set aside at least

50 percent of the funding allocation for the installation of protective devices at rail-highway crossings. If all needs for installation of protective devices have been met, then the funds available can be used for other at-grade crossing projects eligible under this program. Eligible projects include separation or protection of grades at crossings, the reconstruction of existing railroad grade crossing structures, and the relocation of highways or rail lines to eliminate grade crossings.

Capital Grants for Rail Line Relocation Projects – SAFETEA-LU Funding (FY 2006 to 2009): $1.4 Billion (Subject to annual appropriation) – The Rail Line Relocation Grant program provides grants to states for local rail line relocation and improvement projects that improve rail traffic safety, motor vehicle traffic flow, community quality of life, or economic development; or involve relocation of any portion of the rail line. SAFETEA-LU authorized $350 million per year for FY 2006 through 2009, subject to appropriations. No funds were appropriated for this program in FY 2006. At least 50 percent of the funds shall be awarded for grants of $20 million or less. The Federal share shall not be more than 90 percent. Colorado received earmarks in 2008 and 2009 for the Pecos Street Grade Separation in Adams County.

Federal Transit Administration (FTA) Fixed Guideway Modernization Program – SAFETEA-LU Funding (FY 2006 to 2009): $6.1 Billion – The FTA's Fixed Guideway Modernization program provides funding for capital improvements on "fixed guideway" systems, including heavy rail, commuter rail, high-occupancy vehicle (HOV) systems, and light rail. Transit and commuter rail providers are eligible to receive funds from this program for systems that have been in place for at least seven years. The funds are allocated to urbanized areas by statutory formula. Although freight projects are not eligible to use this funding source, capital improvements on passenger rail lines shared with freight rail could benefit railroads.

Federal Aviation Administration (FAA) – Airport Improvement Program (AIP) – The FAA's AIP provides funding for airport planning and development projects at airports included in the *National Plan of Integrated Airports Systems* (FAA AIP Handbook). Eligible airports must meet the following criteria: cargo service airports receiving cargo in excess of 100 million pounds annually; and private commercial airports that enplane more than 10,000 passengers annually.

U.S. Department of Commerce Economic Development Administration (EDA) Funds – The EDA provides grants for projects in economically distressed industrial sites that promote job creation and/or retention. Eligible projects must be located within an EDA-designated redevelopment area or economic development center. Eligible freight-related projects include industrial access roads, port development and expansion, and railroad spurs and sidings. Grantees must provide evidence of economic distress that the project is intended to alleviate.

U. S. Environmental Protection Agency (EPA) Brownfield Revitalization Program – Through the EPA's Brownfield Revitalization Program, the Federal government provides grants and loans for brownfield site cleanup. Brownfield sites could be redeveloped for commercial, residential, and/or industrial uses, including intermodal facilities (e.g., rail-truck transfer facilities). Site cleanup grants provide up to $200,000 per site to fund

cleanup conducted by cities, development agencies, nonprofit groups, and similar entities at sites that they own.

In addition to the programs mentioned above, there are other ways to raise dollars to fund freight improvements and/or match grant funds. These methods are discussed below:

User Fees/Tolls – User fees commonly provide a dedicated stream of revenue to repay the loans or bonds issued to support freight investments. For instance, railroads pay fees on the Alameda Corridor (per container) or the Shellpot Bridge (per rail car) for using the new infrastructure. Truck-only toll (TOT) lanes have been studied in the Los Angeles region on SR 60 and I-710; both of which are heavily used by trucks accessing the Ports of Los Angeles and Long Beach.

Dedicated Taxes – The use of dedicated taxes at the state and local level for transportation investments has increased significantly in the past few years. Highway projects are traditionally funded with motor fuel taxes levied at the state level. Local governments have used property taxes to fund local transportation investments, because such taxes are the primary revenue source at the local level. Dedicated taxes can be used as one of the funding mechanisms for freight-related projects.

Special Taxing and Assessment Districts – Special taxing or assessment districts capture the benefits of particular improvements. Residents and/or business owners agree to pay additional property taxes that are allocated for specific improvements. In some instances, the assessment district is dissolved once the proposed improvements are completed. Special taxing or assessment districts are commonly used for transit investments, although they have been increasingly used for general highway or port, and even for freight rail investments.

Equity and In-Kind Contributions – Private-sector funding for freight improvements could be in the form of cash or in-kind contributions. In the case of in-kind contributions, private entities (such as railroads) donate land or professional services, which are included as part of the project costs. Local governments often donate right-of-way for highway projects, which accounts for the non-Federal share for Federally funded projects.

Public Debt – In the case of bonds issued by public entities there are two broad classifications of debt: 1) tax-supported bonds, and 2) revenue bonds. Tax-supported bonds can be used to fund freight improvement projects. Revenue bonds would need to be backed by a toll collection or user fee strategy. Either type of bond can be used to fund freight projects and programs in Colorado.

Tax-Exempt Facility Bonds/Private Activity Bonds – Tax-exempt facility bonds, otherwise known as private activity bonds, have their interest excluded for Federal income tax purposes in the gross income of recipients. With this qualified status and the accompanying tax benefit to investors, exempt facility bonds can be offered at a lower interest rate, thus providing the issuer with considerable financing cost savings. This type of funding can make freight improvement projects more attractive to the private sector because the interest rates are lower.

Joint Development – The concept of joint development takes on many meanings in the area of public capital development. Joint development is defined as any formal arrangement between a public authority and a private organization (beyond just ports) that involves either private-sector payments to the public authority, or the private-sector sharing project capital costs. This type of development allows for the private sector freight community to benefit from lowered interest rates that arte typically available only to the public sector.

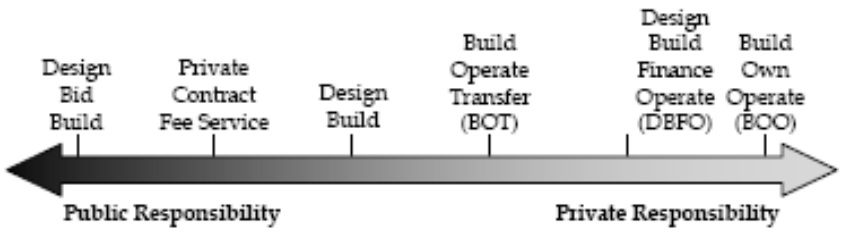
Revenue-Sharing Arrangements/Leases – When a freight facility enters into a contractual lease arrangement, it is transferring the future services rendered by a fixed asset (e.g., a container crane or other terminal facility) to a private organization, while retaining the title to that fixed asset. Other lease transactions include sale/lease-back arrangements, in which assets are sold and then leased back by the seller. An example of such transaction is the Southern Tier Rail Rehabilitation project, in which Norfolk Southern transferred the rail line title to a rail authority for 10 years, and then leased the rail line from the rail authority. The purpose of this transaction was to allow for tax abatement on the rail line over the lease period. Similar transactions can be implemented in Colorado to allow the freight community to benefit from long-term operation of a freight facility with the cost of capital being provided at interest rates that are typically available only to the public sector.

Public-Private Partnerships (PPP) for Freight Investments – PPP refers to contractual agreements formed between a public agency and private-sector entity that allow for greater private-sector participation in the delivery of transportation projects. The three principal aspects of private-sector participation are:

1. Project Delivery (development phase through design and construction);
2. Project Management (long-term operational and maintenance responsibilities); and
3. Project Financing (raising the capital necessary to fund the project).

Some PPP approaches involve just one of these services (such as design-build contracting for a public-sponsored project, such as highway construction); whereas, others may involve all three (e.g., user-charge project financings under long-term private concessions). In the case of freight investments, PPPs are essential for project implementation for several reasons. First, the private sector is heavily invested in freight transportation, whether it is through ownership of infrastructure or by facilitating the movement of goods. Second, unlike other transportation investments, much of the freight investments are on private property, which makes it difficult for allocation of public funding. Third, the efficient movement of goods is important to both the private and public sectors. Overall, the creation of partnerships can facilitate freight investments by leveraging scarce resources and accelerating the benefits realized through these investments. Traditionally, private-sector participation in surface transportation projects was limited to planning, design, or construction contracts. Figure 4.2 below shows the different options of PPPs. These PPP arrangements provide for expanded participation and responsibility from the private sector in traditionally public investments on transportation.

Figure 4.2 Range of PPP Options



Source: FHWA Financing Freight Improvements, 2007.

Finance Options

A common barrier to freight project implementation by the private sector is the high cost of financing projects. The creation of tax-exempt corporations allows for the issuance of debt at lower interest rates, reducing the financing costs of the project. Other Federal financing tools can be grouped into the following four categories:

1. **Loans**, where a project sponsor borrows Federal highway funds directly from a state DOT or the Federal Government (e.g., State Infrastructure Banks, Transportation Infrastructure Finance and Innovation Act (TIFIA) loans, Rail Rehabilitation and Improvement Financing).

2. **Credit Enhancement**, where a state DOT or the Federal Government makes Federal funds available on a contingent (or standby) basis (e.g., TIFIA loan guarantees and lines of credit, Private Activity Bonds). Credit enhancement helps reduce risk to investors, and thus allows the project sponsor to borrow at lower interest rates.

3. **Debt financing through Grant Anticipation Revenue Vehicles (GARVEEs) bonds**, where a state DOT can pledge a share of future Federal highway funding toward debt service on a long-term bond issue.

4. **Special Experimental Project Number 15 (SEP-15)** allows the Secretary to waive some of the requirements in four project delivery categories: contracting, right-of-way acquisition, project finance, and compliance with the NEPA and other environmental requirements. This can reduce the amount of time needed to construct a project and thereby reduce the total financing costs.

Details on these finance options can be found in the FHWA 2007 report, *Financing Freight Improvements*. The list of funding and financing alternatives presented in this section should be considered as reference material as specific freight projects are identified through freight planning and general planning activities at CDOT.

5.0 Options for Structural Changes for Conducting Freight Planning

There are two types of structural changes to consider for improving freight planning at CDOT:

1. Internal structural changes within CDOT; and
2. Structural changes to the Colorado Freight Advisory Council (FAC).

5.1 Options to Consider for CDOT Internal Structure to Conduct Freight Planning

There are several reasons to consider structural changes to the method in which CDOT conducts freight planning:

- Freight demand is growing and it requires significant attention;
- CDOT has been increasing the number of freight-related studies and projects;
- Freight stakeholders are quietly demanding that some effort and personal attention be given to this issue;
- Freight planning seems to be a key topic of interest in discussions related to the next Federal transportation legislation authorization;
- Need leadership and staff to manage and implement the Freight Roadmap;
- Budget constraints at CDOT are increasing, which demands increased efficiency in freight planning efforts;
- Need to consider how freight planning will occur in the context of the new Division of Transit and Rail; and
- Need to anticipate freight-related project and program requirements of the Efficiency and Accountability Committee.

The Project Team identified four alternative freight planning and programming structures to consider which can be summarized as follows:

1. Keep the Freight Program as-is;

2. Create a Freight Program Unit in CDOT Division of Transportation Development (DTD) focused on freight planning;

3. Create an enhanced Freight Program Unit in CDOT DTD with expanded freight responsibilities; and

4. Create a Freight Program Unit within the new Division of Rail and Transit.

These options are described separately below with a discussion of advantages and disadvantages for each option.

Option #1 – Keep the Freight Program As-Is

Description – Keep the Freight Program as part of the Mobility Analysis Unit with no change in the current structure for performing freight planning.

The advantages of this option are:

- No changes are necessary; and
- No budget implications.

The disadvantages of this option are:

- Freight efforts will not be as recognized, may lose support from external stakeholders;
- Does not provide sufficient resources to fully prepare CDOT for anticipated freight elements of new transportation authorization; and
- Continues to require a great deal of coordination both internal and external to DTD.

Option #2 – Create a Freight Program Unit in DTD Focused on Freight Planning

Description – Create a Freight Program Unit in DTD within the Information Management Branch; excludes bringing together all freight-related efforts from other CDOT Divisions. This can start as a small unit of one to two people and expand as needs require, and can be done without Transportation Commission action. This option should also consider the possibility of incorporating a freight internship to assist with the increasing amount of freight planning work.

The advantages of this option are:

- Creates a visible program that external stakeholders can identify;
- Can be done with little involvement of other CDOT Divisions;
- Utilizes existing DTD leadership that has a good understanding of freight issues and know freight community;
- Is initially budget neutral; and
- Prepares CDOT for expanded Freight Program as indicated in new authorization.

The disadvantages of this option are:

- Requires coordination with other CDOT Units both internal and external to DTD.

Option #3 – Create a Freight Program Unit in DTD With Expanded Freight Responsibilities

Description – Create a Freight Program Unit in DTD within the Information Management Branch; include Permitting Unit, and Railroad Programs from Chief Engineer's organization. This probably would require Transportation Commission action.

The advantages of this option are:

- All freight activities in one place – less internal coordination;
- Creates a visible program that external stakeholders can identify;
- Utilizes existing DTD leadership that has a good understanding of freight issues and know freight community; and
- Prepares CDOT for expanded Freight Program as indicated in new authorization.

The disadvantages of this option are:

- Moves people from other Divisions to DTD: this could create some conflict; and
- Complicated budget transitions.

Option #4 – Create a Freight Program Unit Within the New Division of Rail and Transit

Description – Create a Freight Program Unit within the new Division of Rail and Transit. This option could include a CDOT Unit with or without Permitting and Railroad programs.

The advantages of this option are:

- Eases synchronization of freight rail and passenger rail planning activities.
- Leverages planned reorganization to minimize disruption of moving Freight Program Unit. New Division is being formed and responsibilities are being defined. This is a great opportunity to make this move.
- Centralizes railroad industry interaction with CDOT thereby increasing likelihood of successful stakeholder involvement in freight planning efforts.

The disadvantages of this option are:

- This activity may not fit into mission of the new Division;
- Complicated budget moves; and
- Could fragment freight planning activities between Divisions.

Recommended Option for Internal Structure Changes

The Project Team recommends Option #2 (Create a Freight Program Unit within DTD Focused on Freight Planning) for moving forward with freight planning at CDOT. Exercising this option creates a new CDOT Unit with the visibility and credibility to conduct freight planning that will be recognized within CDOT, with Colorado's MPOs/TPRs, and with the private-sector freight stakeholders. There would be minimal disruption to CDOT organization, and it would not require approval from the Colorado Transportation Commission.

It should be noted that this recommendation along with the other options should also be reviewed by the Interim Transit and Rail Committee. As the new Transit and Rail Division is developed, the best structure for allowing freight should be considered as part of the structural changes that are made. This new Transit and Rail Division will have areas of overlap with freight, most notably in relationship to freight rail activity and passenger rail operating on freight rail lines. Therefore, the structure of the new division should also consider how freight planning will be accomplished at the Colorado DOT.

This new Freight Program Unit would be responsible for developing and leading the full freight program for CDOT. There would be 11 key tasks of this Unit as shown below:

1. Develop the statewide Freight Plan utilizing the guidance provided in the Freight Roadmap.

2. Serve as a liaison and lead the coordination with external stakeholders, including, but not limited to, the FAC.

3. Lead an internal freight working group comprised of key freight-related program managers and other key leadership.

4. Advocate for the Freight Program at CDOT; ensure that freight planning is included appropriately in all stages of program and project development.

5. Develop and maintain a statewide freight project plan. This plan must be coordinated with DTD Regional and Statewide Planning Sections and the CDOT Regions.

6. Maintain a library of freight data and freight data sources, and act as the "owner" of freight data in Colorado (e.g., O/D surveys, truck counts, freight flow data).

7. Coordinate all freight studies and investigations within CDOT.

8. Work with other sections of DTD, the Division of Transit and Rail, and the Chief Engineers organization, including the CDOT Regions.

9. Help address freight issues as part of the strategic transit and rail plan.

10. Serve as a resource for Colorado MPOs and TPRsto provide guidance, data, and examples of freight planning.

11. As funding is identified for this program, coordinate the funding of programs and projects with other managers in DTD, the Regions, and the FAC.

This recommendation proposes to include the Freight Program Unit as part of the DTD in the Information Management Branch. Initial budget for this unit will be borne by DTD from existing programs and/or vacancy savings. This placement of the Freight Program Unit takes advantage of the current internal knowledge base, as it relates to freight planning. It also efficiently leverages the current organizational structure. Freight stakeholders have established rapport with organizational structure and leadership; they will easily accept this as long as it is independently identifiable. Additionally, the proposed Unit requires no additional budget, which is key in the current CDOT funding environment. The Unit also retains a great deal of flexibility, and it can easily be expanded, as needed.

This Unit would be staffed based on an initial Position Description Questionnaire (PDQ) and a finalized set of program responsibilities. This program could likely be activated as early as January of 2010.

This recommended option also includes the development of a freight working group within CDOT to ensure that freight planning, operations, and programming are coordinated across CDOT Divisions. The working group would include:

- Freight Program Manager;
- Representative from the Statewide and Regional Planning Section;
- Representative from the Division of Transit and Rail;
- Manager of the Permitting Unit;
- Manager of Utilities and Railroad Programs;
- Representative of Region Planners;
- Representative of Region PE IIIs;
- Representative of Government Relations Office;
- Representative from the Public Utilities Commission; and
- Representative from the FHWA.

5.2 Options for Framework of Cooperation Between CDOT and Private-Sector Freight Industry

Current Colorado Freight Advisory Council (FAC) Activities

Earlier in this decade, the CDOT recognized a desire to engage the freight industry to foster partnerships and a shared vision and goals for addressing the demanding freight needs of the State. Recognizing the growing freight demand, the Department established a FAC in September 2003. The FAC is comprised of 15 leaders and industry partners in both the trucking and rail sectors, as well as other key stakeholders; and has met on a quarterly interval the past six years. The key focus is for CDOT to receive advice and direction on freight issues important to the State. The key objectives of the FAC include:

- Serve as a forum for discussions of freight movement and freight infrastructure within and through Colorado;
- Educate freight interests regarding the local, regional, and statewide transportation planning processes;
- Incorporate freight interests into transportation planning;

- Educate public sector regarding the importance of freight infrastructure improvements; and

- Improve statewide understanding of the importance of freight transportation.

The meetings, which are chaired by the CDOT Executive Director, have existed on a mutually beneficial basis – helping CDOT and the freight industry to achieve joint as well as independent benefits. Often, this is one of the few opportunities that the freight industries have to directly engage the CDOT Executive Director and key staff about critical issues pertaining to their businesses. A key benefit has been development and enhancement of relationships between CDOT, the freight leaders, as well as freight leaders amongst themselves. This is one opportunity where the competing truck and rail businesses can share and discuss common issues and concerns. Other key benefits include:

- Provide CDOT, regional, and local entities with improved access to freight planning data and data sources;

- Provide advice and other information on specific modes of freight movement; and

- Discuss relevant freight transportation security issues.

Each quarterly meeting has a unique and distinct purpose. One is for the members and key CDOT staff only and focuses on more specific strategies and policy issues. The second is a field trip of various freight-oriented businesses such as rail facilities, and distributions centers such as Denver International Airport's freight facilities. The third meeting is a longer, often even full day workshop, open to the public and other interested stakeholders. At this meeting critical new trends, reports and data are shared. In addition, members of the legislature are invited to share their thoughts and analysis of applicable legislation. The fourth meeting is geared to a shorter single presentation on a significant and agreed key issue.

It is becoming apparent that these meetings, while mutually beneficial, are beginning to lose their appeal to CDOT and some members of the industry. The FAC needs a greater role and purpose to keep membership invigorated and staffed with the right professionals to help CDOT to better achieve its overall mission "…to provide the best multimodal transportation system for Colorado that most effectively moves people, goods, and information." In order to help define a greater role, we have reviewed FAC practices in Minnesota, Florida, Oregon, and the Mid-Atlantic Regional Council (the MPO for Kansas City) and used these experiences to develop potential options for moving forward with the Colorado FAC. The summary reviews are provided in the Appendix B.

Future Options for Colorado FAC

There are four options for making adjustments to the Colorado FAC. The consistent theme of each of the options is to provide the Council with a specific set of ongoing

responsibilities that they can use to organize their activities. The options are not exclusive, so several combinations should be considered in developing a final strategy for the FAC.

Option 1 – Direct Programming Authority

Description: This option would give the Colorado FAC programming authority for a specific set of project recommendations, which would proceed directly from the FAC to implementation. This method was used in Florida, where the Florida Freight Stakeholder Task Force had the authority to commit $10 million of DOT funds to a short-list of quick-fix projects around the State.

The advantages to this option are:

- It has proved to be extraordinarily successful in increasing the enthusiasm and participation of the private sector.
- Increased participation can be leveraged to create a forum to thoroughly review freight-related study deliverables, identify the State's freight infrastructure, and develop freight prioritization criteria.

The disadvantages to this option are:

- Implementation would be politically and administratively difficult to set up in the current funding environment in Colorado.

Option 2 – Specific Programming Advisory Input

Description: This option would give the Colorado FAC the responsibility of identifying and recommending a set of freight-related projects within a specific budgetary constraint. This is similar to the Oregon FAC method, in which the State Legislature authorized them to prioritize $100 million worth of freight projects for the Oregon DOT to consider in its own programming process. The FAC does not have direct programming authority, but their recommendations are a consideration in the Oregon DOT programming process.

The advantages to this option are:

- Provides an activity that can be used to rally private sector
- Provides input that is important for the CDOT programming and planning processes.
- Freight stakeholders are directly involved in an important element of CDOT's operations.
- Results in a process that can be used to provide momentum for requesting additional transportation funds for freight projects.

The disadvantages to this option are:

- Time-consuming for private sector stakeholders with no guarantee that their recommendation will be adopted by CDOT.

Option 3 – Authorship for Freight Element of Long-Range Transportation Plan

Description: FAC has authorship for Freight Element of next long-range transportation plan update. This could include working with a consultant to develop the structure, graphics, and tone for the freight element. It also includes final review authority for the final product that is developed for the plan. The Minnesota DOT used their FAC to develop the freight element of its long-range transportation plan. This was an effective activity in Minnesota to balance the passive participation of the FAC in other activities.

The advantages to this option are:

- Provides an activity that can be used to rally private sector
- Provides input that is important for the CDOT planning processes.
- Solid first step towards active involvement of the freight community in the statewide transportation planning process.

The disadvantages to this option are:

- This option would not be viewed as enthusiastically as Options 1 or 2.

Option 4 – Review and Comment on Freight-Related Studies

Description: Use the FAC to provide comment on methodology, analysis, and final deliverables for freight-related studies in Colorado. For the Mid-Atlantic Regional Commission (the Kansas City, Missouri MPO), at the beginning of each annual cycle, it develops a plan for its FAC in terms of specific FAC activities, meetings, and legislative actions that will occur every year.

The advantages to this option are:

- Provides useful input on freight-related studies in Colorado, including a streamlined source to ensure that private sector freight stakeholder involvement is incorporated into studies.
- Provides identifiable activities with which to engage the private sector.

The disadvantages to this option are:

- This option would not be viewed as enthusiastically as Options 1 or 2.

- This does not provide a regularly scheduled activity for the FAC, but rather requests their assistance on an as-needed basis.

- There is no end product that the FAC can identify with and take ownership of.

Recommended Option for FAC Framework

It is our recommendation that Option #2 (Specific Programming Advisory Input) be used as the structural framework used for the Colorado FAC. This option would serve to energize the FAC, provide them with a specific set of responsibilities to focus on for the upcoming year, and it would provide CDOT with a list of freight-focused projects with a private-sector endorsement. This could be important as future national transportation bills could set aside funds specifically for freight projects. It will also be a valuable tool for conducting statewide freight planning in Colorado to have a set of projects for further analysis and consideration. If this option is selected, then there will need to be a reexamination of the Colorado FAC members to ensure that the proper balance of modal, regional, and industry representatives are involved.

Frequency of Colorado FAC Meetings

The Colorado FAC meets roughly once every quarter. This is consistent with the meeting frequency of other states. However, with the new activities proposed above added to the responsibilities of the FAC, it may be necessary to reduce the meeting time spent on other activities. We recommend that the attendance at each of the four previous events be reviewed to determine which activity was of the least interest to Colorado FAC members. The regular FAC meetings should be limited to two per year with other meetings planned as needed based on the new responsibilities.

6.0 Putting It All Together

The goal of the Statewide Freight Roadmap is to develop a set of activities and programs for the Colorado DOT to embark upon in the short, medium, and long terms to implement a freight program for the State. However, the amount of activities that occur will be directly correlated to the amount of resources that are devoted to the program. Therefore, we have developed three alternative freight work programs depending on the level of resources that CDOT decides to allocate to freight planning.

We have denoted these options as "the Conservative Option", "the Moderate Option", and "the Aggressive Option". These options are used as general categories to illustrate how activities can be grouped and sequenced in different ways. Activities are assigned to options based on what could reasonably be done at various resource levels. We have also provided preliminary rough estimates for dollar amounts for each of these options. Much more research and scoping of activities scoping would be needed to verify and specify these estimates. It is also difficult to estimate these values using national data, because the data is sparse, and not easily applied to Colorado. As more certainty is developed regarding the availability of resources for conducting freight planning, it is recommended that the packaging and sequencing of these activities be re-examined as well.

A description of the three categories is as follows:

1. The Conservative Option represents the activities that are proposed to be done within the current structure for conducting freight planning and with roughly the same amount of resources that have been provided over the last five years. It is estimated that the cost of this option could range from $500,000 to $1,500,000 over 10 years depending on the specifics of each of the program options.

2. The Moderate Option represents the activities that are proposed to be done with a modest increase in resources devoted to freight and only slight changes to structure (e.g., freight as a new unit). It is estimated that the cost of this option could range from $1,500,000 to $3,000,000 over 10 years.

3. The Aggressive Option represents an option of how to structure a freight work program that encompasses the vast majority of ideas that were generated in the process of this study in addition to those identified in previous freight planning efforts. It is estimated that the cost of this option could range from $5,000,000 to $10,000,000 over 10 years.

Table 6.1 lists all of the recommendations developed in this study and identifies which of the recommendations would be done under each of the three options. It also identifies whether the recommendation should occur in the immediate timeframe, in years 2-5, or in years 6-10. Figure 6.1 shows how each of the recommendations match up with the CDOT

Freight Goals for the Conservative, Moderate, and Aggressive Options. Sections 6.1 through 6.4 describe each of the options in more details also showing the timing for implementing recommendations. These sections also provide additional information on how some of these recommendations would be implemented (e.g. Statewide Freight Plan, State Rail Plan, working with other CDOT Divisions).

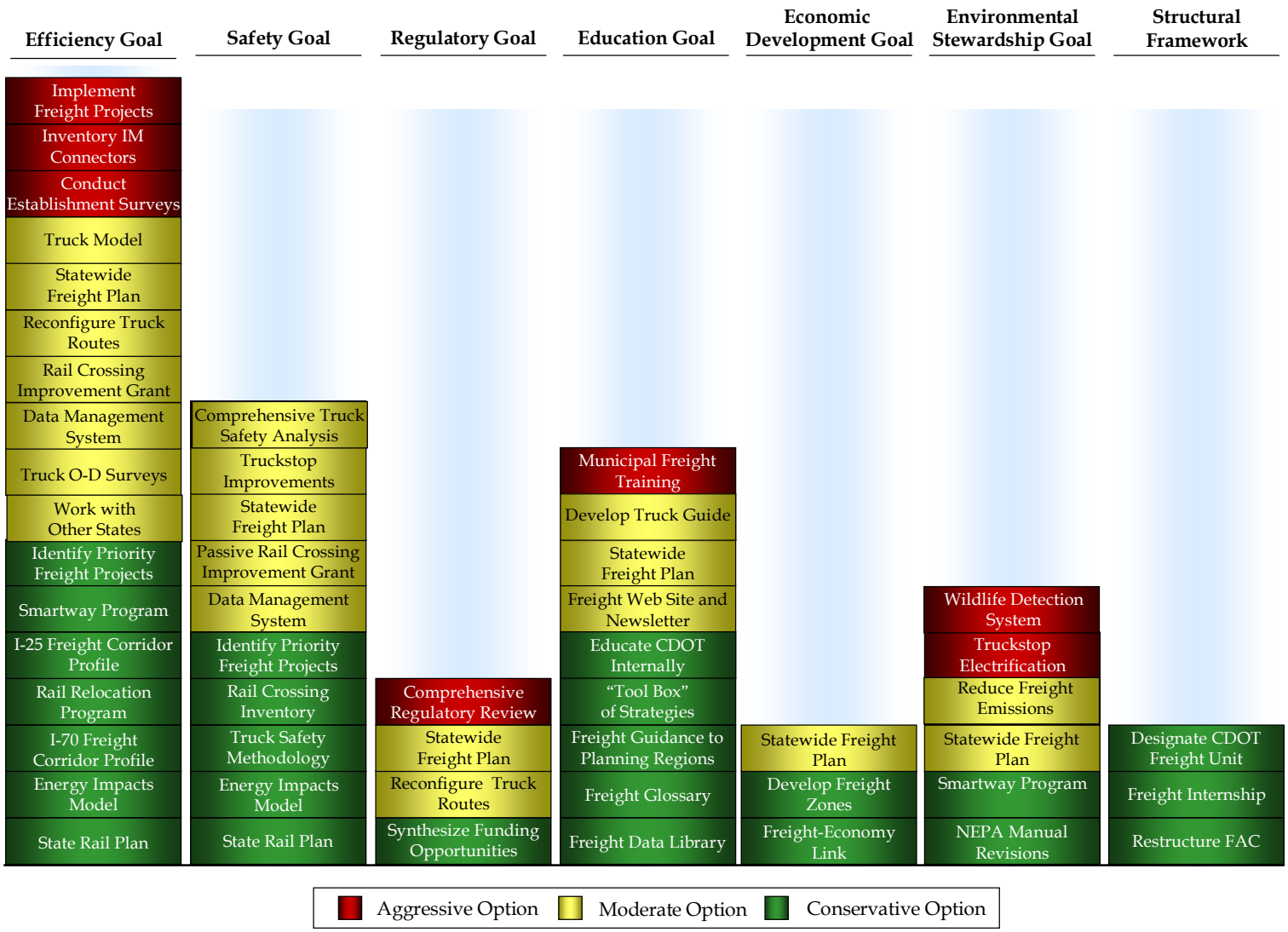
Table 6.1 Activities Conducted in Short, Medium, and Long-Term

Freight Activity	Activity ID	Conservative Option			Moderate Option			Aggressive Option		
		Immediate Actions	Year 2-5	Year 6-10	Immediate Actions	Year 2-5	Year 6-10	Immediate Actions	Year 2-5	Year 6-10
Reconfiguration of Truck Routes	A.1					✓			✓	
Rail Relocation Program	A.2	✓			✓			✓		
Rail Crossing Inventory Program	A.3	✓			✓			✓		
Truckstop Improvements	A.4						✓			✓
Statewide Rail Plan	A.5	✓			✓			✓		
Work with Other States on Multi-State Freight Planning Efforts	A.6		✓			✓			✓	
Conduct Truck O/D Surveys	A.7				✓			✓		
Conduct Establishment Survey Program	A.8								✓	
Develop Truck Model	A.9						✓			✓
Develop Statewide Corridor Profiles for I-70 and I-25	A.10		✓			✓			✓	
Provide Guidance to Planning Regions on Freight Factors in Corridor Visions	A.11		✓			✓			✓	
Prepare a "Tool Box" of Strategies for Planning Regions for Freight Corridor studies	A.12		✓			✓			✓	
Inventory Intermodal Connectors	A.13								✓	
Wildlife Detection Systems	B.1									✓
Passive Rail Crossing Improvement Grant	B.2					✓			✓	
Comprehensive Truck Safety Analysis	B.3					✓			✓	
Work with CDOT Regions to Improve Poor Roadway/High Truck Volume Locations	B.4								✓	
Develop Truck Safety Estimation Methodology	B.5	✓			✓			✓		
Comprehensive Regulatory Review	C.1									✓
Develop Freight Newsletter and Website	D.1					✓			✓	
Truck Guide	D.2								✓	
Educate CDOT Internally	D.3		✓			✓			✓	
Create Freight Data Library	D.4	✓			✓			✓		
Develop Municipal Freight Training Program	D.5								✓	
Develop Freight Data Management System	D.6				✓			✓		
Update Freight Glossary	D.7	✓			✓			✓		

Table 6.1 Activities Conducted in Short, Medium, and Long-Term (continued)

Freight Planning Effort	Activity ID	Conservative Option			Moderate Option			Aggressive Option		
		Immediate Actions	Year 2-5	Year 6-10	Immediate Actions	Year 2-5	Year 6-10	Immediate Actions	Year 2-5	Year 6-10
Establish Statewide Freight Zones	E.1	✓			✓			✓		
Develop Document Linking Freight to Economy	E.2	✓			✓			✓		
Take Ownership of and Operate Energy Development Impacts Model	E.3		✓			✓			✓	
Electrification of Truck Stops	F.1								✓	
Encourage Participation in the FHWA Smartway Program	F.2		✓			✓			✓	
Reduce Freight-Related Emissions	F.3					✓			✓	
Incorporate Freight into NEPA Manual	F.4	✓			✓			✓		
Identify Priority Freight Projects	G.1			✓			✓			✓
Identify Freight Funding Opportunities in Next Federal Transportation Reauthorization	G.2	✓			✓			✓		
Restructure FAC	H.1	✓			✓			✓		
Select Freight Unit Option	H.2	✓			✓			✓		
Develop CDOT Freight Internship	H.3	✓			✓			✓		

Figure 6.1 Freight Planning Options



6.1 Conservative Option – Current Structure and Minimal Increase in Level of Resources

Year 1 Activities

- Create freight data library – including documentation of truck counts collected at the state, MPO, and county-level; TRANSEARCH freight flow data; and freight-related economic data.
- Develop document that links freight and the economy to build momentum for freight planning in CDOT.
- Work with New Rail and Transit Division to structure and implement PRIIA-compliant Statewide Rail Plan, including the following tasks:
  - Identify truck-rail diversion opportunities;
  - Identify railroad relocation opportunities; and
  - Working with freight railroads to develop an annual survey of rail activity in the State.
- Implement preferred option for restructuring the Colorado FAC.
- Work with DTD's Environmental Programs Branch to incorporate freight into the CDOT NEPA Manual.
- Develop statewide freight zones.
- Develop freight internship.
- Designate CDOT Freight Unit.
- Update freight glossary as needed.

Year 2 to 5 Activities

- Become the "owner" of the Energy Development Impacts Model under development as part of the Energy Development Study.
- Develop a statewide freight corridor profile for I-70 that incorporates plans and projects in other states along I-70.

- Develop a statewide freight corridor profile for I-25 that incorporates plans and projects in other states along I-25.
- Quantify truck-rail diversion opportunities in the State.
- Develop methodology to incorporate truck safety analysis as part of future corridor studies at the state and MPO level.
- Develop methodology to incorporate freight-related emissions analysis as part of future corridor studies and general transportation plans.
- Provide refined guidance to the planning regions on freight factors to be considered in the development of corridor visions and methodology to incorporate freight into a corridor-tiering process.
- Prepare for use by the planning regions a "tool box" of strategies which would be appropriate for use in corridors where freight movement is significant. This "tool box" should include a description of the strategy, its benefits and its implications, and its cost.
- Develop synthesis of freight funding opportunities in next Federal transportation reauthorization.
- Develop a rail crossing inventory program.
- Find methods to encourage private sector to participate in Smartway Program.

Years 6 to 10 Activities

- Identify priority freight projects.

6.2 Moderate Option – Slight Changes to Structure and Modest Increase in Resources

Year 1 Activities

- All of the activities included in the Year 1 Conservative Option
- Conduct statewide origin-destination surveys.
- Develop freight newsletter and freight component of CDOT web site.

Year 2 to 5 Activities

- All of the activities included in the Year 2-5 Conservative Option
- Develop a freight data management system that includes traditional freight planning data and merges that with oversize/overweight/crash data.
- Develop methodology to locate truck routes.
- Develop a passive rail crossing improvement grant.
- Work with other states on multi-state freight planning efforts.
- Develop a statewide freight plan that will become part of the statewide transportation plan, and would serve as a baseline for the development of freight elements of regional plans. The freight plan would cover the following topics:
  - Developing a statewide vehicle classification program.
  - Quantify truck-rail diversion opportunities in the State.
  - Identifies freight bottlenecks in the truck and rail network.
  - Reconfiguration of truck routes in the State.
  - Develops specific programs and projects to reduce freight-related emissions.
  - Develop a truck information booklet.
  - Conduct comprehensive freight safety analysis (truck and rail) to determine the cause, location, and frequency of truck crashes and develop recommendations to reduce these accidents. Build off of safety analysis conducted as part of this study.

Year 6 to 10 Activities

- All of the activities included in the Year 6-20 Conservative Option
- Develop statewide truck travel demand model; and
- Improve truck stops (e.g., increased lighting, parking spaces, wi-fi technology).

6.3 Aggressive Option – Unrestricted Changes to Structure and Large Increase in Resources

Year 1 Activities

- All of the activities included in the Year 1 Conservative and Moderate Options

Year 2 to 5 Activities

- All of the activities included in the Year 2-5 Conservative and Moderate Options
- Electrification of truck stops.
- Expand the establishment survey program to compile better information on freight activity throughout the State.
- Work with Maintenance program to identify high truck/poor road condition locations, and determine how to incorporate truck needs into Asset Management activities.
- Develop statewide truck travel demand model.
- Implement a wildlife detection system.

Year 6 to 10 Activities

- All of the activities included in the Year 6-20 Conservative and Moderate Options
- Comprehensive regulatory review to ensure equity in fees being paid by trucks relative to the damage they cause.
- Develop a Municipal Freight Training Program.
- Implement projects and programs identified in statewide freight plan.

6.4 Next Steps

This report has described the Colorado Statewide Roadmap development process. This process included developing a Vision, Goals, and Objectives for the CDOT Freight Program. It also included a long-list of potential recommendations for consideration in terms of the structure of CDOT for conducting freight planning, freight programs, and freight projects. This report has also developed a categorization scheme for combinations of activities to consider based on the level of resources devoted to freight. The next steps from this study are to:

- Identify resource level to be devoted to freight
- Decide on structural issues in regards to where freight planning will occur.

- Finalize recommendations for immediate freight actions to be conducted in the next year.

A. Catalog of Freight Plans in Other States

This technical memorandum summarizes recent freight planning efforts in neighboring states to Colorado. This memo describes the freight planning efforts that were conducted in these other states and identifies issues and analyses that will be most relevant for freight planning in Colorado. This document is meant to complement the *Scan of National, State, and Regional Freight Data and Freight Planning Efforts* which was conducted as part of the Colorado Department of Transportation (CDOT) Freight Data Synthesis.

A.1 Summary of Previous Scan of Freight Planning Efforts

In November 2007, CDOT completed the Task 2 report for the CDOT Freight Data Synthesis Study. This report was titled *Scan of National, State, and Regional Freight Data and Freight Planning Efforts*. The report scanned a broad range of national, state, and regional projects to describe a set of potential freight planning and data collection practices for consideration in Colorado. The projects reviewed in the report were divided into five categories:

1. Multimodal freight studies and plans;
2. Freight data collection and development programs;
3. Freight models;
4. Corridor studies; and
5. Economic issues in freight planning.

In total, 32 projects were reviewed as shown in Table A.1. Each review consisted of a description of the overall study with an emphasis on the types of data that were utilized in the study. The review concludes with a section describing the relevance of the project (or group of projects) for the Colorado DOT and MPOs in Colorado. Additionally, each section included a description of the types of data that would be needed to implement a similar type of study in Colorado based on the existing data in the State.

Table A.1 Studies Included in Scan of Freight Data and Freight Planning Efforts

	MPO	State	National or Multijurisdictional
Multimodal Freight Studies and Plans	Delaware Valley Regional Planning Commission Freight Forward Improvement Program	Virginia Freight Plan	American Association of Railroads National Rail Freight Infrastructure Capacity and Investment Study
	Freight Action Strategy Corridor Program	New Mexico Freight Plan	
	Binghamton Metropolitan Transportation Study Regional Freight Study	Florida Freight Network and Statewide Freight Plan	
	Greater Vancouver Goods Movement Study	New York State DOT Trade Overview Study	
	The South Suburban Mayors and Managers Association Freight Study	Washington Statewide Rail Capacity and System Needs Study	
	San Francisco Bay Area Regional Goods Movement Study		
Freight Data Collection and Development Programs	Southern California Association of Governments Goods Movement Truck Count and Survey Study	Oregon Commodity Flow Database	FHWA Freight Analysis Framework
	Portland Freight Data Collection Program (Portland Metro, Port of Portland, Oregon DOT)	Intermodal Transportation Management System (California)	
		California Statewide Truck Survey	
Freight Models	Portland Metro Truck Model	Oregon Statewide Freight Model	
	Southern California Association of Governments Truck Model		
	San Joaquin Valley Truck Model		

Table A.1 Studies Included in Scan of Freight Data and Freight Planning Efforts (continued)

	MPO	State	National or Multijurisdictional
Corridor Studies	I-710 Major Corridor Study	Georgia Statewide Truck-Lane Needs Study	West Coast Corridor Coalition I-5 Trade Study
	I-15 Comprehensive Corridor Study (San Bernadino Association of Governments)		
	SR 60 Truck-Lane Study (Southern California Association of Governments)		
	Southern California Association of Governments Multi-County Goods Action Plan Truck-Lane Analysis		
Economic Issues in Freight Planning	Riverside County Transportation Commission Colton Crossing Benefits Analysis Project	Freight Rail and the Oregon Economy	
	Southern California Association of Governments Port and Modal Elasticity Study		
	Regional Economic Impacts of the I-5 Columbia River Crossing Chokepoints (Oregon DOT)		

A.2 Recent Freight Planning Efforts Relevant for Colorado

Because freight trips often cross state lines, understanding freight planning efforts in neighboring states is particularly important in understanding which freight solutions will be most effective in Colorado. This section describes recent freight planning activities for each of Colorado's neighboring states. Missouri also is included in this description because of recent planning projects the Missouri DOT has conducted on I-70.

Kansas

The Kansas DOT recently completed the Kansas Statewide Freight Study which developed seven recommendations for improving the movement of goods in the State. The recommendations were:

1. Integrate freight, mobility, and economic development goals and strategies;
2. Identify and designate key freight corridors and facilities of statewide or regional significance;
3. Address critical bottlenecks and link improvement strategies to economic benefits;
4. Develop freight performance measures that link to existing planning activities;
5. Enhance rail planning efforts – including developing a statewide rail plan;
6. Maintain good communications with the private sector freight community; and
7. Address oversize/overweight policies and streamline permitting process.

There also were four quick start action items that were identified for immediate implementation as follows:

1. Formally designate a freight point-of-contact/lead;
2. Assess freight data needs and develop a freight data collection strategy;
3. Track SAFETEA-LU reauthorization process and other pending legislation; and
4. Develop a process to maintain communications with the private sector.

There were no specific freight projects that were recommended as part of this study. Overall, it appears that Kansas DOT is in the initial stages of integrating freight into its transportation planning process. The Colorado DOT may want to set up a cooperative agreement with Kansas DOT to coordinate on the collection of freight data. Additionally, rail planning efforts and I-70 planning efforts may benefit from a multistate perspective.

New Mexico

The New Mexico DOT Multimodal Freight Plan was divided into three tasks:

1. Industry Analysis;
2. Multimodal Infrastructure; and
3. Strategic Direction.

Specific project recommendations were not developed as a part of the New Mexico DOT Multimodal Freight Plan. However, the New Mexico DOT recently completed a separate project to identify the factors for establishing freight corridors for rail and truck across the State and to gain a detailed understanding of multimodal planning for the freight industry. The goal of this study was acceptance by the industry of the freight corridor concept to include NMDOT utilization of freight projections within the design plans and utilization plans for monitoring public safety. This project incorporated some early efforts to reach out to the private sector and some development of freight performance measures.

Wyoming

The Wyoming DOT has incorporated freight into a number of its planning activities, most notably the Wyoming Statewide Long-Range Transportation Plan. WYDOT has begun evaluating the need for a continuous third lane along the I-80 corridor. Climbing lanes have relieved congestion and improved level of service in certain locations and there is consideration of adding more climbing lanes. WYDOT is in the process of implementing ITS improvements on the I-80 corridor as well. Also, the Department is evaluating the economics of separate facilities for large trucks and passenger vehicles as an alternative to a continuous third lane on I-80.

The Wyoming DOT also conducted an analysis of crash data on I-80 for the period from 1992 to 2002 indicating that almost two-thirds of the crashes involving more than one vehicle involved a large truck. About 39 percent of all crashes involved large trucks over the period. On average, about 42 percent of the traffic on the route for the same 10-year period was large trucks. This shows that truck-related safety is a huge issue for the State.

WYDOT also completed a planning effort which gave rise to the Multilane Initiative. The potential need to expand the State's system of multilane facilities was discussed in the 1995 Statewide Long-Range Plan. Highway freight forecasts from the FHWA indicate a need for added capacity on major freight routes. The Transportation Commission has moved the issue forward by proposing legislation to fund expansion of the multilane system. Currently, the stretch of US287 from Laramie, Wyoming to the Colorado State Line is one of the ten corridors being considered for multilaning.

According to the Wyoming long-range transportation plan, the WYDOT also is tracking the impacts of several rail-related actions in the State and as such they would be a potential partner in a multistate freight rail planning effort. They also have investigated truck-rail diversion, including the development of a simulation model to analyze the costs and benefits of pavement alternatives such as material changes, additional capacity, and strategies to divert trucks from I-80 to rail. This simulation model utilizes equations based on traffic data, pavement data, cost data, construction inflation, and safety data. Funding scenarios and constraints also are included in the simulation model. Preliminary analysis indicates that substantial benefits would result from diverting as little as 20 percent of trucks from I-80 to rail using an innovative "land ferry" concept in which entire tractor-trailer combinations are loaded onto rail cars. However, this would require increasing Union Pacific Railroad's rail capacity by approximately 1,400 miles on their central

corridor. Based on the study that accompanied this simulation effort, one of the recommendations was for WYDOT to supports private sector efforts to divert freight from highways to rail.

Missouri (I-70 Only)

Missouri does not share a border with Colorado, but the Missouri DOT (MODOT) is doing a significant amount of planning and environmental work on I-70 that should be noted. MODOT is in the process of completing the I-70 First Tier EIS. Truck-only lanes was considered as one of the early strategies, but the three strategies which made it to the final analyses are:

1. Fixing five key bottlenecks along I-70;

2. Fixing key bottlenecks on I-70 and adding a transportation corridor to connect with downtown Kansas City; and

3. Add general lane capacity across the entire State.

The preferred strategy has not yet been documented. Additionally, Missouri is part of a four-state coalition that is considering the development of truck lanes for I-70. This project started approximately six months ago.

Arizona

The Arizona DOT recently completed the ADOT Multimodal Freight Analysis Study. The primary goal of the study was to ensure that freight analysis is an integral part of Arizona's long-range planning process. This study was directed to include the following as part of the strategy development:

- Broad themes to guide future freight planning;
- A description of how multimodal transportation networks impact the freight industry;
- Potential impacts of freight strategies on economic development in Arizona;
- A strategy for freight data collection, analysis, and planning; and
- Measurable indicators describing the impact of freight traffic on the performance of Arizona's multimodal freight transportation network.

This study was not specific in terms of recommendations or freight projects to pursue for Arizona. The most relevant aspect of this study for Colorado was the development of a series of performance measures which can serve as a reference as Colorado develops their measures for freight planning. These measures and their associated strategies can be found in the Executive Summary Report at the following link: http://www.azdot.gov/mpd/systems_planning/freightstudy.asp

Oklahoma

The Oklahoma DOT has incorporated freight principles throughout their long-range transportation plan. On the highway network, they have identified industrial areas where they want to improve capacity and road condition. For their waterways and air cargo facilities, they have identified specific strategies to assist them in growing as well. Additionally, the Oklahoma DOT has a detailed strategy for improving freight rail in the state, including the following five objectives:

- Support the Improved Efficiency of the Freight Rail System;
- Enhance Freight Rail Service Connectivity to Serve Selected Economic Sectors/ Clusters;
- Improve Connectivity to Serve Existing and to Support Development of New Multimodal Freight and Logistics Centers;
- Continue Cooperation and Coordination with Operating Railroads Regarding Safety at Rail-Highway Crossings; and
- Evaluate the Rail Network for Potential State Acquisition of Lines Subject to Abandonment.

The freight rail policies encourage the improved efficiency of the existing freight rail system through actions over which the State of Oklahoma has jurisdiction, primarily state-owned rights-of-way and infrastructure, as well as actions that the State might take to encourage or support improvements throughout the State's rail network to serve selected economic sectors/clusters and improve connectivity to existing and potential new multimodal freight and logistics centers. In addition, the policies and proposed capital improvements and operational, planning, and regulatory strategies encourage continued cooperation and coordination with the operating railroads regarding safety and rail-highway crossings, as well as a forward-thinking evaluation of the potential for state acquisition of rail lines subject to abandonment. The Oklahoma DOT has acknowledged that rail transports major portions of several of Oklahoma's most significant commodity exports, including nearly 100 percent of broken stone, 90 percent of grain, 36 percent of petroleum refining products, and 24 percent of Portland cement.

As part of their freight rail policy, the Oklahoma DOT seeks to encourage and promote development of transload and/or major intermodal freight rail facilities on the basis of the kinds of products and commodities produced or consumed in the State. This includes identifying manufacturers, warehousing and distribution firms, and/or commercial facilities and developers with potential interest in developing transload or multimodal freight facilities – e.g., auto industry. Additionally, the Oklahoma DOT seeks to preserve right-of-way for construction of sidings, yards, and connectors to multimodal freight facilities and logistics centers within the State.

If the Colorado DOT were to consider creating or joining a multistate initiative to improve freight rail traffic, the Oklahoma DOT appears to be a good partner state to include in such efforts.

Utah

Transportation plans in Utah also were reviewed as part of the work for this memo. The Utah DOT has not conducted any freight-related studies recently. Additionally, there are no projects for I-70 (the main connector between Utah and Colorado) that are noted in the Utah DOT Long-Range Transportation Plan. Similarly, the Nebraska Department of Roads mentioned freight in their long-range transportation plan, but does not have any major freight projects or planning efforts that would impact Colorado.

A.3 Implications for CDOT Freight Planning Efforts

One of the recurring themes for each of the states is the interest in freight rail. The interest is in part based on its potential as an economic development engine for many of the states. There also is interest in diverting freight from highway to rail, thereby freeing up highway capacity and reducing the deterioration of highway facilities. It appears that CDOT has willing regional partners to explore multistate rail planning efforts.

There also are a number of DOTs that are conducting studies on CDOT's two main interstates: I-70 and I-25 in their jurisdictions. There should be coordination between the states to assure that the data collected for these studies is leveraged to the greatest extent possible. Additionally, there should be an effort to ensure that analytical tools used in each state are somewhat consistent. Finally, there should be multistate consideration of how improvement ideas in one state will impact traffic flows in other states based on the high amount of multistate origin-destination pairs.

Examining the freight planning efforts in the region, it does not appear that CDOT is significantly behind any of its neighboring states. New Mexico and Kansas are the only states to perform full-fledged statewide freight plans. Neither of these plans was done at the level of specificity to generate projects that would impact Colorado. CDOT on the other hand has done a lot more than these other states in terms of identifying freight data, collect freight data, and understand freight data sources. CDOT also seems to be further along in terms of actually working with the freight railroads rather than just identifying freight rail diversion and rail relocation as an opportunity. Additionally, the tasks performed as part of the Statewide Freight Roadmap represent a significant step towards assembling initial analysis and data that will be helpful for future freight planning efforts.

B. Sample FAC Structures Used in Other States

B.1 Mid-Atlantic Region Council Goods Movement Committee

Scope – The MARC Goods Movement Committee seeks to integrate freight issues and concerns with the overall metropolitan planning process.

Background – The committee grew out of the 1995 Intermodal Freight Strategies Study. The committee meets on an as-needed basis as determined by the cochairs. Since June of 2008, the committee has met five times equating to roughly quarterly meetings.

Committee Roles and Responsibilities – The committee discusses major freight activities, and provides policy recommendations on regional freight planning to the Total Transportation Policy Committee (TTPC). The Goods Movement Committee is responsible to address the update of policies and goals of the freight transportation industry in the region's Long-Range Transportation Plan (LRTP), *Transportation Outlook 2030 Update*. This section is one of the major products that the Goods Movement Committee will work on updating over the 2009 to 2010 year. Upcoming reports on several large, freight−related planning activities also are a part of what is considered by the committee in the update of the LRTP.

Committee Work Plan – The Goods Movement Committee: will review, discuss, and provide input on:

- Intermodal facility developments;
- Increasing truck traffic;
- Safety related to freight movement;
- Inventory/assess current facilities and identify future needs;
- Economic development impacts;
- Public education on the role of goods movement;
- Update of the Goods Movement Element of the LRTP; draft plan developed by December, 2009;

- Update by KC SmartPort on their activities, including the Federal Trade Data Exchange Project and the Cross Town Improvement Project;
- Trade processing centers;
- Security aspects of freight movement from the Pacific Rim to the Heartland;
- Sustainable local movements of freight;
- Regulatory impact of climate change on freight industry; and
- More adaptive development affecting climate change and growing resource scarcity.

Members – There is no formal list of committee members available, but members noted as present in at least one of the last four meetings included:

- Commissioner Doug Wood, Johnson County – Kansas Co‐Chair;
- Alice Amrein, Johnson County Transit;
- Gary Bartek, Kansas City Aviation Department;
- Shellee Currier, Watco Companies;
- Lee Ann Kell, Allan Zafft, Linda Clark, and Mike Sinn, Missouri Department of Transportation;
- John Maddox, John Rosacker, Chris Herrick, and Allison Smith, Kansas Departmentof Transportation;
- John Rosacker for John Maddox, Kansas Department of Transportation; Chris Herrick, Kansas Department of Transportation;
- Councilman John Sharp, City of Kansas City; Ariane Coleman for John Sharp, Kansas City Councilman;
- John Wagner, Sr., Wagner Industries;
- Dan Wancura, Supply Chain Networking;
- Roger Woody, EmbarqLogistics/Chair, Council of Supply Chain Management Professionals; and
- Chris Gutierrez, Kansas City SmartPort.

Topics covered at the last five meetings included:

- Long-Range Transportation Plan work session – *Transportation Outlook 2040;*

- SmartPort Trade Data Exchange;
- MoDOT's Freight Direction;
- Update on KDOT's Statewide Freight Transportation Study;
- Presentation – KCI Airport Master Plan;
- Kansas City Regional Freight Outlook Project Status (Report and Exercise);
- I‐70 Supplemental Environmental Impact Statement;
- Committee Roles and Responsibilities; and
- Committee Work Plan.

Summary – The primary role of this organization is to review and comment on updates to freight-related projects that occur in Kansas and Missouri. The committee does take a leadership role on developing the freight element of the Kansas City MPO LRTP. While the MARC Freight Advisory Council is made up of private sector and public sector members, the bulk of the attendance and participation is from the public sector.

B.2 Minnesota Freight Advisory Committee

Background – The Minnesota Freight Advisory Committee (MFAC) provides a forum for the exchange of ideas and addressing of issues between Mn/DOT and the private sector to develop and promote a safe, reliable, efficient, and environmentally responsible freight transportation system for the State. The objectives are to:

- Ensure freight transportation needs are addressed in the planning, investment, and operation of Minnesota's transportation system.
- Establish guidelines to measure and manage the State's freight transportation needs.
- Provide input and direction to Mn/DOT's freight investment committee on freight transportation policies, needs, and issues.
- Recommend program and research areas for Mn/DOT follow-up and direction.
- Represent the needs and requirements of freight transportation to the public, elected officials, and other public agencies and organizations.

Since October of 2003, MFAC has met on 13 occasions. The topics they have covered in the last four meetings include:

- **Mn/DOT – Future Directions –** Tom Sorel – Commissioner, Minnesota Department of Transportation (Mn/DOT) Commissioner Sorel shared his philosophies, plans for the

department's direction and priority issues to be addressed. This included emphasis of the partnership approach for working with the business/freight community.

- **Transportation Legislation –** 2008 Session – Betsy Parker – Government Affairs Director, Mn/DOT Betsy provided an overview of the transportation legislation that was passed and signed into law by the Governor from the 2008 State Legislative Session. There were numerous provisions that will impact freight transportation in the State and information on these was handed out at the meeting.

- **Renewable Fuel Transportation and Terminal Infrastructure –** Provided an overview of the liquid pipeline system in Minnesota, of which Magellan facilities make up 1050 miles of refined products pipelines, five distribution terminals and two tank farms.

- **Statewide Transportation Plan –** Freight Elements Discussion and Survey – presented an overview of the freight aspects of the Statewide Transportation Plan (STP) currently being developed by Mn/DOT. Provided a survey document to the meeting attendees on freight transportation issues and priorities. Attendees were asked to complete the survey and turn it in at the end of the meeting.

- **Security Practices Within Transportation Systems –** Provided an update on the present status of security issues and regulatory provisions related to freight transportation, including hazmat commodity movement, along with information on possible upcoming changes to security/hazmat regulations.

- **Minnesota Interstate Truck Parking Study –** Phase I Results Highlights from the Minnesota Interstate Truck Parking Phase I Study were presented covering the project purpose; analysis of truck parking supply and demand; identification of capacity constrained rest area facilities; and results from driver/dispatch survey.

- **Metropolitan Council Transportation Policy Plan –** Freight Transportation – presented an overview of the Metropolitan Council's 2030 Transportation Policy Plan and the current schedule for its update. Specifically covered were freight transportation elements and the Met Council's approach to this area.

- **Minnesota State Transportation Plan (STP) –** Described the State Transportation Plan (STP) process and reviewed the impact of projected highway revenues on Mn/DOT's investment approach and priorities. Presented a review of Mn/DOT's approach to system investment in the STP.

- **Shipper panel reports on experiences and strategies dealing with freight transportation system capacity issues –** Provided information about Target's supply chain and transportation programs, including: partners, technology, network, supply chain network, stores, transportation, and deliveries.

- **Minnesota Statewide Freight Plan –** Outlined the plan for implementing the recommendations from the Statewide Freight Plan, which was completed in 2005 with significant input from MFAC. Recommendation that emphasis be placed on safety issues and concerns, especially in the trucking sector. Some areas for consideration

would include: truck crash analysis, such as, identifying higher crash incident locations; downstream system conditions; engineering considerations; etc.

Summary – MFAC is primarily constituted of private sector stakeholders. The committee is used to disseminate information regarding several aspects of freight transportation, particularly the impacts of recent and potential state legislative actions. Secondarily, the committee provides input and comment to freight-related studies.

B.3 Florida Freight Stakeholders Task Force

Background – Created as a result of Governor's Intermodal Transportation Summit in 1998. Designed to identify, prioritize, and recommend freight improvement projects for fast-track funding and develop recommendations for State's long-range transportation plan. The Florida Freight Stakeholders Task Force, consisting of representatives from both the public and private sectors, was initiated by Governor Chiles and continued by the Governor Bush administration. The Freight Stakeholders Task Force was unique in that it had a dedicated source of funding to use in the advancement of freight improvement projects. Ten million dollars were appropriated by the 1999 Florida Legislature and available to the Task Force to fast-track eligible freight improvement projects.

The Florida Freight Stakeholders Task Force has led several activities, including:

- Identified Florida Strategic Freight Network
- Developed freight project prioritization methodology to include: 1) be located on the Strategic Freight Network; 2) facilitate freight movement; and have a public benefit to cost ratio greater than one.
- Recommended five projects totaling $10 million

In addition to the list of recommended projects, other Task Force recommendations were eventually converted to statute (341.053) by the Florida Legislature. This statute created an intermodal development program within the DOT and required a "plan to connect Florida's airports, deepwater seaports, rail systems serving both passenger and freight, and major intermodal connectors to the Florida Intrastate Highway System facilities as the primary system for the movement of people and freight in this State." This requirement led to the creation of the Intermodal System Plan, completed in 1999.

Summary – While this is a more dated example of a Freight Stakeholders Task Force, it is noteworthy, because they had actual programming authority.

■ B.4 Oregon Freight Advisory Council

Background – OFAC was established in August 1998 by former Oregon Department of Transportation (ODOT) Director Grace Crunican. This was in part due to selected stakeholders' desire to give freight more visibility in ODOT policy, planning, and programming. The Committee consists of regular members represented by shippers, carriers, intermodal companies, and advocacy organizations. Associate members include primarily Federal, state, regional and local agency representatives. About 30 to 40 people typically attend meetings, with record attendance during 2005 to 2006 *Connect*Oregon deliberations. The Policy Subcommittee makes policy recommendations on a variety of subjects for member approval; the Projects Subcommittee prioritizes and recommends projects for multiple initiatives; and the Membership and Nominations Subcommittee ensures a representative and engaged membership. Staffing the Committee is an Executive Sponsor, Jerri Bohard, ODOT Transportation Development Division (TDD) Administrator, a TDD/Freight Mobility Unit Manager; and all Freight Mobility Section staff.

Legislative Authority – In 2001, the Oregon Legislature formalized the Committee through the passage of House Bill. This legislation calls for the ODOT Director to "appoint members of a Freight Advisory Committee to advise the Director and Oregon Transportation Commission (OTC) on issues, policies, and programs that impact multimodal freight mobility in Oregon." This includes identifying high-priority freight mobility projects for consideration in ODOT's Statewide Transportation Improvement Programs (STIP) as well as TIPs at regional and local levels. In 2003, the Oregon Legislature further enhanced OFAC's powers by giving it authority to make recommendations for freight mobility projects to the OTC as well as ODOT, giving priority to multimodal projects. OFAC also was authorized to prioritize $100 million in OTIA III freight mobility projects.

The legislation determined that, in developing each STIP, ODOT should give priority to freight mobility projects that: 1) are located on identified freight routes of statewide or regional significance; 2) remove identified barriers to the safe, reliable and efficient movement of goods; and 3) facilitate public and private investment that creates or sustains jobs.

Activities – OFAC's activities to date have included quarterly (or more frequent) meetings, at which members agreed to provide support for initiatives at many levels statewide to promote freight mobility. Some of the more significant initiatives include:

- Report to the Legislature (2003): providing OFAC progress to date and recommending freight mobility projects statewide;
- OTIA III (2004): recommending $100M in freight mobility projects to the OTC and ongoing input regarding allocation of returned funds;

- *Connect*Oregon (2006): recommending $100M in air, rail, marine and public transit projects to ODOT staff for input to the *Connect*Oregon Consensus Committee;

- Oregon Transportation Plan update (2006): providing key stakeholder input;

- Report to the OTC (2006): updating OFAC progress since 2003 and making recommendations on improving the freight system, creating a greater understanding of freight in Oregon and looking ahead to future challenges;

- Draft 2008-2011 STIP: recommending statewide freight mobility projects;

- ODOT Research (2003 to 2006): providing problem statements for potential research projects, of which four have been selected to date; and

- 2006 Report to the OTC, January 2007.

OFAC also receives educational presentations at its regular meetings. It has received presentations on, and provided organizational and/or individual member support to several statewide freight-related studies, including: the I-5 Trade Corridor improvement project (Oregon-Washington); Statewide and Portland Metro Cost of Congestion studies; ODOT's impending statewide freight planning initiative; shipper challenges in moving goods; the statewide petroleum and liquid natural gas (LNG) pipeline hub in Portland; Portland Metro's Freight and Goods Movement Plan and freight provisions of their Regional Transportation Plan (RTP) update; regional freight data collection initiatives and challenges; the inclusion of freight mobility as a prioritization factor for the 2008 to 2011 and 2010 to 2013 STIPs; and ODOT industrial rail spur projects and rail crossing policy, procedures and issues.

Summary – ODOT represents an example of a very active, long-running Freight Advisory Council. They were given significant legislative authority and ODOT provides high-level support to the committee. It also is highly structured, including a set of by-laws to guide its functioning.

C. TRANSEARCH and FAF² Database Usage

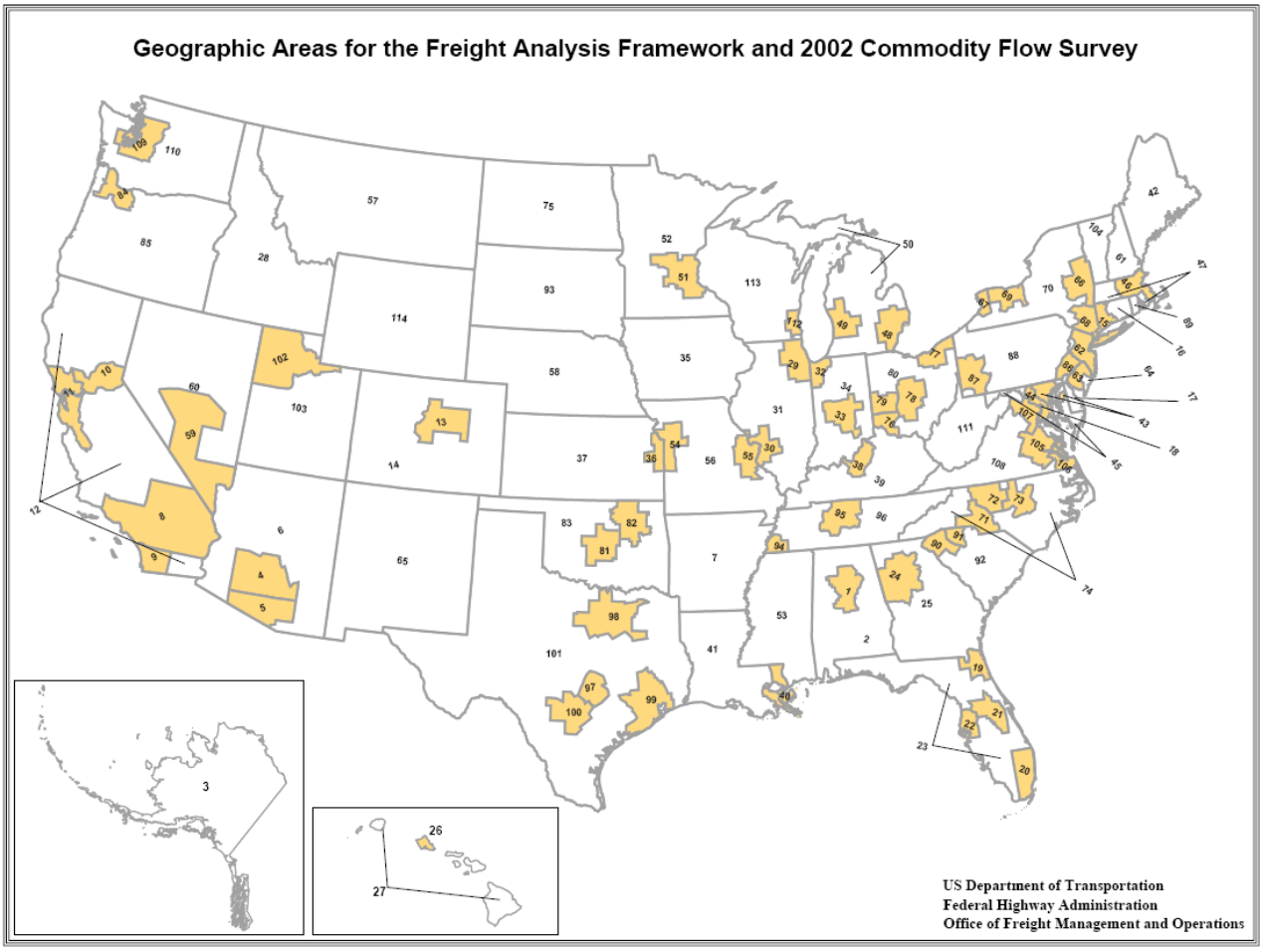
This technical memorandum summarizes TRANSEARCH and Freight Analysis Framework Version 2.2 (FAF²) data in relationship to the Colorado Statewide Freight Roadmap. This memo includes a brief description of the two databases, summary descriptions of uses of TRANSEARCH and FAF² from around the U.S., and then provides recommendations on uses of TRANSEARCH and FAF² data for Colorado.

C.1 Background on FAF² and TRANSEARCH Data

FAF² is the most recently updated version of the Federal Highway Administration Freight Analysis Framework (FAF) database. The FAF² database estimates tonnage and value of goods shipped by type of commodity and mode of transportation among and within 114 areas, as well as to and from 7 international trading regions. The base year (2002) estimate of FAF² is based primarily on the Bureau of Transportation Commodity Flow Statistics and other components of the Economic Census. Forecasts are included for 2010 to 2035 in five-year increments. As shown in Figure C.1, Colorado is divided into two separate geographic areas in the FAF² database. The first region covers the Denver-Aurora-Boulder combined statistical area which includes the counties of Adams, Arapahoe, Boulder, Broomfield, Clear Creek, Denver, Douglas, Elbert, Gilpin, Jefferson, Park, and Weld. The second region covers the rest of Colorado.

TRANSEARCH is a proprietary data product developed by IHS Global Insight. It has the ability to generate county-level estimates of freight flows by commodity and by mode for the U.S. It also has the ability to generate forecasts of freight data as well. The Colorado DOT purchased county-level TRANSEARCH data with a base year of 2004 and a forecast year of 2035.

Figure C.1 Geographic Areas for the FAF2 Database



C.2 Review of TRANSEARCH Usage in Select Studies

Eastern Colorado Mobility Study – TRANSEARCH data was used to describe existing and projected commodity flows and patterns in Eastern Colorado. Commodity flow data also was used in conjunction with system capacity data to identify needs, deficiencies, and recommended policies and strategies for Eastern Colorado.

Georgia DOT Statewide Truck-Lane Needs Identification Study – In this study, TRANSEARCH data was utilized to develop a statewide Origin-Destination Matrix Estimation (ODME) truck model for Georgia DOT. Average truck trip lengths were estimated using TRANSEARCH data. Additionally, TRANSEARCH data was used to estimate commodity distributions for various corridors and thereby estimating payload conversion factors for the model.

Tennessee DOT I-40/I-81 Corridor Feasibility Study – TRANSEARCH data was used in conjunction with O/D surveys to estimate the potential amount of goods that were divertible from truck to rail for the study. The O/D survey data identified the mode split between select regions along the "Crescent Corridor," a rail line running from the Gulf of Mexico to Pennsylvania. TRANSEARCH was used to develop a control total of goods between regions for each commodity type and thereby determine mode split for goods using the I-40/I-81 corridor. The rail component of TRANSEARCH data was used to populate a pre-existing rail model for the State.

Florida Freight Model – TRANSEARCH data were used as the foundation of this statewide truck model. A county-level truck trip table was developed directly from the truck tonnage data in the Florida database. Similarly, a forecast year truck trip table was developed from TRANSEARCH data.

San Joaquin Valley Truck Model – TRANSEARCH data also was used as the foundation for the development of this truck model. County-level TRANSEARCH data were disaggregated to the zip code level employment data and then disaggregated again to zone level to develop zone level freight flows for the seven-county study area. Input-output data were used to match inbound flows to employment in each zone. The resulting zone level truck trip table was used as the truck trip table for the regional truck travel demand model.

Arizona Trade and Logistics Study – TRANSEARCH data were used to assist in describing the State's economy. Economic output data from other sources was used in conjunction with freight flow data from TRANSEARCH to determine Arizona's largest trade partners and to determine the most and least labor-intensive industries.

Oregon Commodity Flow Database Development – TRANSEARCH data was used as the base to develop a commodity flow database for the State. The TRANSEARCH database was supplemented with agricultural data and other nonmanufacturing industries to strengthen commodities where TRANSEARCH data has historically been weak.

California Interregional Intermodal Rail Service – TRANSEARCH data was used to estimate the demand for a proposed new rail service between the Port of Oakland and the Central Valley of California. County-level truck estimates were used as a base of demand between the two locations. This data was compared to truck O/D surveys in the same region and Bureau of Transportation Statistics Commodity Flow Survey data in the same region.

C.3 Review of FAF Usage in Select Studies

FAF² is a relatively new database for conducting freight planning. There are relatively few published examples of uses from this database. However, the original FAF database is roughly six years old and there are several examples of usage of this data as described below.

Montana Highway Reconfiguration Study – For this study, FAF data were used to develop forecasts of base year TRANSEARCH data for the truck mode. Statewide growth rates for truck tonnage in Montana were extracted from FAF by commodity and disaggregated to the county level based on local employment data. A forecast of the base year data was developed based on these county-level forecasts. The base year and forecast truck flow databases were used to develop a truck travel demand model for the State.

Minnesota Department of Transportation Freight Plan – Similar to the Montana study, FAF data also was used to develop county-level forecasts of base year TRANSEARCH data. For this forecast, all modes were incorporated.

Texas DOT Transportation Plan Update – For this study, FAF data was used to describe freight flows in the State. The data also was used to describe the relationship between the State's economy and the transportation system.

Oregon DOT Regional Economic Effects of I-5 Chokepoints – For this study, FAF data was utilized to estimate truck origin-destination patterns for a multistate region that includes I-5 in Oregon. FAF data was used to develop forecasts of base year TRANSEARCH data.

Arizona DOT Statewide Transportation Plan Component – For this study FAF data was used to describe freight flows in, out, around, and through the State. It also was used to describe the relationship between the State's economy and the transportation system.

Texas Truck Parking Study – For this study, FAF data was used to develop growth rates of truck activity to expand the base year truck parking data over a long-term planning horizon. The statewide growth rates were used for each of the commodities in Texas. These were applied to truck parking rates developed in the base year and specified for a broad basket of commodities.

National Capital Planning Commission Rail Realignment – This study evaluated relocation alternatives for a rail line that transports passengers and freight through the nation's capital. One of the primary objectives was to avoid the transport of hazardous material near to the U.S. Capitol. FAF data were utilized to determine the commodity distribution of goods in, out, and through the Washington D.C. metro area.

C.4 Conclusions Based on Examples of TRANSEARCH and FAF Usage

The above examples illustrate that TRANSEARCH and FAF data are most effective under the following circumstances:

1. Providing general description of freight flows for large geographic regions (e.g., counties, states);

2. Relating freight transportation to the economy (e.g., identifying major trading partners, major industries);

3. Performing systemwide freight analysis (e.g., comparing truck share to rail share, modal diversion analysis); and

4. Developing forecasts of base year freight flow databases.

One commonality between all of the examples show that there is a significant amount of resources that must be committed to analyzing either the TRANSEARCH or the FAF database to make it useful for planning or modeling purposes. Additionally, it should be noted that purchases of TRANSEARCH data are expensive relative to other types of databases. Therefore, it is common for agencies to purchase base year TRANSEARCH data and then utilize FAF data to develop forecasts as needed for specific planning and modeling types of activities.

To make TRANSEARCH and FAF data usable on a corridor level, a travel demand model of some type must be developed. This process consumes considerable time and resources, but is the only way to generate specific corridor usable information from the TRANSEARCH and FAF databases. The travel demand models developed for Florida and the San Joaquin Valley in California are examples of how this can be done.

C.5 Recommendations on Practical Uses of TRANSEARCH and FAF^2 for Colorado

Using the conclusions above combined with the consultant experience working with TRANSEARCH and FAF^2 data, there are numerous potential uses for TRANSEARCH and FAF^2 data in Colorado. These include:

- Describing freight flows at the state or county level;

- Extracting commodity information to develop estimates of commodity distributions for specific corridors and point locations;

- Describing the importance of goods movement to the economy of Colorado. Also, describing the importance of specific modes to specific industries and describing the importance of specific trading partners to Colorado's economy;

- Extracting commodity, mode, and trip length data for conducting truck-rail diversion analysis;

- Factoring daily commodity information developed from other sources (e.g., roadside truck surveys) to annual totals;

- Developing corridor-level analytical tools, particularly for long distance corridors such as I-70;

- Developing statewide or MPO-level truck travel demand model. As mentioned earlier, this would require a significant investment in other analysis; and

- Developing a forecast freight flow database for the existing TRANSEARCH base year data

Specific uses will need to be tailored to freight planning needs and available resources at the DOT and MPO levels in Colorado. This information will be generated through the stakeholder involvement process within the Roadmap study. This memo will be updated at that time to provide more detail on near-term uses for TRANSEARCH and FAF^2 data.

D. Truck-Rail Diversion Activities

This memorandum discusses the potential for truck-rail diversion in Colorado. The first portion of the memorandum describes current rail activity in the State. This is followed by a discussion of long-term rail capacity issues in the State and an analysis of potential divertible commodities in Colorado. The memorandum concludes with a brief summary of recent rail planning projects in the State.

D.1 Background on Rail Activity in Colorado

In Colorado, Class I railroads operate on approximately 81 percent of the State's rail lines, while the remaining 19 percent of the rail miles are operated by regional, local, and switching/terminal railroads. Figure D.1 shows the Colorado rail network along with other elements of the state transportation system. Table D.1 shows data on total rail track mileage in Colorado by railroad class (excluding trackage rights) and compares it to the national rail network mileage, for 2006.[1] Colorado has around 2 percent of total rail network mileage in the U.S, a large share of which (more than 77 percent) is operated on by the Class I railroads. According to state railroad statistics[2] reported by the Association of American Railroads (AAR) for 2007, the total freight rail miles operated in the State (including trackage rights) equaled a little more then 3,600 miles. In 2007, the State ranked 27th in the U.S. in total rail track mileage (excluding trackage rights) of 2,645 miles.

There are two Class I railroads that operate in Colorado, the Union Pacific (UP) and Burlington Northern Santa Fe (BNSF). Both railroads currently operate a major intermodal railyard in the Denver metropolitan region. The UP operates an intermodal facility at 40th Avenue and York Street in Denver. The BNSF operates a major transfer site at 53rd Place and Fox Street in Denver.

[1] 2006 was the most recent year for which data was available from the Association of American Railroads (AAR) to allow for comparisons between Colorado and total U.S. rail network mileage.

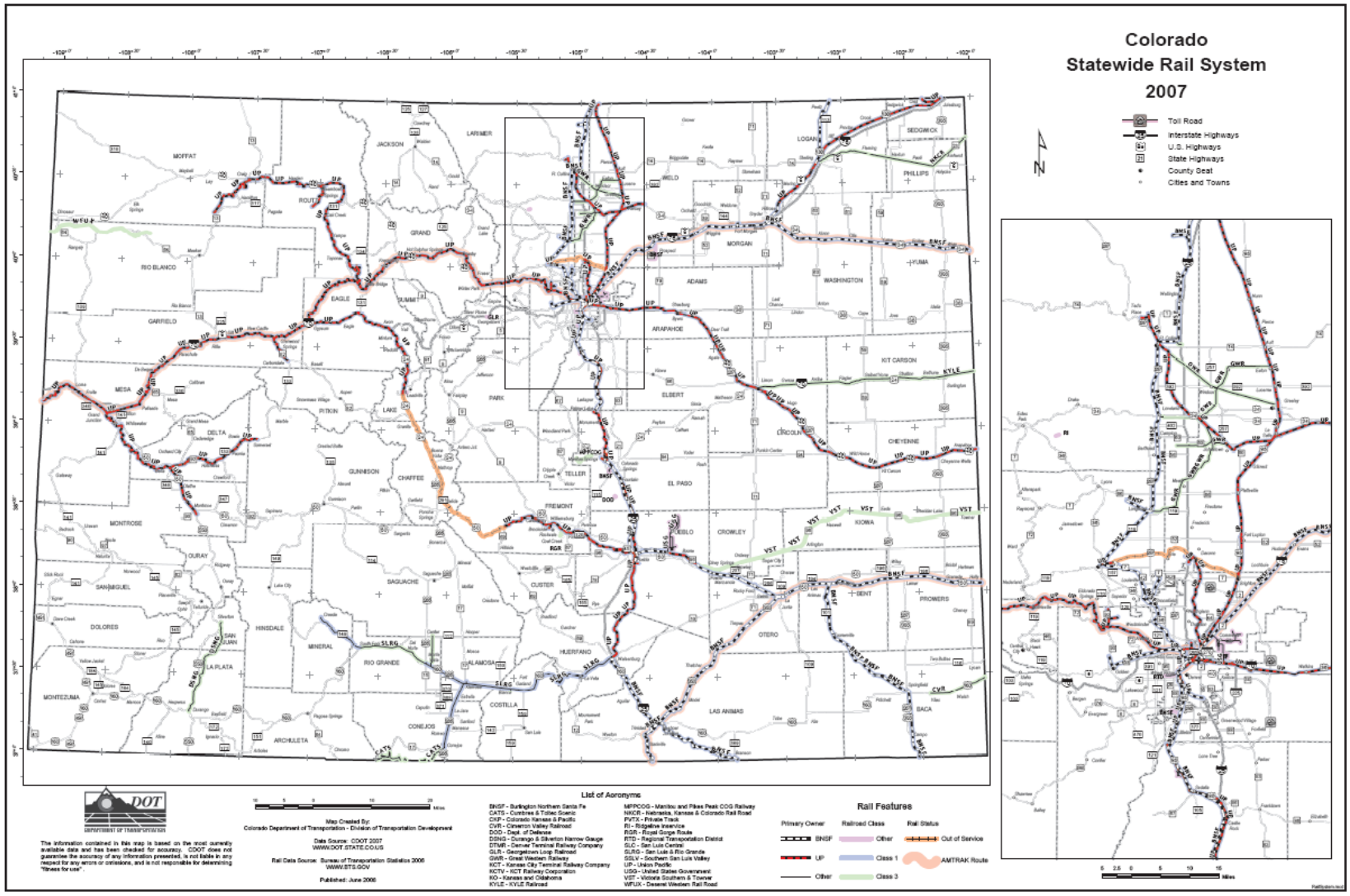
[2] http://aar.org/~/media/AAR/InCongress_RailroadsStates/Colorado.ashx.

Table D.1 Comparison between Colorado and U.S. Freight Railroad Statistics (Operating Railroads and Mileage)

	Number of Operating Freight Railroads		Freight Rail Miles Operated (excluding trackage rights)		
Type of Railroad	**United States**	**Colorado**	**U.S.**	**Colorado**	**Percent of U.S. Total**
Class I	7	2	94,801	2,042	2%
Regional	33	4	16,713	157	1%
Local	323	5	21,960	368	2%
Switching and Terminal	196	3	6,455	78	1%
Canadian	2	0	561	-	0%
Total	**561**	**14**	**140,490**	**2,645**	**2%**

Source: Association of American Railroads, State, and U.S. Railroad Statistics, 2006.
http://www.aar.org/PubCommon/Documents/AboutTheIndustry/RRState_CO.pdf.
http://www.aar.org/PubCommon/Documents/AboutTheIndustry/RRState_USSummary.pdf.

Figure D.1 Colorado Rail Network



Source: 2035 Colorado Long-Range Transportation Plan Freight Technical Report.

D.2 Mode Share for Major Commodities in Colorado

The attractiveness of rail service for shipment of goods compared to other modes (primarily trucking) is a function of many factors, the primary ones being the following:

- Type of commodity: Certain commodities have a higher propensity to use rail service compared to other commodities. These commodities can be typically categorized into bulk goods such as coal, bulk liquids such as crude petroleum and ethanol, and farm products such as grain; other nonperishable goods such as nonmetallic minerals, glass and stone products, and automotive equipment; and goods moving in intermodal containers. Typically, time sensitivity is not a primary issue for these commodities, and shippers choose to take advantage of the economies of scale (shipping large quantities at low costs) of railroads for the shipment of these commodities (compared to other modes such as trucks or air).

- Shipment distance: The competitiveness of railroads for goods movement compared to other modes depends on shipment distance. The rail mode becomes cost competitive compared to trucking for distances greater than 500 to 750 miles. This can be attributed to a couple of factors: 1) since railroads are capital intensive, carrying goods over longer distances maximizes their capital utilization and also minimizes operating costs, which allows them to offer competitive rates to shippers to recover the cost of capital; and 2) rail shipments are associated with fixed costs associated with truck drayage at origin and destination, and for goods shipped over smaller distances, the drayage costs could account for a large share of the total rail shipment costs.

- Rail network connectivity: The advantage of trucking over rail is the connectivity of the highway network compared to rail. Thus, in order for rail to be competitive with trucking, the rail network should provide connectivity to the desired origin-destination of shipments, so that truck drayage costs can be minimized.

Table D.2 compares Colorado's rail mode share to rail mode share in the nation as a whole to determine Colorado's rail system performance for the most frequently shipped commodities in Colorado based on tonnage. The rows that are in bold indicate commodities where Colorado's rail share is significantly less than the national rail share. For example, the 60 percent rail share for coal in Colorado is equal to the national rail share. Colorado has a relatively high rail mode share for petroleum products and food products. However, Colorado has a relatively low rail mode share for chemical products, waste and scrap materials, and pulp/paper and allied products. It appears that the industries that ship these commodities underutilize rail as a mode of shipment. These commodities appear to offer potential opportunities for increased rail diversion in the future if their shipment distances are such that rail service would be competitive relative to trucking.

Table D.2 Comparison of National and Colorado Commodity (Originating) Rail Market Shares, 2002

Commodity	Colorado		National	
	Rail Share	Truck Share	Rail Share	Truck Share
Coal	60%	32%	60%	31%
Petroleum Products	27%	73%	1%	85%
Food Products	10%	90%	8%	91%
Farm Products	7%	92%	10%	84%
Glass and Stone Products	2%	98%	3%	96%
Waste and Scrap Materials	**2%**	**98%**	**9%**	**90%**
Chemical Products	**1%**	**97%**	**24%**	**67%**
Nonmetallic Minerals	**1%**	**99%**	**5%**	**91%**
Lumber and Wood Products	**0%**	**100%**	**13%**	**87%**
Pulp, Paper, and Allied Products	**0%**	**100%**	**17%**	**83%**

Source: FHWA Freight Analysis Framework (2002), bold commodities are likely candidates for diversion.

D.3 Long-Distance Truck Trips in Colorado

Another perspective on divertible truck trips can be generated from analyzing the Colorado DOT 2004 TRANSEARCH database. This database provides information on freight flows for all modes in, out, around, and through Colorado. The database estimates that there were 128,000,000 truck tons that traveled through the State in 2004 with no intermediate stops within the State. Using rough conversions of 20 tons per truck and 300 weekdays per year, this amounts to over 21,000 trucks per day passing through the State. Many of these truck trips are over 500 miles making them candidates for diversion to rail. Based on the TRANSEARCH database, of these roughly 21,000 trucks per day, approximately 27 percent (or 5,700 trucks per day) fall into the category of commodities that seem to underutilize rail in Colorado as shown in Table D.2. This represents a significant volume of freight with a potential to divert from the highway mode to the rail mode. It also should be noted that several of the inbound and outbound truck trips meet both the distance and commodity requirements for being potentially divertible to rail.

In 2008, the Colorado DOT conducted the Freight Origin Destination Pilot Study to develop a plan for surveying goods movement in the State. As part of this pilot study,

three roadside truck origin destination surveys were conducted in the State. These surveys were taken on I-70 westbound in Georgetown, I-25 southbound just south of Fort Collins, and State Highway 287 eastbound in Hugo. Each of these surveys showed that there is a significant percentage of the truck traffic that is long distance goods movement. At the I-70 westbound location, 13 of the 91 trucks (14 percent) surveyed originated in the Denver metropolitan region and were destined for locations further west than Utah. All of these truck trips are greater than 500 miles, which is the distance threshold to be considered divertible between truck and rail.

At the I-25 southbound location, 19 of the 94 (20 percent) trucks surveyed were trips through the State of Colorado with no intermediate stops within the State. These truck trips are at least 250 miles, but most are much longer, since the next major metropolitan area outside of Colorado on I-25 is Santa Fe, New Mexico. Truck trips to Santa Fe, New Mexico would be a minimum of 500 miles for through-Colorado trips. At the State Highway 287 eastbound location, 20 of the 77 truck trips (26 percent) surveyed were through Colorado trips with originating states further east or south than Kansas and Oklahoma. All of these 20 trips are over 500 miles in length as well. Another 31 of the 77 (40 percent) truck trips were destined for the Denver metropolitan area and had originating states further east or south of Kansas and Oklahoma. The vast majority of these trips also are longer than 500 miles. The results at these three locations indicate that there is a significant portion of the truck trips on Colorado's highways that are long enough to consider potentially divertible to rail depending on the commodity. The pilot roadside truck survey study is not large enough to make inferences about both truck trip length and divertible commodities. However, it is reasonable to assume based on the TRANSEARCH analysis described above that many of these trucks would be divertible on a commodity basis as well.

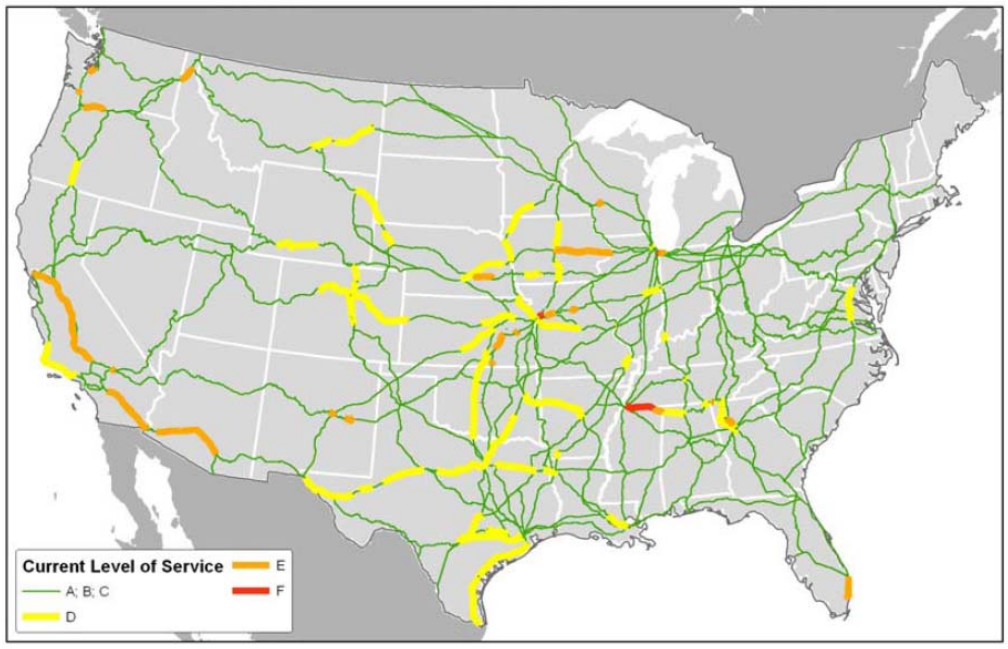
D.4 Colorado Freight Rail Capacity

According to the 2035 Statewide Transportation Plan for Colorado, completed in March 2008, significant rail capacity constraints along the Front Range are impacting freight rail operations in the State. Most notable among these constraints is the single track between Monument and Colorado Springs which leads to significant idling of trains with sometimes as many as three trains waiting to use the single track section.

The American Association of Railroads (AAR) recently completed the National Freight Infrastructure Capacity and Investment Study which estimated current and future freight rail levels of service based on national freight flow data and existing data from the freight railroads. This study shows congestion on both the east-west and north-south rail lines through Denver extending north to the Colorado-Wyoming border and east just beyond the Colorado-Kansas border (Figure D.2). This congestion is higher than that noted in the Colorado Long-Range Transportation Plan. The freight rail congestion is projected to grow to a severe level by 2035 with no improvements to the freight rail infrastructure (Figure D.3). However, through implementing the set of projects that are described in the

AAR study the congestion can be relieved in the long term (Figure D.4). This reinforces the critical need to improve the rail infrastructure to ensure that the maximum level of truck-rail diversion can occur.

Figure D.2 Current Level of Service on the National Rail Network



Source: Cambridge Systematics, Inc.

Figure D.3 Future Level of Service on the National Rail Network
2035, Without Improvements

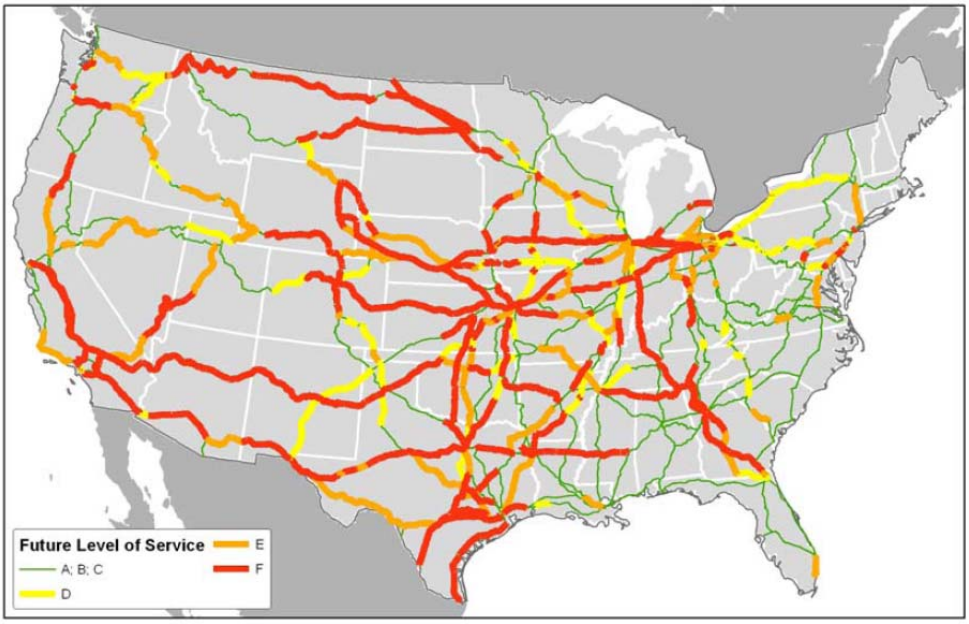
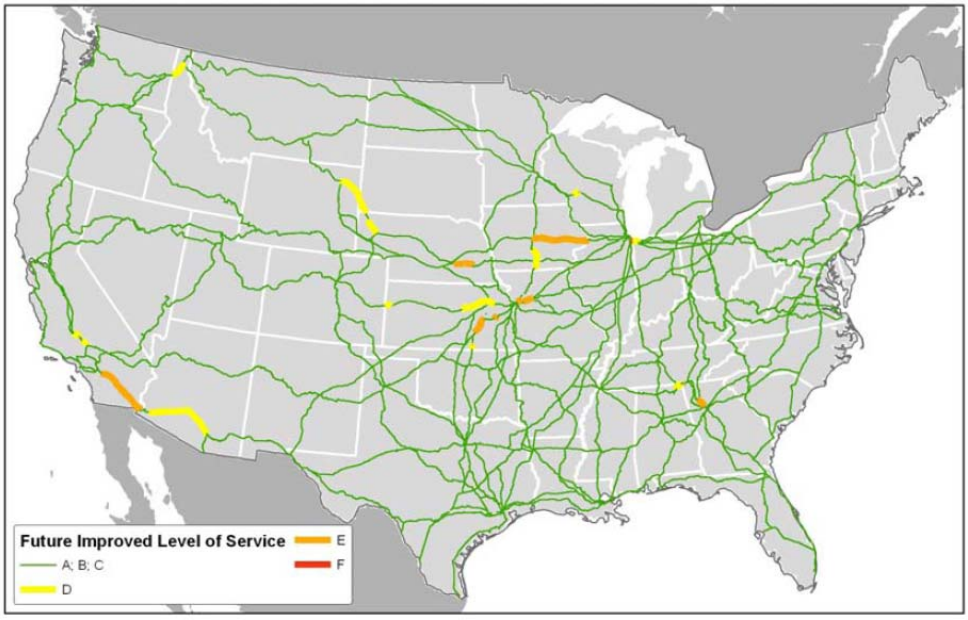


Figure D.4 Future Level of Service on the National Rail Network
2035, With Improvements



D.5 Recent Rail Improvement Projects in Colorado

For many years there has been an interest in enhancing the ability of freight trains to travel through Colorado, while at the same time reducing the impacts of these freight trains on the communities along the Front Range.

In 1979, with increasing unit coal train traffic carrying Powder River Basin coal from northeast Wyoming to electric utilities in Texas and impacting communities from Denver to Pueblo, the Colorado Department of Highways undertook an effort entitled *Colorado State Rail Plan – Rail Bypass Feasibility Study.* This study evaluated the feasibility of rerouting Front Range through freight rail traffic to several alternative bypass alignments in eastern Colorado. Due to many complicating factors and financial constraints, no immediate action to pursue such a bypass resulted from this study.

Then, in 2002, the two Class I railroads operating in Colorado (the UP and the BNSF) proposed a long-term plan to ease traffic congestion and improve passenger and freight mobility along the Front Range. This plan, known as the Front Range Railroad Infrastructure Rationalization Project, would include consolidation of certain freight lines and operations, relocation of freight terminals and yards, and construction of a freight bypass route in eastern Colorado. The goal would be to remove through freight trains from the congested Front Range, while still maintaining local freight service and competitive options to Colorado rail customers.

In 2003, the Colorado Department of Transportation, in cooperation with the UP and the BNSF, initiated the *Public Benefits and Costs Study* to determine whether there would be sufficient benefits to the citizens of Colorado to warrant a public investment in the project to remove through freight trains from the congested Front Range. This study concluded that the benefits, when compared to the cost, would justify further consideration of this concept.

Hence, in 2007 CDOT initiated the next phase of evaluation for this concept, referred to as the *Colorado Rail Relocation Implementation Study.* The purposes of this effort were to identify the necessary steps to form a public-private partnership for the project, to finalize the scope and cost estimate of the project, to define cost-sharing mechanisms and potential funding sources, and to develop strategies to meet necessary environmental regulatory requirements. The study also updated the costs and benefits associated with several alternative alignments for the eastern bypass. However, it did not evaluate the potential benefits and costs associated with being able to use the existing Joint Line between Denver and Pueblo for intercity rail passenger service as a result of relocating much of the freight traffic. This is being studied in a separate Rocky Mountain Rail Authority study to be concluded in the fall of 2009.

As a result of the *Colorado Rail Relocation Implementation Study*, CDOT will pursue the following next steps:

- Create a Citizens Advisory Group to continue the involvement of citizens with CDOT as the planning process continues.

- Support an independent, detailed evaluation of the benefits and impacts of a new rail line to the agriculture industry and the communities of eastern Colorado.

- Pursue funding that would allow the findings of the *Colorado Rail Relocation Implementation Study* and the Rocky Mountain Rail Authority study to be combined in order to determine the consolidated benefits and costs to the State of both freight and passenger operations.

- Continue conversations with both of the railroads and with the public to explore possible options that may lead to an acceptable strategy for implementation of a rail bypass.

D.6 Conclusions Regarding Truck-Rail Diversion Potential in Colorado

The discussions in the previous sections generate the following key findings regarding the potential for increased truck-rail diversion in the State:

- There are five commodities with a high tonnage shipped in the State, and a relatively low rail mode share compared to the rest of the country. This indicates that there is the potential to move the needle in terms of increasing rail mode share to divert freight from the highway system to the rail system. The five commodities are: waste and scrap materials, chemical products, nonmetallic minerals, lumber and related products, and paper and related products.

- There are a significant number of long-distance truck trips in the State which meet the distance threshold for diverting freight from highway to rail. Many of these trucks appear to also be carrying divertible commodities

- To ensure sufficient capacity for truck-rail diversion, significant investment is required in the Colorado rail system. It also should be noted that the long distance nature of rail trips indicates that Colorado will have to work with neighboring states and the railroads to improve entire rail corridors rather than simply moving congestion from Colorado to nearby locations.

- There are significant freight rail planning projects underway in Colorado that have the potential to improve the efficiency of rail as a mode for carrying goods. These are good first steps towards increasing truck-rail diversion. However, the Colorado DOT should consider conducting a comprehensive review of rail activity in and through the State to identify the most deficient locations impacting rail movement (including locations outside the State), potential projects to remove these bottlenecks, and partnerships with the railroads and nearby states to improve rail movement for the region.

E. Freight Needs Assessment

E.1 Introduction

This technical memorandum summarizes the freight flow trends and freight needs for Colorado based on several sources. Vehicle classification volumes, volume to capacity ratios, and the physical condition of freight infrastructure, all derived from the 2007 Colorado Roadway Information System (CORIS) are used to identify locations where high truck volumes intersect with high congestion or poor pavement conditions. The Colorado DOT's TRANSEARCH database and the FHWA FAF2 data are utilized to understand the types, modes, and weight of freight that is moving in the State and to estimate its growth rate. Additionally, previous studies also are referenced to document previously identified freight needs in the State.

This document discusses the freight needs of Colorado at four different levels: statewide, Transportation Planning Region, county, and corridor. The Colorado DOT has obtained TRANSEARCH data which has a 2004 base year estimate of freight flows for the State and a forecast of freight flows for the State in 2035. The Colorado DOT also maintains highway traffic data. The most recent available highway traffic data for the State is 2007. The highway traffic data also includes a projection of traffic data to 2027. Unless otherwise noted, these are the base year and forecast years for freight flow and traffic data described in this memorandum.

The remainder of this memorandum is divided into five sections:

- **Statewide Freight Trends** is a discussion of broad freight trends at the statewide level, including total tonnage, mode splits, and top commodities;
- **Statewide Freight Needs** analyzes statewide goods movement needs based on truck volumes, congestion, and road condition;
- **TPR Level Needs** discusses specific freight issues for Colorado's 15 Transportation Planning Regions (TPR);
- **Intermodal Connector Needs** discusses freight issues on the state's designated intermodal connector system;
- **Freight Needs From Previous Studies** describes freight needs that were highlighted in other CDOT planning and environmental documents; and
- **Conclusions and Recommendations** summarizes the key conclusions of the analysis and presents recommendations for CDOT to plan more effectively for freight.

E.2 Statewide Freight Trends

It is important to understand overall goods movement patterns and trends in Colorado to gain perspective on freight system needs. Accordingly, the following sections discuss freight trends at the statewide level, focusing on different movement types (inbound, outbound, through, and within), mode shares, and commodity mixes.

Overall Commodity Flows in Colorado

In 2004, total freight flows to, from, within, and through Colorado were about 354 million tons. By 2035, they are expected to reach 693 million tons – an increase of 96 percent over 2004. Figure E.1 shows overall flows by shipment type for 2004 and 2035. As the chart demonstrates, goods movement in Colorado is dominated by intrastate flows and through shipments, when measured by weight. Each of these movement types made up 36 percent of total freight tonnage in 2004. Through freight is expected to grow rapidly in the future, becoming the largest movement type by weight by 2035. Colorado's relatively low population density, combined with the presence of major east-west and north-south trade corridors running through the State, means that through shipments are a considerable part of the overall freight traffic mix in the State. A large fraction of intrastate flows, meanwhile, are short distance sand and gravel trucks moving from quarry sites to construction sites based on demand for construction material.

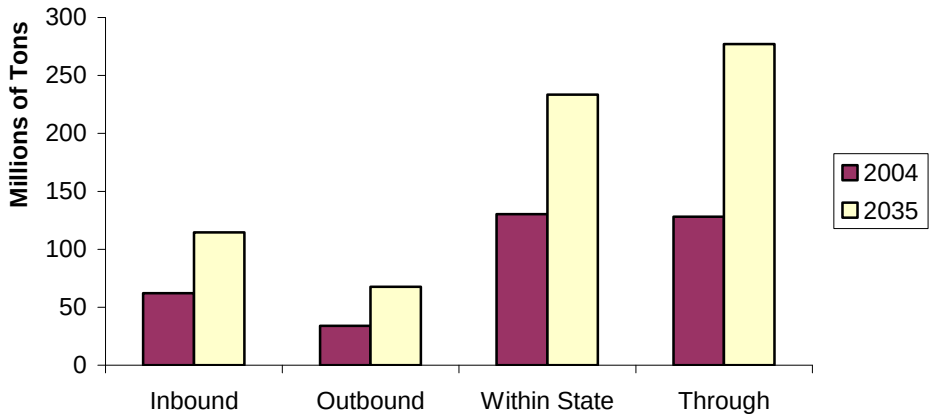
It also should be noted that Colorado's inbound flows are roughly double the volume of its outbound flows. This indicates that Colorado is more of a consuming state than a producing state despite its large energy and agriculture industries. Inbound shipments of goods supply Colorado's growing consumer markets, especially in and around the State's urbanized areas. However, outbound shipments – often composed of the output from key Colorado resource-based industries like mining and agriculture – are equally important to the State's economic vitality.

Mode Split Analysis

It is important to determine how freight is moving along Colorado's freight system in order to get a sense of modal dependencies and traffic patterns. Understanding mode splits can help provide insight into current and future stresses and capacity issues on individual elements of Colorado's freight network.

One limitation of the Colorado TRANSEARCH data set is that it does not include data for the rail mode. This is because TRANSEARCH rail data is developed using the Surface Transportation Board (STB) Carload Waybill Sample. Users must obtain special permission from the STB prior to release of Waybill data, which contains sensitive business information from freight railroads. It was therefore necessary to use another data source to analyze mode splits in Colorado.

Figure E.1 Total Freight Flows in Colorado by Movement Type
2004 and 2035



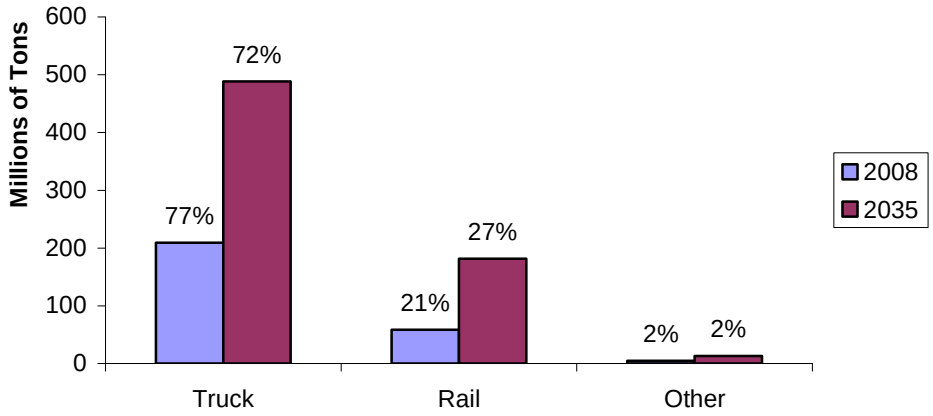
We used the FAF2 database developed by FHWA to estimate statewide mode shares for goods movement in Colorado. FAF2 estimates commodity flows and related freight transportation activity among states, substate regions, and major international gateways. Commodity flows within the FAF2 database are provided for 114 individual regions in the United States, as well as 17 international gateways (i.e., ports and border crossings) and seven international regions. FAF2 contains data for seven modes: air and truck intermodal, trucks, rail, truck and rail intermodal, water, and pipeline and unknown.[3] Provisional data for 2008 is available, with forecasts in five-year intervals through 2035.

Figure E.2 presents the overall mode split by weight for all inbound, outbound, and intrastate freight in Colorado in 2008 and 2035. Like most states, Colorado depends upon trucks to move a large share of its freight; in 2008, trucks carried 77 percent of all freight in Colorado (excluding through movements). Rail accounted for the next largest share at 21 percent of the total; all other modes combined were only about two percent of overall freight volume in 2008. However, by 2035 trucks are expected to lose market share to trains, constituting 72 percent of overall freight movements versus 27 percent for rail. This will likely be driven by rapid growth in truck/rail intermodal shipments, including port-driven rail traffic from the West Coast.

[3] Pipeline and unknown movements are excluded from the analysis because of the considerable uncertainty associated with estimating and validating pipeline flows.

Figure E.2 Mode Shares by Weight for All Movements To, From, and Within Colorado

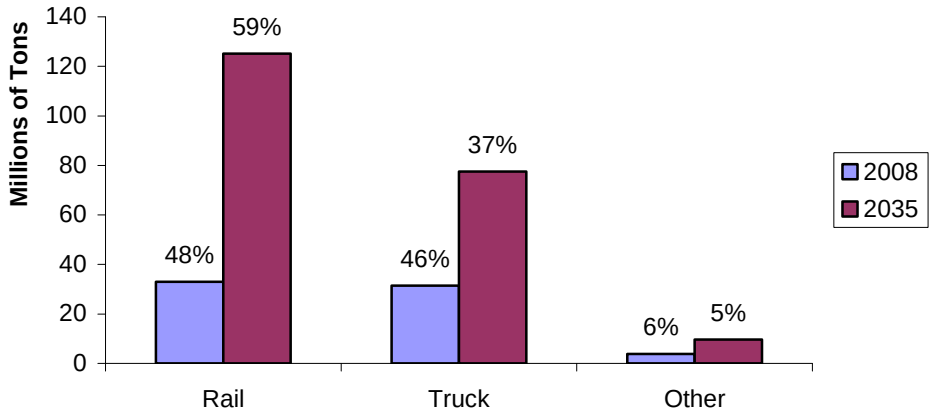
2008 and 2035



The mode split is much more diverse when different movement types are considered. Figure E.3 shows the mode shares for freight moving out of Colorado to other states and nations. Rail carries the largest share of these movements (48 percent), followed by trucks at 46 percent. Moreover, in future the rail mode is expected to gain market share from trucks for freight moving outside of the State, capturing nearly 60 percent of outbound freight by 2035. This growth will likely be driven by increasing production of resource-based commodities such as minerals, which tend to ship by rail.

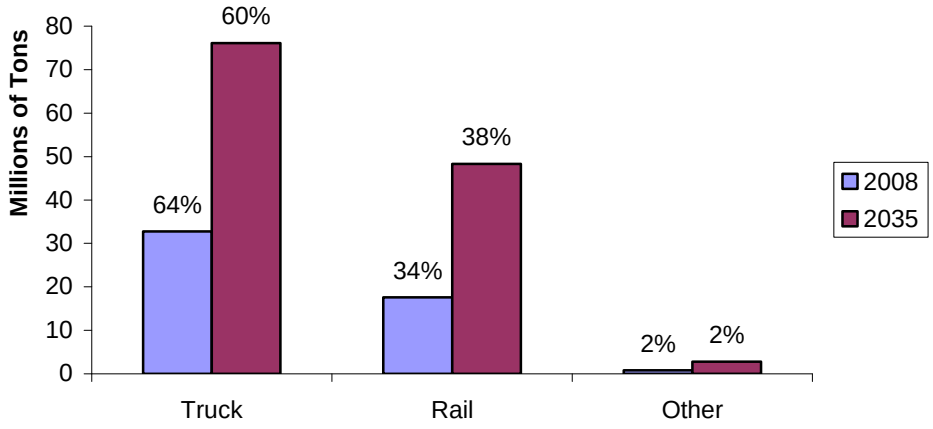
Figure E.3 Mode Shares by Weight for All Movements from Colorado

2008 and 2035



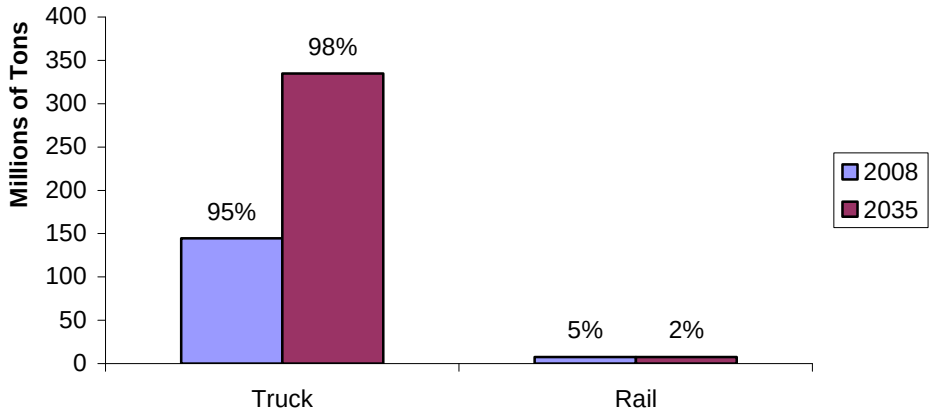
In contrast to outbound freight shipments, trucks carry most of the freight moving into Colorado. This is largely because inbound freight in Colorado is much more likely to consist of consumer goods and other value-added manufacturing products that are most often shipped by truck. In 2008, trucks accounted for 64 percent of total inbound movements, by weight (Figure E.4). Rail carried most of the remainder (34 percent), while all other modes combined were about two percent of the total. Although rail tonnage is expected to grow faster than truck tonnage in the future, trucks will still dominate inbound freight volumes by 2035 at 60 percent of the total, compared to 38 percent for rail. The growth in the rail mode will likely be fueled by increasing truck/rail intermodal shipments, which are the fastest growing market for Class I railroads.

Figure E.4 Mode Shares by Weight for All Movements to Colorado
2008 and 2035



As shown in Figure E.5, trucks account for the vast majority of freight shipments that both originate and terminate in Colorado. This is because shorter freight movements are usually best served by truck (rail tends to become more competitive for distances greater than about 500 miles). As shown in the analysis of top commodities, the majority of these intrastate movements consist of mineral products and other heavy, resource-based goods. Since intrastate movements of these products are overwhelmingly made by truck, they can exacerbate existing concerns about pavement consumption and bridge stress. By 2035, trucks will account for 98 percent of intrastate freight in Colorado. This indicates that the resource-based commodities that many of Colorado's key industries produce will continue to move by truck in the future.

Figure E.5 Mode Shares by Weight for All Movements within Colorado *2008 and 2035*[4]



Top Commodities

It also is important to understand the types of commodities being moved on a State's transportation system, as this indicates which specific industries are being supplied. It also can give insight into the effect of freight on the transportation network, since different commodities tend to affect the system in different ways.

Figure E.6 shows the top commodities moving to, from, through, and within Colorado in 2004, based on TRANSEARCH data. The number one commodity is nonmetallic minerals, which makes up 27 percent of overall freight tonnage in the State, or nearly 93 million tons in 2004. This reflects the importance of mining to the Colorado economy. Food products are a distant second at about 41 million tons (11 percent of the total). Clay, concrete, glass, or stone products (which consist largely of construction materials) are another 11 percent (40 million tons). Petroleum and coal products are about 31 million tons, or nine percent of the total; chemicals and secondary traffic are seven percent of each (about 24 million tons each). Secondary traffic represents drayage movements transporting cargo between origin and destination points and a transshipment facility such as a retail distribution center.

[4] Modes other than truck and rail are an insignificant part of overall intrastate freight tonnage in Colorado.

Figure E.6 Top 10 Commodities in Colorado
2004

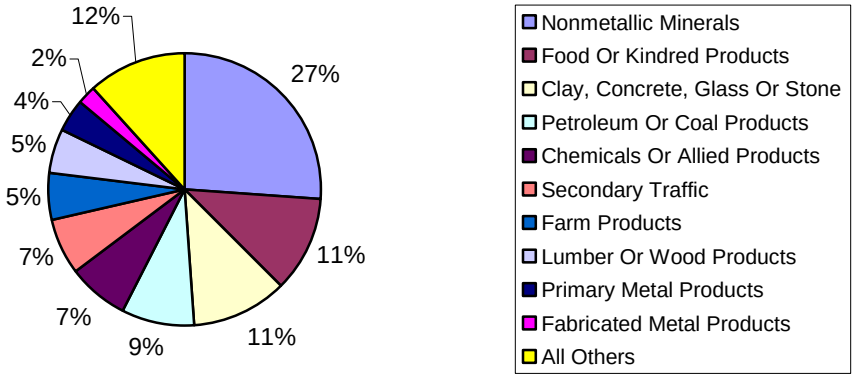


Table E.1 shows the expected top 10 commodities in Colorado by 2035, along with their percentage of the total and compound annual growth rate (CAGR). The overall composition of top commodities will not change much. However, secondary traffic will become the second largest commodity group moving in Colorado at about 96 million tons, quadruple the 2004 level. Since all secondary traffic represents drayage movements by truck, this will translate directly into more trucks on Colorado's highways, especially in the State's urban areas. Shipments of machinery are expected to exhibit the fastest annual growth rate (8.3 percent), propelling them from less than one million tons in 2004 to nearly 12 million tons in 2035. Nonmetallic minerals will remain the top commodity by weight, but are expected to grow more slowly and thus represent a smaller share of overall freight movement.

Figure E.7 shows the top 10 commodities moving into Colorado in 2004, by weight. With the exception of petroleum or coal products (which are the number one inbound commodity at 12 million tons), many of the products moving into the State consist of more refined goods such as food products, chemicals, secondary traffic, and metal products. This indicates that Colorado is relatively dependent on shipments of consumer goods from elsewhere to supply the State's retail and wholesale industries.

Table E.1 Top 10 Commodities in Colorado
2035 Forecast

Commodity	Millions of Tons	Percent of Total	CAGR
Nonmetallic Minerals	129.4	19%	1.1%
Secondary Traffic	96.0	14%	4.5%
Clay, Concrete, Glass Or Stone	88.4	13%	2.6%
Petroleum Or Coal Products	57.9	8%	2.2%
Food Or Kindred Products	77.7	11%	1.8%
Farm Products	22.8	3%	0.1%
Machinery	57.6	8%	8.3%
Chemicals Or Allied Products	29.7	4%	0.2%
Lumber Or Wood Products	19.2	3%	-0.1%
Coal	7.0	1%	2.2%
All Others	107.4	15%	1.8%
Total	**693.1**	**100%**	**2.2%**

Figure E.7 Top 10 Inbound Commodities in Colorado by Weight
2004

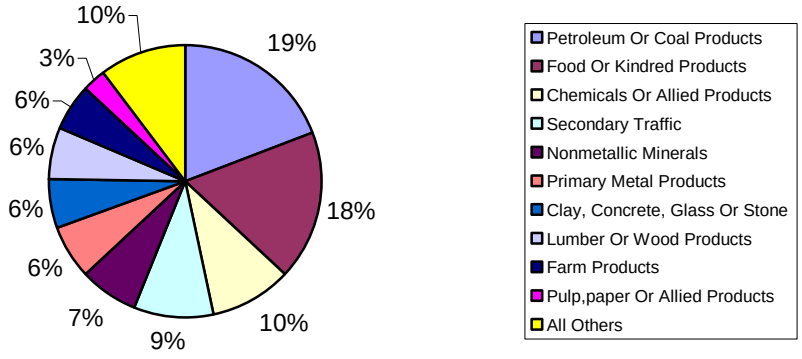


Table E.2 shows the forecast top 10 inbound commodities in Colorado for 2035, along with growth rates for each. Secondary traffic (drayage movements mostly consisting of consumer goods) are expected to grow at 4.5 percent annually through the forecast

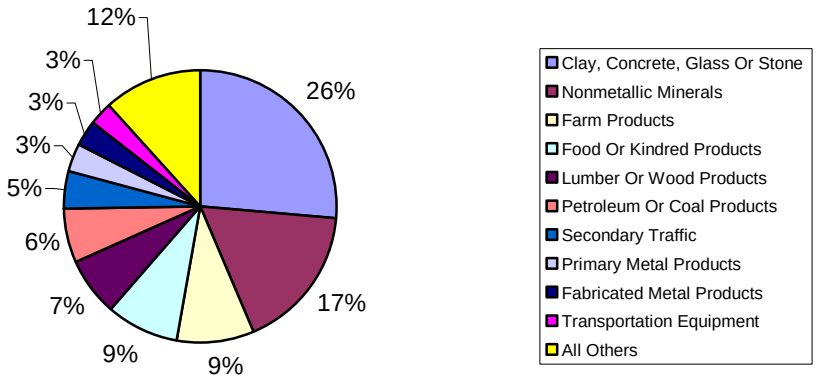
horizon, making them the predominant commodity by weight in 2035. Other consumer-oriented and resource-based commodities will remain in the top 10, including food products, chemicals, and building materials. Machinery will become an important inbound commodity as well. Inbound shipments of farm products are expected to grow at slightly more than one percent annually (to almost five million tons in 2035), indicating that Colorado will have to rely increasingly on livestock and produce shipped from other states and nations as its population continues to rise. Although inbound movements of lumber and wood products are expected to decline slightly, this will be partially offset by growth in outbound shipments of these commodities.

Table E.2 Top 10 Inbound Commodities in Colorado
2035 Forecast

Commodity	Millions of Tons	Percent of Total	CAGR
Secondary Traffic	23.3	20%	4.5%
Food Or Kindred Products	18.2	16%	1.6%
Petroleum Or Coal Products	15.9	14%	0.9%
Clay, Concrete, Glass Or Stone	10.2	9%	3.3%
Machinery	8.5	7%	8.5%
Chemicals Or Allied Products	6.6	6%	0.3%
Primary Metal Products	5.3	5%	0.9%
Farm Products	4.9	4%	1.1%
Nonmetallic Minerals	4.6	4%	0.3%
Lumber Or Wood Products	3.5	3%	-0.2%
All Others	13.6	12%	2.0%
Total	**114.7**	**100%**	**2.0%**

Figure E.8 presents the top 10 commodities shipped outside of Colorado in 2004, by weight. Overall, outbound commodities tend to be more concentrated in the types of resource-based goods that Colorado specializes in producing. These include minerals, farm products, lumber, and petroleum or coal products. However, the top outbound commodity is clay, concrete, glass, or stone products, which represents a broad class of manufactured products, many of which are used in the construction industry. These products comprised almost nine million tons in 2004, over a quarter of the total. Many of these products are derived from mineral products, which are the State's overall top commodity by weight.

Figure E.8 Top 10 Outbound Commodities in Colorado by Weight
2004



As shown in Table E.3, clay, concrete, glass, and stone products will remain the top outbound commodity through 2035, indicating that these will remain critical export commodities for the State. Exports of petroleum or coal products will experience rapid growth, making them the second most important outbound commodity group by 2035 at eight million tons (12 percent of the total). This commodity group includes refined petroleum products, liquefied coal or petroleum gases, asphalt, and other petroleum derivatives. The high growth in outbound shipments indicates the importance of the energy sector to Colorado's economy. The slight decline in outbound tonnage of farm products will be more than offset by growth in inbound agricultural shipments.

Table E.3 Top 10 Outbound Commodities in Colorado
2035 Forecast

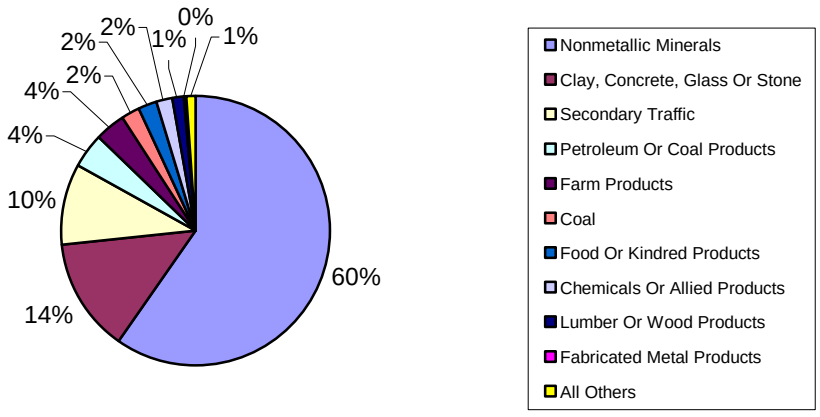
Commodity	Millions of Tons	Percent of Total	CAGR
Clay, Concrete, Glass Or Stone	20.0	30%	2.6%
Petroleum Or Coal Products	8.0	12%	4.3%
Nonmetallic Minerals	8.0	12%	1.0%
Secondary Traffic	6.1	9%	4.4%
Food Or Kindred Products	5.6	8%	2.1%
Farm Products	2.9	4%	-0.2%
Fabricated Metal Products	2.6	4%	3.0%
Machinery	2.6	4%	7.6%

Table E.3 Top 10 Outbound Commodities in Colorado (continued)
2035 Forecast

Commodity	Millions of Tons	Percent of Total	CAGR
Transportation Equipment	2.4	4%	2.9%
Lumber Or Wood Products	2.4	4%	0.1%
All Others	7.2	11%	1.4%
Total	**67.7**	**100%**	**2.3%**

Figure E.9 shows the top intrastate commodities in Colorado for 2004, by weight. The commodity mix reflects the State's economy – heavily tilted towards resource-based products. Nonmetallic minerals dominate this movement type, making up 60 percent of the total (about 78 million tons). Clay, concrete, glass, or stone products are another 14 percent, or about 18 million tons. Secondary traffic (drayage movements) represents 10 percent of the total or 13 million tons. All other commodities comprise four percent or less of total intrastate freight tonnage.

Figure E.9 Top 10 Intrastate Commodities in Colorado by Weight
2004



Nonmetallic minerals will remain the top intrastate commodity in 2035 (see Table E.4), but they will make up a smaller share of total freight moving within the State at 48 percent. Nonetheless, total volumes will grow to almost 112 million tons, an increase of about 44 percent over 2004. Secondary traffic will overtake clay, concrete, glass and stone products as the second highest volume commodity, growing at 4.4 percent annually to 49 million tons. Petroleum and coal products and coal will round out the top five intrastate

commodities by weight. Farm products shipped within the State are expected to decline slightly, similar to outbound shipments of agricultural commodities. However, as indicated above inbound shipments of these types of goods are expected to grow. Taken together, this implies that Colorado will increasingly rely on agricultural goods produced outside the State to supply growing consuming markets.

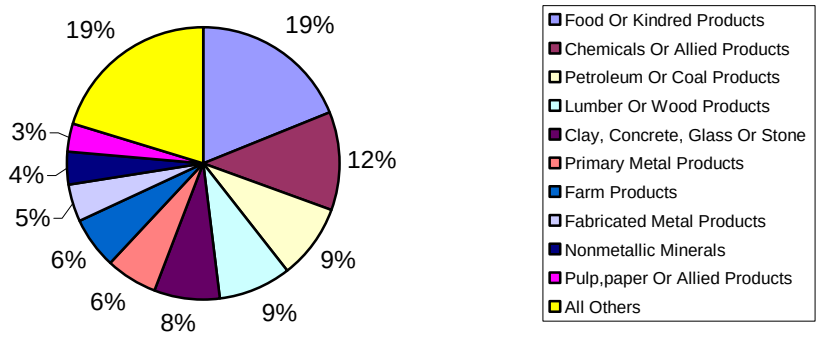
Table E.4 Top 10 Intrastate Commodities in Colorado
2035 Forecast

Commodity	Millions of Tons	Percent of Total	CAGR
Nonmetallic Minerals	111.6	48%	1.2%
Secondary Traffic	49.1	21%	4.4%
Clay, Concrete, Glass, or Stone	36.4	16%	2.4%
Petroleum Or Coal Products	14.0	6%	3.3%
Coal	5.9	3%	2.3%
Food Or Kindred Products	4.9	2%	1.9%
Farm Products	4.0	2%	-0.6%
Chemicals or Allied Products	2.8	1%	0.3%
Lumber or Wood Products	1.7	1%	-0.3%
Fabricated Metal Products	0.7	0%	1.4%
All Others	2.4	1%	2.0%
Total	**233.5**	**100%**	**1.9%**

Through commodities in Colorado are slightly more diverse and are more likely to consist of manufactured products and other value-added goods, as shown in Figure E.10. This reflects Colorado's position as a "bridge state" linking major freight generators (such as West Coast seaports) to markets elsewhere in the country. Food products accounted for nearly one fifth of overall through freight in 2004, or 24 million tons. Chemicals and allied products (which include a range of commodities such as basic chemicals and, drugs, and household products) made up another 12 percent (15 million tons). Resource-based commodities also often ship through Colorado – petroleum or coal products and lumber or wood products each constituted nine percent of through freight volumes in 2004 (12 million tons and 11 million tons, respectively). Clay, concrete, glass or stone products were another eight percent, or nearly 10 million tons. No other commodities made up more than six percent of the total in 2004.

Figure E.10 Top 10 Through Commodities by Weight

2004



By 2035, the mix of through commodities is expected to become more tilted towards higher-value manufactured products (Table E.5). Food products will remain the top through commodity by tonnage, but machinery shipments are forecast to become the second highest volume commodity moving through the State. Shipments of electrical equipment also will grow quite rapidly, becoming the fourth most important through commodity when measured by weight. Many of the other top through commodities will remain the same as in 2004, but their order will change.

Table E.5 Top 10 Through Commodities in Colorado

2035 Projected

Commodity	Millions of Tons	Percent of Total	CAGR
Food Or Kindred Products	49.1	18%	2.3%
Machinery	46.2	17%	8.5%
Clay, Concrete, Glass Or Stone	21.7	8%	2.6%
Electrical Equipment	21.3	8%	5.7%
Petroleum Or Coal Products	20.0	7%	1.8%
Chemicals Or Allied Products	19.3	7%	0.8%
Secondary Traffic	17.5	6%	4.7%
Lumber Or Wood Products	11.7	4%	0.2%
Farm Products	11.0	4%	1.2%
Fabricated Metal Products	10.4	4%	1.9%
All Others	49.1	18%	1.4%
Total	**277.2**	**100%**	**2.5%**

E.3 Statewide Freight Needs

Congestion and High Truck Volume Corridors

To identify locations where highway congestion impact truck operations, truck volume information was overlaid with locations with high volume-to-capacity (V/C) ratios. Figure E.11 shows locations in Colorado with a truck AADT greater than 2,000 and V/C ratio greater than or equal to 0.85 for both 2007 and 2027. Current and projected V/C ratios were taken from the CORIS database. The map shows that in 2007, the vast majority of high truck volume/high congestion locations are in the Denver metropolitan region. In 2027, the high truck volume/high congestion locations include more road segments further away from Denver, but the vast majority are still in the Denver metropolitan region. In 2027, these additional segments include:

- SH 50 near Pueblo;
- SH 160 in Durango and Cortez;
- SH 24 in the Pikes Peak area;
- SH 83 southeast of Denver;
- SH 85 through Denver and extending to the North Front Range region;
- SH 287 north of Denver, and through Longmont and Loveland; and
- SH 14 in Fort Collins.

Figure E.12 shows the high truck volume/high congestion locations in the Denver metropolitan region. Most of the interstate network in the Denver region falls into this category. There also are several noninterstate locations that have both high truck volumes and high congestion, including U.S. 36, SH 470, and U.S. 285. Based on the TRANSEARCH data analysis, much of the increasing congestion and heavy truck traffic in these locations will be driven by growing drayage movements (secondary traffic) and shipments of construction materials such as sand and gravel, which are often heavy. Figures E.11 and E.12 illustrate the need for congestion relief to improve the movement of goods in Colorado.

This analysis demonstrates that one of the freight needs for Colorado is congestion relief on the highway system. There are several segments in Colorado that have high truck volumes and high V/C ratios which indicates that there is a significant amount of truck delay in the State.

Figure E.11 High Truck AADT and V/C Ratio (0.85 and above) Route Segments
2007 and 2027

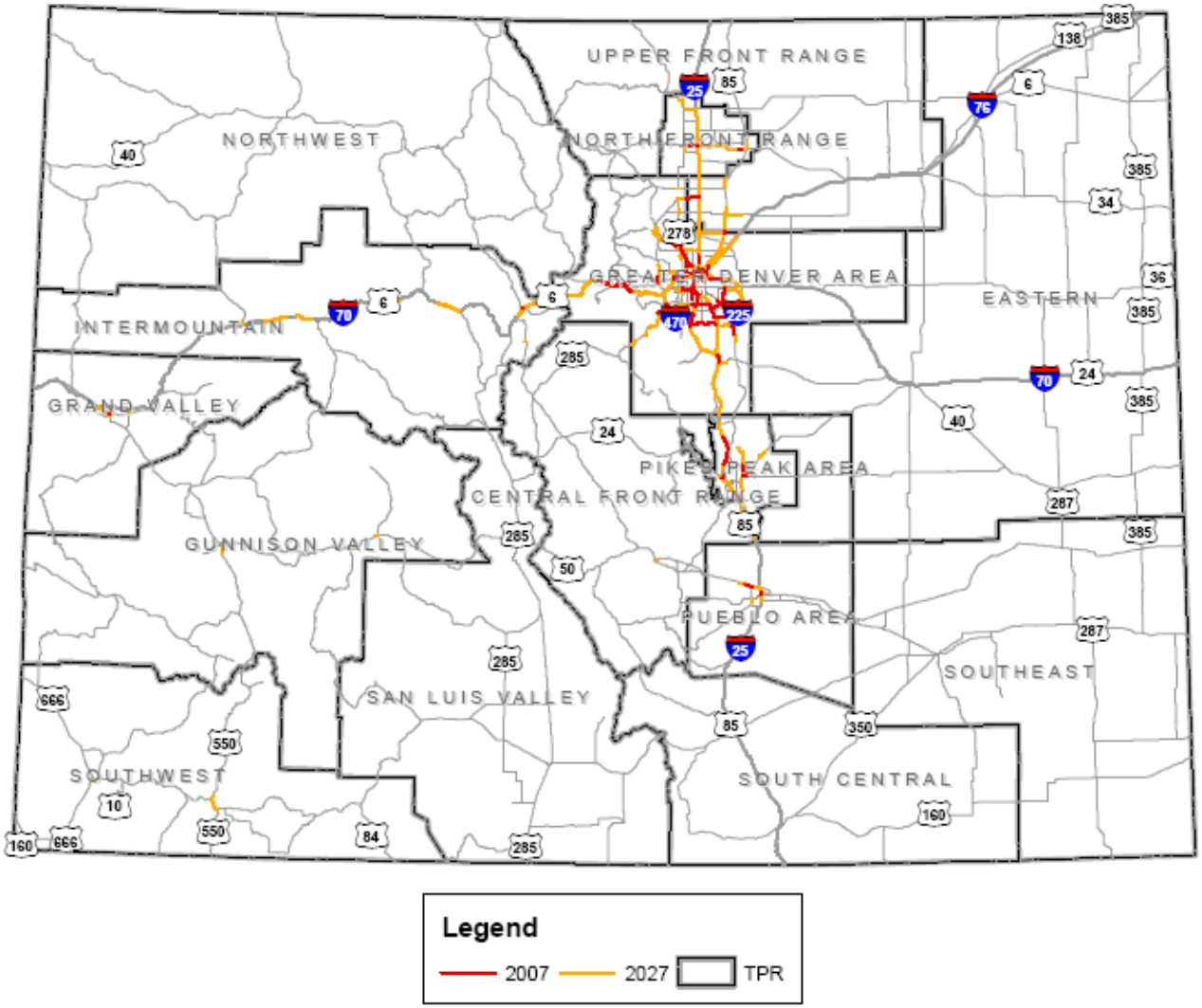
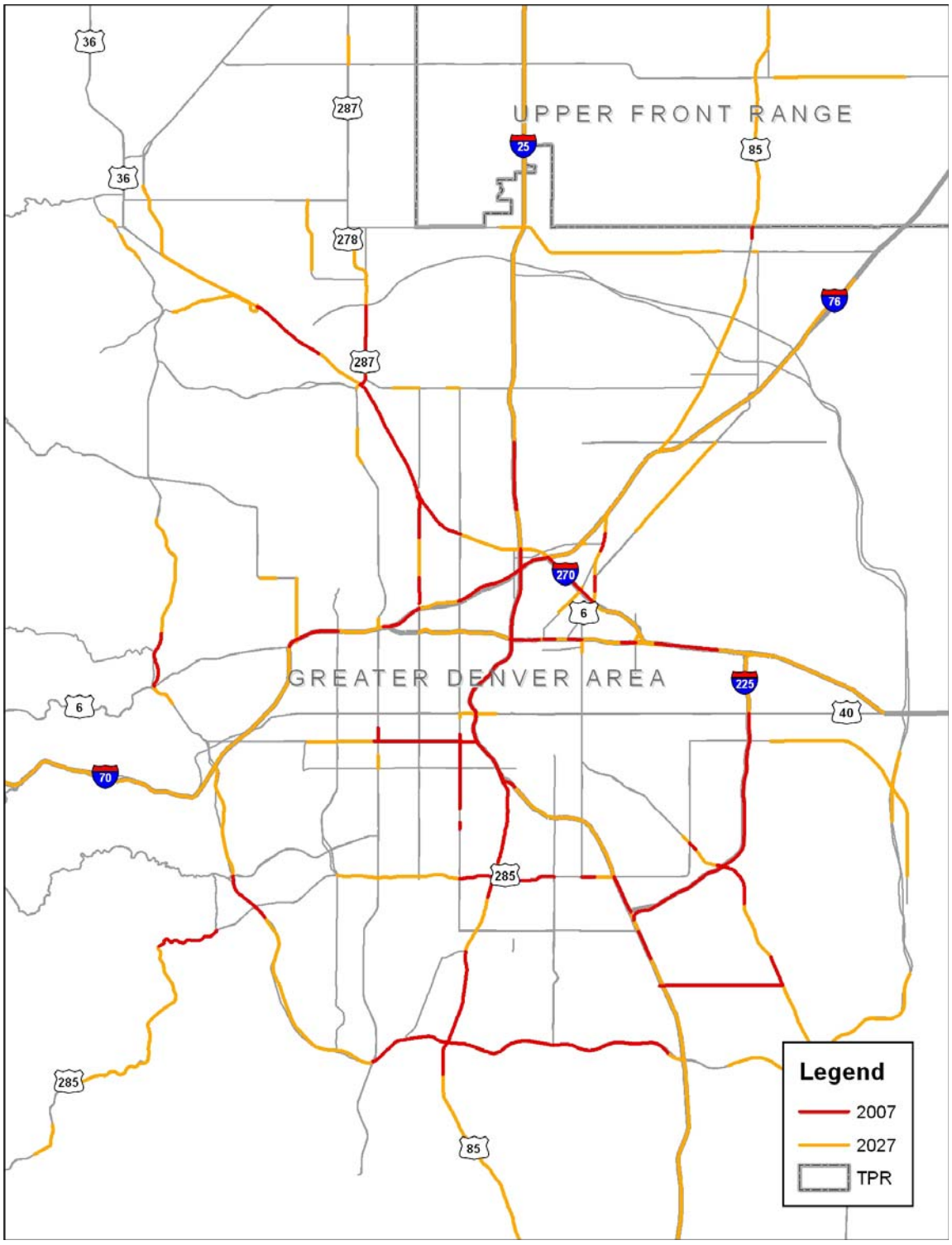


Figure E.12 High Truck AADT and V/C Ratio Route (0.85 and above) Segments in the Denver Region
2007 and 2027



Road Condition and High Truck Volume Corridors

Information on the physical condition of the highway infrastructure also was obtained to identify locations where high levels of truck activity were intersecting with poor road condition. Truck activity is negatively impacted by poor road conditions, but truck activity also can be a cause of poor road conditions as well. Additionally, deteriorating roads can be especially unsafe in locations where there are high volumes of trucks. Figure E.13 shows the locations of poor road conditions and the locations of bridges that are in poor condition based on the 2007 Colorado DOT roadway assessment database. More than 41 percent of the physical highway system is in poor condition on a system mileage basis and about 3.4 percent of state-owned bridges are in poor condition.

Figure E.14 shows the overlap of poor roads and bridges with high truck volumes (truck AADT greater than 2,000). Most of the overlap occurs on the interstate system, particularly I-25 and I-70 in both urban and rural locations and I-76 roughly between Fort Morgan and Sterling. However, there also are some locations off of the interstate which have both high truck volumes and poor road/bridge conditions.

This demonstrates that one of the freight needs in the State is for improved physical highway infrastructure. There are several locations where there are high volumes of trucks using roads and bridges that are in poor condition. Poor road conditions cause additional wear and tear to trucks and it also leads to particularly unsafe driving conditions for trucks and the traveling public.

Figure E.13 State-Owned Bridges and Highway Segments in Poor Condition

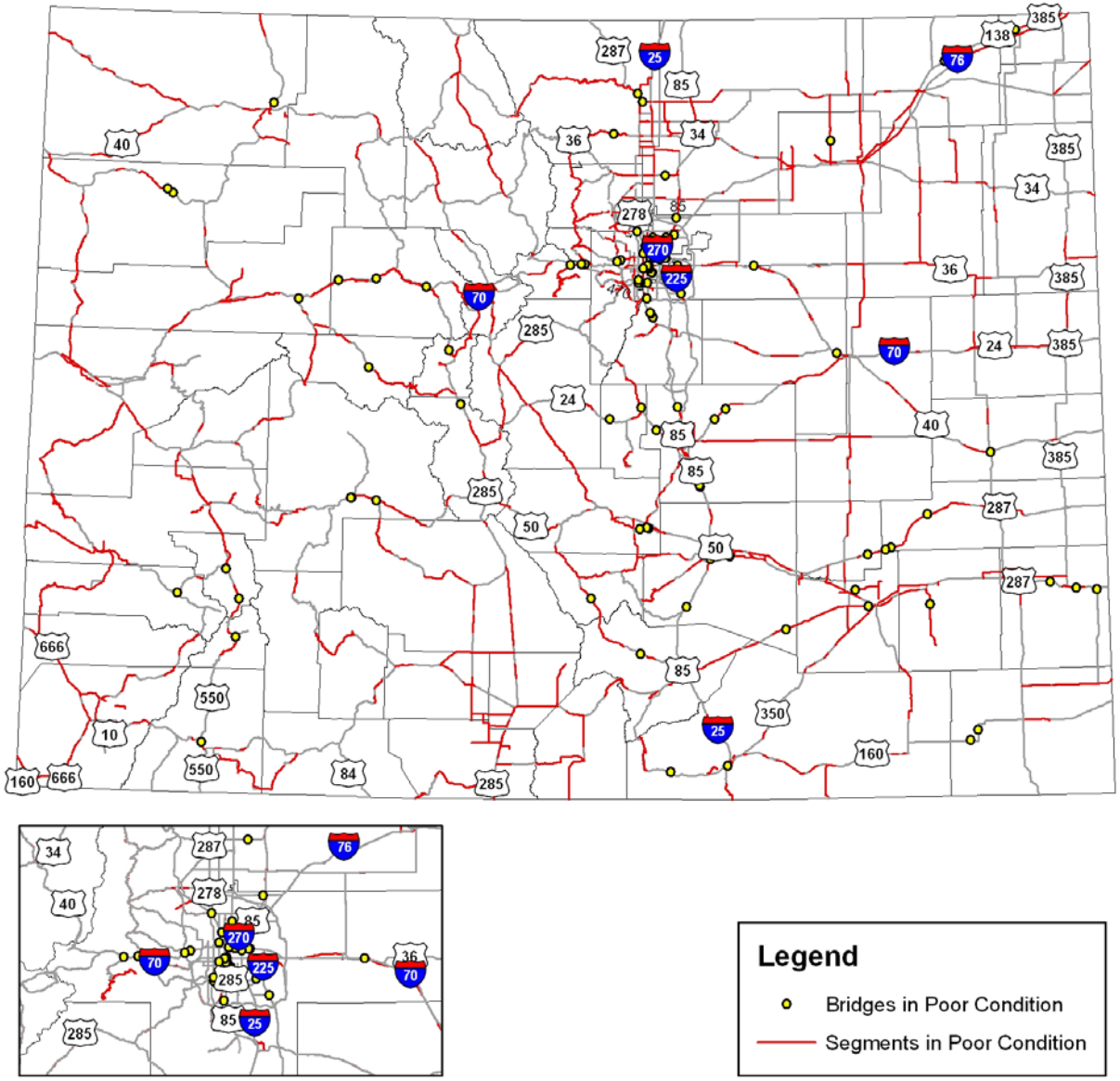
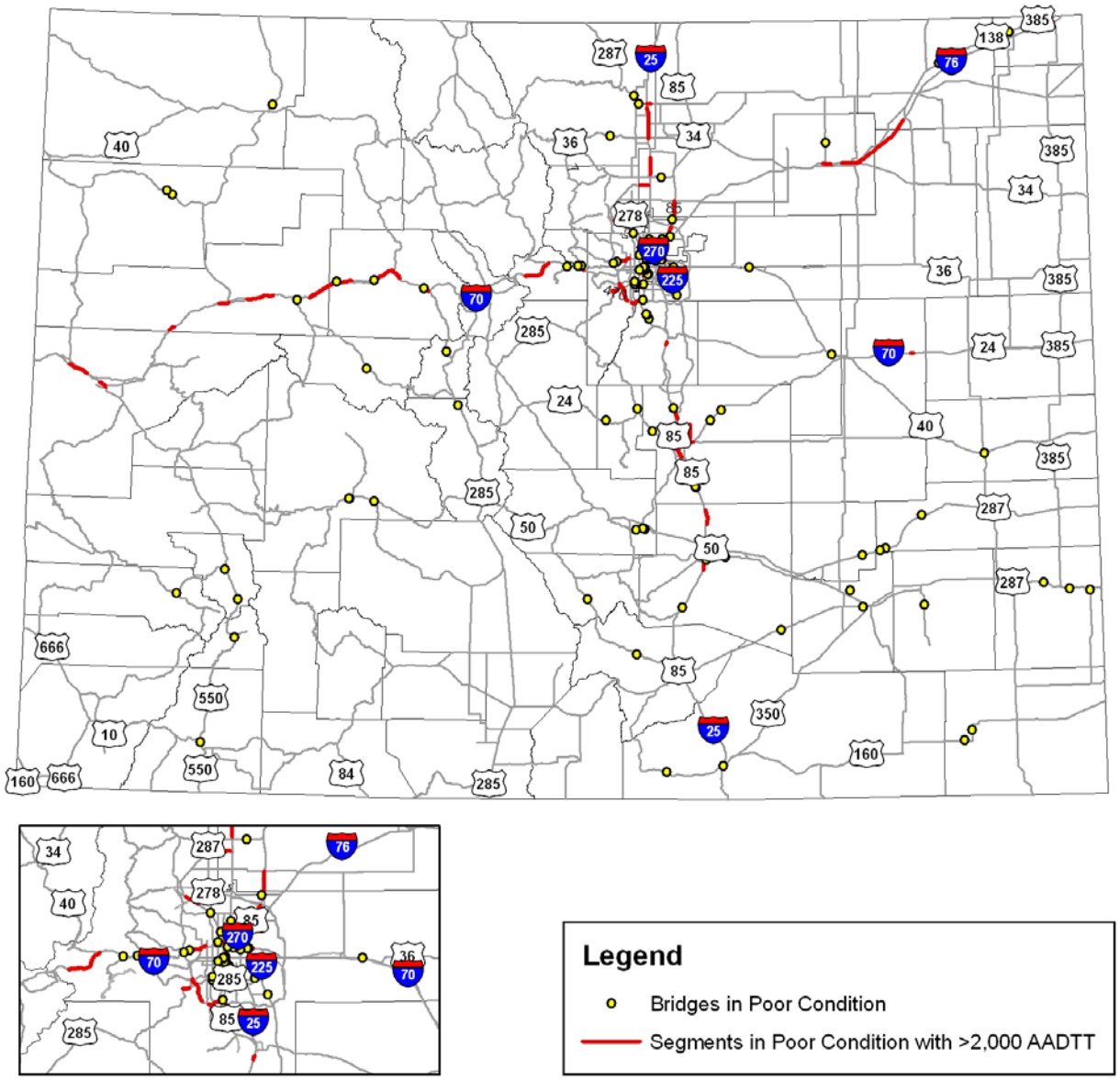


Figure E.14 State-Owned Bridges and Highway Segments in Poor Condition with High Truck Traffic



E.4 Transportation Planning Region (TPR) Level Analysis

Identifying freight needs for TPRs is difficult due to the lack of TPR-level freight data. However, TRANSEARCH freight flow data is available at the county level and it can be used to provide insights into which TPRs are most heavily impacted by freight. Figure E.15 shows the amount of freight moving into, out of, and within each of the counties. The most freight-intensive counties appear to be located in a "Y-shaped" area starting at the Colorado border with Wyoming following I-25 through the Denver region and ending at Pueblo County. This area generally encompasses the Greater Denver Area, Upper Front Range, North Front Range, Pikes Peak Area, and Central Front Range TPRs. Additionally, the counties in the Grand Valley TPR region along with Prowers and Alamosa counties carry a sizeable amount of freight.

Many of these counties will experience substantial growth in overall freight flows by 2035 (see Figure E.16). The Upper Front Range TPR and the Denver Greater Region TPR are both projected to be in the highest category of freight flows in 2035. In general, tonnage growth will radiate to the north and south from the Denver region and, to a lesser extent, the Grand Valley and Intermountain TPRs (which contain the I-70 corridor).

Figure E.17 shows annual average percentage growth in tonnage by county. Several areas are projected to grow faster than three percent annually between 2004 and 2035, including counties in TPRs in all corners of the State such as the Southeast TPR, the Grand Valley TPR, the North Front Range TPR, the Pikes Peak TPR, and the Northwest TPR. The Eastern TPR contains a few counties with negative freight growth projected between 2004 and 2035 as well as Lincoln County, which is projected to be one of the fastest growing in terms of freight. Although total freight volumes in more rural parts of Colorado may not be as large as those in urban areas, in some instances local infrastructure may be unable to accommodate increasing freight activity. Table E.6 shows the current and projected freight flows in each county in Colorado, ranked in descending order according to total 2004 volumes.

Figure E.15 Total Tonnage by County
2004

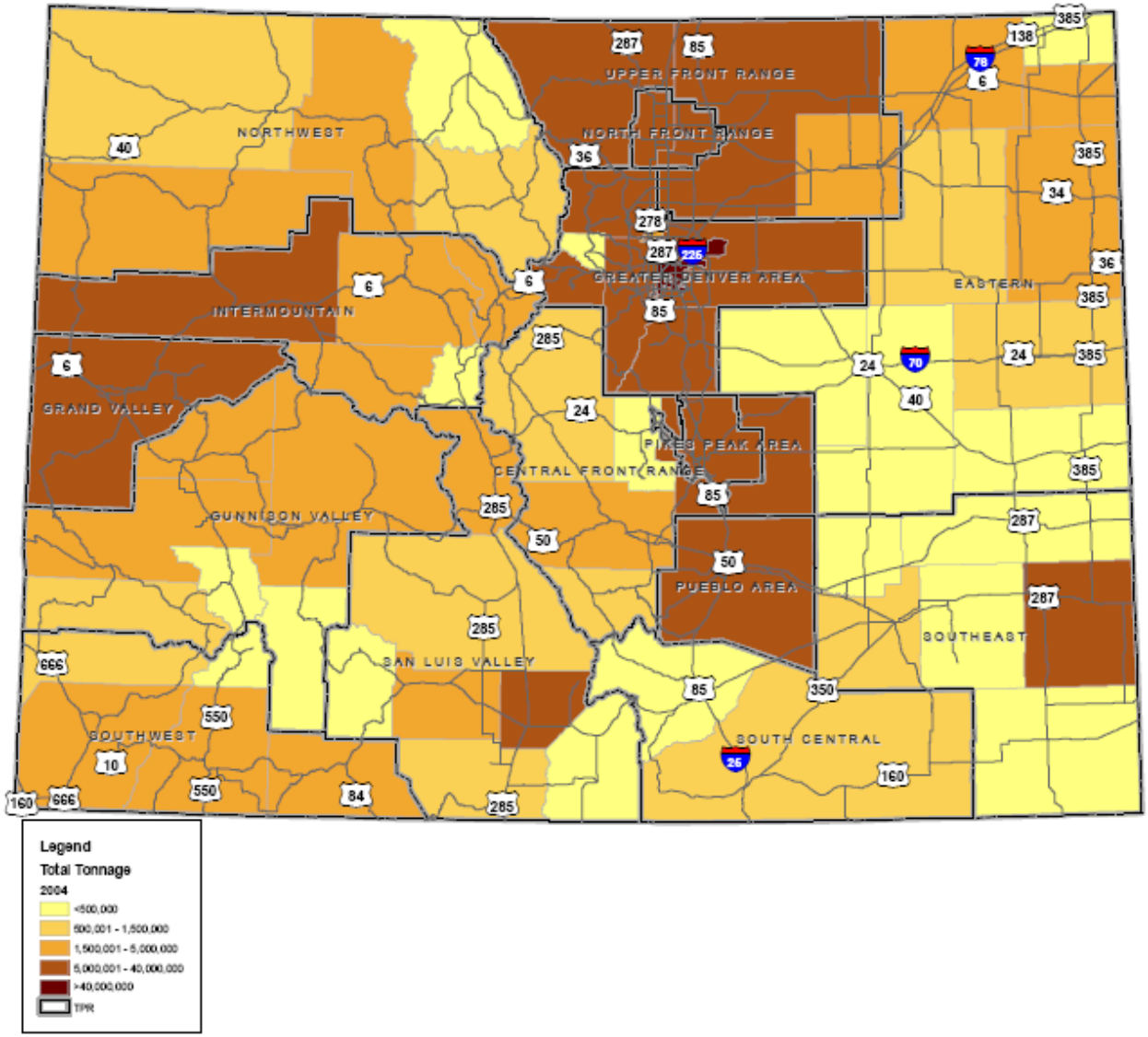


Figure E.16 Total Tonnage by County

2035 Forecast

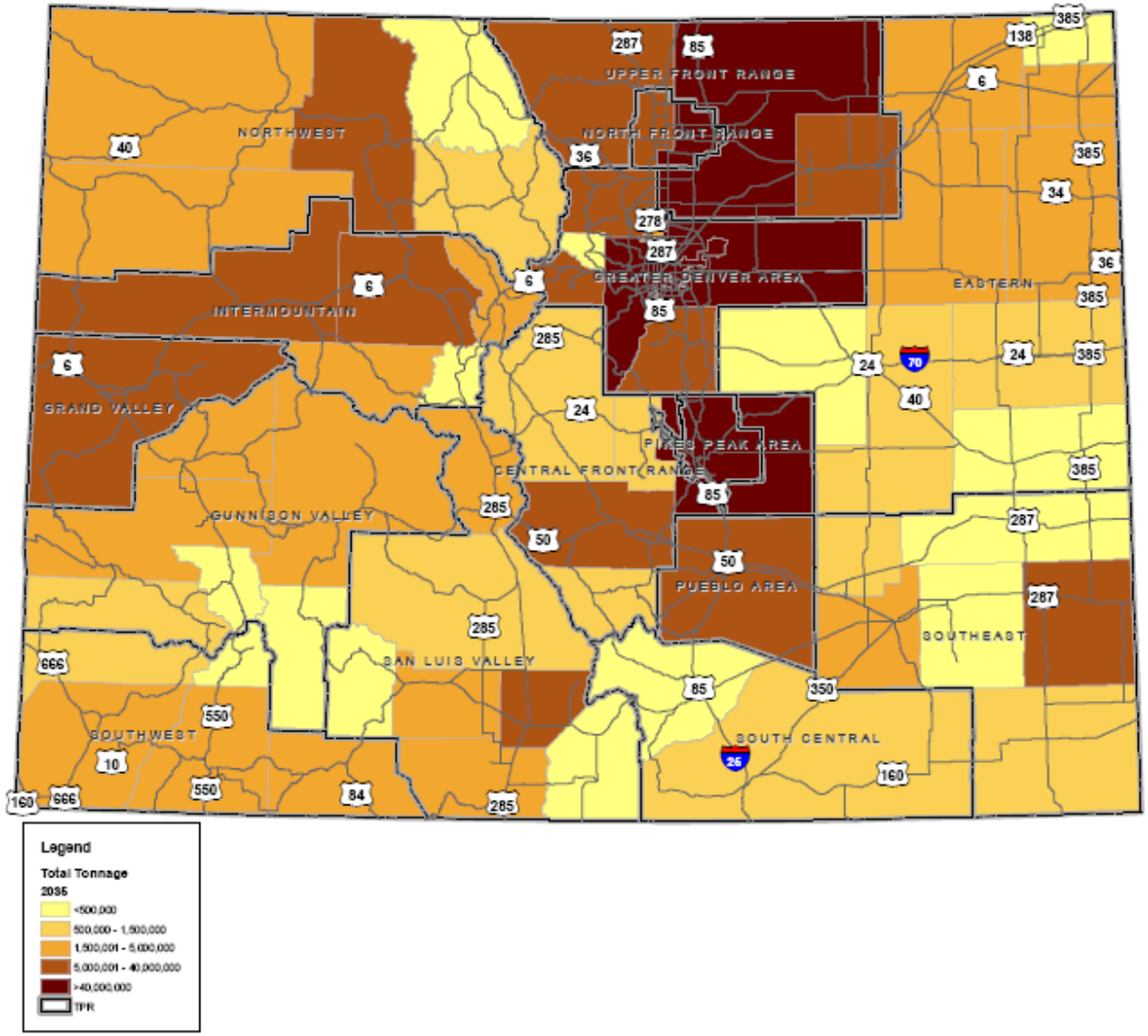


Figure E.17 Annual Average Percent Freight Growth by County

2004 to 2035

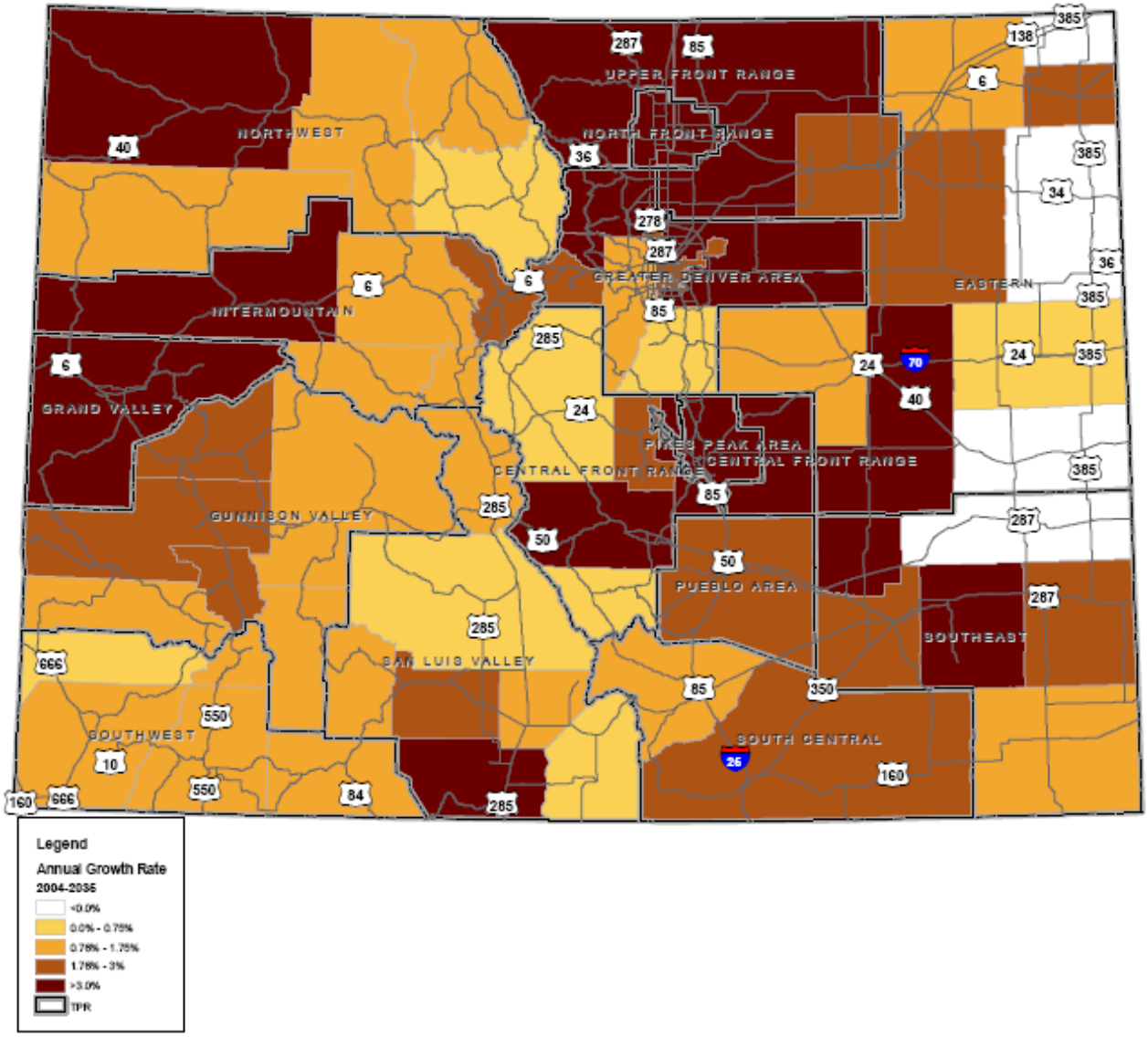


Table E.6 Current and Projected Commodity Flows by County
2004 and 2035

County	2004				2035				Annual Avg % Increase
	Outbound	Inbound	Within County	Total	Outbound	Inbound	Within County	Total	
DENVER	11,478,885	41,468,919	959,460	53,907,264	27,774,986	66,215,544	1,361,274	95,351,804	2.48
JEFFERSON	13,466,562	14,191,013	1,341,094	28,998,669	17,845,140	23,730,275	1,090,843	42,666,258	1.52
ADAMS	10,458,162	15,903,339	399,173	26,760,674	20,301,857	36,262,089	1,352,215	57,916,161	3.76
EL PASO	11,647,890	6,682,675	6,352,081	24,682,646	26,722,247	15,647,737	7,310,052	49,680,036	3.27
ARAPAHOE	5,083,188	15,295,186	206,315	20,584,689	14,996,030	31,537,551	628,422	47,162,003	4.16
WELD	11,323,367	4,609,427	4,387,924	20,320,718	27,484,460	10,865,177	8,383,998	46,733,635	4.19
BOULDER	7,448,689	9,924,319	1,031,696	18,404,704	13,055,190	21,968,233	1,692,438	36,715,861	3.21
LARIMER	6,441,820	5,751,560	3,600,249	15,793,629	12,185,640	16,657,069	5,423,140	34,265,849	3.77
PUEBLO	3,910,226	8,378,285	25,415	12,313,926	7,472,135	15,828,766	56,325	23,357,226	2.89
ALAMOSA	7,766,519	258,870	807,551	8,832,940	9,971,498	484,073	1,028,780	11,484,351	0.97
MESA	2,355,325	4,871,503	426,625	7,653,453	5,686,895	10,354,045	604,929	16,645,869	3.79
GARFIELD	4,838,682	566,806	2,128,928	7,534,416	6,325,795	1,168,105	8,045,477	15,539,377	3.43
CLEAR CREEK	7,181,202	147,668	69,187	7,398,057	11,695,876	384,980	180,691	12,261,547	2.12
PROWERS	6,065,727	868,742	221,933	7,156,402	10,516,160	1,134,986	379,475	12,030,621	2.20
DOUGLAS	1,198,814	4,082,068	5,588	5,286,470	1,918,065	4,234,086	18,085	6,170,236	0.54
EAGLE	390,816	4,208,944	179,400	4,779,160	497,901	5,354,790	153,877	6,006,568	0.83
ROUTT	1,091,535	1,666,492	1,166,687	3,924,714	2,610,414	1,416,581	1,792,371	5,819,366	1.56
FREMONT	2,341,678	893,799	397,014	3,632,491	5,132,587	2,402,522	750,971	8,286,080	4.13
MORGAN	1,153,859	2,214,604	250,515	3,618,978	1,613,295	4,345,830	310,910	6,270,035	2.36
LA PLATA	705,126	1,402,466	803,044	2,910,636	983,160	2,400,682	893,181	4,277,023	1.51
CHAFFEE	1,661,387	969,476	3,386	2,634,249	2,341,390	1,294,745	4,514	3,640,649	1.23
GUNNISON	2,025,447	583,538	0	2,608,985	2,818,748	873,420	0	3,692,168	1.34
MONTROSE	1,398,423	662,949	531,412	2,592,784	2,533,535	1,399,555	386,081	4,319,171	2.15
BROOMFIELD	54,625	2,331,042	132,505	2,518,172	192,888	4,058,580	292,635	4,544,103	2.60
YUMA	1,682,669	414,911	286,063	2,383,643	1,737,262	363,877	27,904	2,129,043	(0.34)
MONTEZUMA	572,317	1,472,390	81,305	2,126,012	923,864	2,142,963	92,522	3,159,349	1.57
RIO BLANCO	1,840,063	129,687	56,969	2,026,719	2,536,382	230,797	72,576	2,839,755	1.29
ARCHULETA	1,071,175	645,552	290,286	2,007,013	1,569,198	826,101	389,636	2,784,935	1.25
PHILLIPS	670,653	1,003,554	247,440	1,921,647	2,570,744	583,846	183,124	3,337,714	2.38
LOGAN	914,302	865,143	123,679	1,903,124	1,370,592	1,168,196	31,399	2,570,187	1.13
DELTA	1,065,856	484,152	127,714	1,677,722	1,786,810	804,151	224,869	2,815,829	2.19
SUMMIT	143,499	1,507,385	101	1,650,985	166,554	2,830,702	235	2,997,491	2.63
RIO GRANDE	946,302	639,468	1,506	1,587,276	1,470,262	1,235,656	3,578	2,709,496	2.28
PITKIN	12,157	1,499,079	0	1,511,236	17,609	1,913,952	0	1,931,561	0.90
CONEJOS	247,828	928,609	160,056	1,336,493	492,449	2,423,781	16,682	2,932,912	3.85
WASHINGTON	524,228	618,923	132,134	1,275,285	1,548,131	542,284	284,839	2,375,254	2.78
MOFFAT	979,649	283,508	0	1,263,157	2,658,976	483,063	0	3,142,039	4.80
KIT CARSON	645,567	339,604	265,900	1,251,071	689,426	569,427	48,420	1,307,273	0.14
SAGUACHE	795,775	155,329	4,381	955,485	889,579	164,698	6,384	1,060,661	0.36
OTERO	218,157	673,420	177	891,754	378,151	1,134,242	105	1,512,498	2.25
GRAND	384,160	447,904	0	832,064	427,968	547,414	0	975,382	0.56
DOLORES	74,159	662,580	9	736,748	121,610	711,235	16	832,861	0.42
LAS ANIMAS	225,090	487,805	252	713,147	357,850	808,588	336	1,166,774	2.05
SAN MIGUEL	45,518	604,540	9,615	659,673	60,778	776,849	12,223	849,850	0.93
CUSTER	81,458	483,856	28	565,342	142,413	456,183	20	598,616	0.19
PARK	217,110	320,506	8,720	546,336	294,478	367,439	11,109	673,026	0.75
TELLER	12,157	433,194	40	445,391	21,115	721,818	96	743,029	2.16
CROWLEY	365,224	51,220	5	416,449	906,821	55,678	5	962,504	4.23
SEDGWICK	279,983	130,388	0	410,371	81,528	151,320	0	232,848	(1.40)
BACA	207,780	174,370	18,488	400,638	275,853	246,365	3,496	525,714	1.01
ELBERT	39,815	279,623	31	319,469	101,013	390,210	28	491,251	1.73
HUERFANO	35,745	244,912	427	281,084	45,140	357,017	281	402,438	1.39
KIOWA	67,327	160,236	43,292	270,855	24,672	77,077	4,310	106,059	(1.96)
COSTILLA	121,081	140,097	376	261,554	146,537	156,123	653	303,313	0.52
OURAY	97,796	156,745	0	254,541	216,187	225,982	0	442,169	2.38
LINCOLN	143,712	88,032	17,519	249,263	314,758	147,664	48,520	510,942	3.39
CHEYENNE	170,799	30,518	0	201,317	45,969	56,572	0	102,541	(1.58)
GILPIN	14,726	170,647	0	185,373	34,372	352,368	0	386,740	3.50
LAKE	42,437	118,864	38	161,339	54,387	159,067	48	213,502	1.04
BENT	82,545	53,434	0	135,979	215,470	122,703	0	338,173	4.80
JACKSON	100,664	32,346	0	133,010	140,788	63,136	0	203,924	1.72
SAN JUAN	86,277	27,765	5,333	119,375	110,904	46,154	6,794	163,852	1.20
MINERAL	8,935	75,936	0	84,871	9,307	103,783	0	113,090	1.07
HINSDALE	7,597	46,335	29	53,961	7,860	61,364	25	69,249	0.91
Total	**136,730,248**	**165,016,259**	**27,309,093**		**257,639,658**	**304,599,265**	**43,610,917**		

The 2007 CDOT CORIS database also can be used to generate estimates for truck AADT and overall volume-to-capacity ratios by road segment for 2007 and 2027. This information can then be aggregated to arrive at the number of state highway system miles in each TPR meeting certain truck traffic and overall congestion criteria. Table E.7 shows the number of state highway miles, by TPR, that have at least 2,000 trucks per day and V/C ratios at or above 0.85 in 2007 and 2027. Statewide, there are about 145 miles of this high-truck volume, congested roads in Colorado. The Greater Denver Area TPR has by far the most road miles that meet these criteria (about 124 miles in 2007, 86 percent of the total). By these measures, congested truck corridors are expected to grow dramatically by 2027, to just over 600 miles statewide. Of that total, 423 miles will be located in the Denver TPR. However, other TPRs will become increasingly congested in the future. The Pikes Peak Area, North Front Range, and Intermountain TPRs will be the most affected by this trend, with other areas experiencing slightly more modest freight congestion issues.

Table E.7 also classifies the different TPRs into regions as outlined in the Colorado 2035 Statewide Transportation Plan's Freight Technical Report. As stated in the Report, this is to provide a comparison for the relative order-of-magnitude estimates of each region, since the TPRs within each region share commonalities with regards to freight characteristics. There are three regions, defined at the county level: 1) Western Colorado; 2) Central Colorado; and 3) Eastern Colorado. Although the boundaries of these regions do not exactly coincide with TPR boundaries, they can provide a rough estimate of the location of freight flows in the State.

Comparing Figures15 through 17 to Table E.7, it becomes apparent that many of the TPRs with the heaviest freight flows also are those with the most congested truck corridors. The Greater Denver Area TPR stands out as having by far the greatest amount of freight traffic and the most roadway miles that could be described as congested for truck movements, but the North Front Range, Pikes Peak Area, and Intermountain TPRs also are notable, especially in 2027. This indicates that freight-related congestion relief is a need for many TPRs, or will be in the future.

Table E.7 Total State Highway Miles with Truck AADT ≥ 2,000 and V/C Ratio ≥ 0.85 by TPR
2007 and 2027

Region	TPR	2007	2027
	Intermountain	< 1	35
	Grand Valley	1	6
	Southwest	0	6
Western	Gunnison Valley	0	2
	San Luis Valley	0	0
	Northwest	0	0
	Subtotal	**2**	**48**
	Greater Denver Area	124	423
	Upper Front Range	0	12
	Pikes Peak Area	12	55
	North Front Range	4	52
Central Colorado	Pueblo Area	3	12
	South Central	0	0
	Central Front Range	0	1
	Subtotal	**143**	**554**
	Eastern	0	0
Eastern	Southeast	0	0
	Subtotal	**0**	**0**
	Grand Total	**145**	**602**

E.5 Intermodal Connector Needs

National Highway System (NHS) Intermodal Connectors are the public roads leading to major intermodal terminals. They link the backbone of the freight highway network, the National Highway System, to other modes of transport at their terminals, thereby creating a national and statewide intermodal freight system and enabling more efficient use of all freight modes. Despite the fact that these intermodal connectors are less than one percent of the total NHS mileage, they are the "front door" to the freight community for a broad

array of intermodal transport services and options. Hence, it is critical that they be designed and maintained to a high standard.

Although these connectors are largely on county roads and city streets, are typically short (averaging less than two miles in length), and generally have lower design standards than mainline NHS routes, their value to the transportation system justifies their inclusion on the National Highway System.

Intermodal connectors are designated in cooperation with State Departments of Transportation and Metropolitan Planning Organizations based on criteria developed by the Federal Highway Administration and the U.S. Department of Transportation. Eight types of intermodal facilities have been identified across the country:

- Commercial Aviation Airports
- Ports
- Truck/Rail Terminals
- Pipeline Terminals
- Amtrak Terminals
- Intercity Bus Terminals
- Public Transit Stations
- Ferry Terminals

The following criteria are used to identify NHS intermodal connectors within these eight categories. The primary criteria are based on annual passenger volumes, annual freight volumes, or daily vehicular traffic on one or more principal routes that serve the intermodal facility. The secondary criteria include factors that underscore the importance of an intermodal facility within a specific state.

Primary Criteria

Commercial Aviation Airports

1. Passengers -scheduled commercial service with more than 250,000 annual enplanements.
2. Cargo -100 trucks per day in each direction on the principal connecting route, or 100,000 tons per year arriving or departing by highway mode.

Ports

1. Terminals that handle more than 50,000 TEUs (a volumetric measure of containerized cargo which stands for twenty-foot equivalent units) per year, or other units measured that would convert to more than 100 trucks per day in each direction. (Trucks are defined as large single-unit trucks or combination vehicles handling freight.)
2. Bulk commodity terminals that handle more than 500,000 tons per year by highway or 100 trucks per day in each direction on the principal connecting route. (If no individual terminal handles this amount of freight, but a cluster of terminals in close proximity to each other does, then the cluster of terminals could be considered in meeting the criteria. In such cases, the connecting route might terminate at a point where the traffic to several terminals begins to separate.)
3. Passenger terminals that handle more than 250,000 passengers per year or 1,000 passengers per day for at least 90 days during the year.

Truck/Rail Terminals

50,000 TEUs/year, or 100 trucks per day, in each direction on the principal connecting route, or other units measured that would convert to more than 100 trucks per day in each direction. (Trucks are defined as large single-unit trucks or combination vehicles carrying freight.)

Pipeline Terminals

100 trucks/day in each direction on the principal connecting route.

Amtrak Terminals

100,000 passengers/year (entrainments and detrainments). Joint Amtrak, intercity bus and public transit terminals should be considered based on the combined passenger volumes. Likewise, two or more separate facilities in close proximity should be considered based on combined passenger volumes.

Intercity Bus Terminals

100,000 passengers/year (boardings and deboardings).

Public Transit Stations

1. Stations with park and ride lots with more than 500 vehicle parking spaces; or
2. 5,000 daily bus or rail passengers with significant highway access (i.e., a high percentage of the passengers arrive by cars and buses using a route that connects to an NHS route); or
3. A major hub terminal that provides for the transfer of passengers between several bus routes. These stations should have a significant number of buses using a connector route to the NHS.

Ferry Terminals

Interstate/International -1000 passengers/day for at least 90 days (usually summer) during the year - A ferry connecting two terminals within the same metropolitan area is considered local transit, not interstate.

Secondary Criteria

Any of the following criteria could be used to justify NHS connections to intermodal terminals where there is a significant highway interface:

1. Intermodal terminals that handle more than 20 percent of passenger or freight volumes by mode within a State;
2. Intermodal terminals identified either in the Intermodal Management System or the State and metropolitan transportation plans as a major facility;
3. Significant investment in, or expansion of, an intermodal terminal; or
4. Connecting routes targeted by the State, MPO, or others for investment to address an existing, or anticipated, deficiency as a result of increased traffic.

In 2000 the FHWA prepared a Report to Congress on the NHS intermodal connectors. As part of that report, they prepared an inventory and assessment of the intermodal connectors. Addressing a representative sampling of the designated connectors across the country, the report identified the following findings regarding their conditions:

- Connectors to ports were found to have twice the percent of mileage with pavement deficiencies when compared to non-Interstate NHS routes. Connectors to rail terminals had 50 percent more mileage in the deficient category. Connectors to airports and pipeline terminals appeared to be in better condition with about the same percent of mileage with pavement deficiencies as those on non-Interstate NHS.

- Problems with shoulders, inadequate turning radii, and inadequate travel way width were most often cited as geometric and physical deficiencies on the connectors.

- Because of the nature of intermodal connectors, railroad crossings are often found on connectors. The most commonly noted railroad crossing deficiencies were rough crossing profiles and delays at crossings.

While the analysis showed that the intermodal connectors have significantly lower physical and operating characteristics when compared to all NHS mileage, there are currently no national, regional or terminal level design standards for intermodal access.

In Colorado there are 34 designated intermodal connectors, totaling about 22.5 miles in length. There are no ports or ferry terminals in Colorado, but the other six categories of facilities are represented. Table E.8 summarizes the intermodal connectors by category for Colorado. A detailed list of the NHS intermodal connectors in Colorado can be found in Table E.10.

Table E.8 Summary of Colorado Intermodal Connectors by Category

Type	Number of Connectors	Length (miles)
Public Transit Stations	13	2.7
Airports	6	10.2
Truck/Rail Terminals	5	5.5
Pipeline Terminals	4	2.4
Amtrak Terminals	2	0.4
Intercity Bus Terminals	4	1.3
Totals	**34**	**22.5**

Regarding the State Freight Roadmap, only the first three categories (including 15 connectors totaling 18.1 miles) could be considered to be freight-related. Two of these connectors are on State Highways (0.156 miles on SH 53 and 5.6 miles on SH 172); the remainder are on city streets or county roads. All of the intermodal connectors are located in the Denver metropolitan area, with the exception of five of the Airport connectors, which provide access to regional airports around the state.

Data on the intermodal connectors are maintained in CDOT's HPMS database, which is updated annually. The database for State Highways is much more thorough than that for city streets and county roads, because CDOT relies on the local governments to provide much of the information on their systems. CDOT does, however, update traffic counts on the connectors on local streets.

Based on the HPMS database, the following information can be gleaned about the two intermodal connectors on the State Highway system that are considered freight-related:

1) State Highway Route 53:

- 0.156 miles
- All pavement in Good condition
- Existing V/C ratio = 0.49
- Projected 2035 V/C ratio = 0.56
- Truck % = Approximately 7 % in both peak and off-peak periods

2) State Highway Route 172:

- 5.6 miles
- 1.1 miles with pavement in Poor condition; remainder in Good condition
- Existing V/C ratio = 0.27 – 0.33
- Projected 2035 V/C ratio = 0.48 – 0.56
- Truck % = 4.5 % in peak period and 7.5 % in off-peak period

These data generally indicate that the freight-related connectors on the State Highway system are in reasonably good shape (with the exception of 1.1 miles of Poor pavement condition) and do not experience congestion. However, the data are not sufficiently detailed to identify either geometric or operational deficiencies at specific locations along the connectors.

The consultant team also conducted a safety analysis on the two corridors using crash data between 1999 and 2004. The result of this safety analysis is shown below in Table E.9. Due to the short length of the intermodal connectors, there is a significant amount of variability in the number of crashes on annual basis for each of the segments. Similarly, only one fatal crash occurred on these two intermodal connectors between 1999 and 2004.

Table E.9 Safety Analysis for SH 53 and SH 172

SH 53	Crashes		MVMT*			Crash Rates (Crashes/Million VMT)	
Year	Auto-Only	Truck-Involved	Total	Auto	Truck	Auto-Only	Truck-Involved
1999	0	1	2.14	1.96	0.17	0.00	5.86
2000	3	0	2.40	2.21	0.19	1.36	0.00
2001	3	1	2.48	2.28	0.20	1.31	5.06
2002	5	2	2.50	2.31	0.20	2.17	10.04
2003	n/a	n/a	n/a	n/a	n/a	n/a	n/a
2004	1	0	2.39	2.20	0.19	0.45	0.00
* MP 0.00 to 0.163							

SH 172	Crashes		MVMT			Crash Rates (Crashes/Million VMT)	
Year	Auto-Only	Truck-Involved	Total	Auto	Truck	Auto-Only	Truck-Involved
1999	20	2	10.47	9.34	1.13	2.14	1.77
2000	8	1	10.31	9.20	1.11	0.87	0.90
2001	18	2	11.97	11.45	0.51	1.57	3.90
2002	22	0	11.51	11.01	0.50	2.00	0.00
2003	29	3	11.23	10.90	0.33	2.66	9.20
2004	21	0	12.14	11.76	0.38	1.79	0.00

SH 53	Fatality Crashes	MVMT*	Crash Rates (Crashes/Million

							VMT)
Year	Auto-Only	Truck-Involved	Total	Auto	Truck	Auto-Only	Truck-Involved
1999	0	0	2.14	1.96	0.17	0.00	0.00
2000	0	0	2.40	2.21	0.19	0.00	0.00
2001	0	0	2.48	2.28	0.20	0.00	0.00
2002	0	0	2.50	2.31	0.20	0.00	0.00
2003	n/a	n/a	n/a	n/a	n/a	n/a	n/a
2004	0	0	2.39	2.20	0.19	0.00	0.00
* MP 0.00 to 0.163							

SH 172	Fatal Crashes		MVMT*			Crash Rates (Crashes/Million VMT)	
Year	Auto-Only	Truck-Involved	Total	Auto	Truck	Auto-Only	Truck-Involved
1999	1	0	10.47	9.34	1.13	0.11	0.00
2000	0	0	10.31	9.20	1.11	0.00	0.00
2001	0	0	11.97	11.45	0.51	0.00	0.00
2002	0	0	11.51	11.01	0.50	0.00	0.00
2003	0	0	11.23	10.90	0.33	0.00	0.00
2004	0	0	12.14	11.76	0.38	0.00	0.00

Recommendation

Recognizing the importance of the intermodal connectors to the freight system and the limitations of the HPMS database (particularly as it relates to local streets), it is recommended that CDOT conduct a field inventory of all intermodal connectors (at least those that are freight-related) to better identify needs as related to surface condition, geometric deficiencies, operational deficiencies, and safety issues. Once established, this inventory and needs assessment could be updated every 2-3 years.

Table E.9 NHS Intermodal Connectors in Colorado

TYPE	FACILITY	CONNECTOR NO.	CONNECTOR DESCRIPTION	CONNECETOR LENGTH
AIRPORTS	Aspen-Pitkin County Airport	1	Served by an existing NHS route	0
	Colorado Springs Airport	1	From Powers Boulevard: East 1.2 miles on Drennan Road to Terminal Entrance	1.2
	Denver International Airport	1	Pena Blvd (E-470 interchange E 0.7 mi)	0.7
	Durango-LaPlata County Airport	1	From U.S. 160: South & Southeasterly 5.6 mi on SH 172, S 1.2 mi on CR 309 to Terminal Entrance	6.8
	Eagle County Regional Airport	1	CR73 – Airport Access Rd (Airport to US 6)	0.5
	Walker Field, Grand Junction Airport	1	From 1-70: NE 1.0 mi on Horizon Drive to Airport Entrance	1
TRUCK/RAIL TERMINALS	Burlington Northern RR Auto Transfer	1	From I-76: E 1.7 mi on 88th Ave, N 0.2 mi on Yosemite Ave to Terminal Entrance	1.9
	Burlington Northern RR Transfer Facility	1	53rd Pl. to Broadway to 58th Ave (SH 53) to I-25	1
	Southern Pacific RR Transfer Facility	1	From I-76: South on Pecos Street to Terminal Entrance at 56th Ave.	0.6
	Union Pacific RR Auto Transfer	1	From I-76: E 0.1 mi on 96th Ave, N 1.0 mi on I-76 Frontage Road to Terminal Entrance	0.6
	Union Pacific RR Transfer Facility	1	From SH 2 (Colorado Blvd): W 1.4 mi on 40th Ave to Terminal Entrance at Williams Street	1.4
PIPELINE TERMINALS	Conoco Ppeline Transfer	1	From US 6: W 0.8 mi on 56th Ave to Terminal Entrance at Brighton Blvd (SH 265)	0.8
	Kaneb Pipeline Transfer	1	From I-76: E 0.1 mi on 88th Ave, S 1.2 mi on Brighton Rd, E 0.3 mi on 80th Street. to Entrance at Krameria Street.	1.6
	Phillips Pipeline	1	From US 6: W 0.8 mi on 56th Ave to Terminal Entrance at Brighton Blvd (same as Conoco Pipeline – 11L)	0

	Total Petroleum Pipeline Terminal	1	From US 6: W 0.8 mi on 56th Ave to Terminal Entrance at Brighton Blvd (Same as Conoco Pipeline – 11L)	0
AMTRAK TERMINALS	Denver Union Station (Amtrak)	1	From Blake Street connector to Transit Station: NW on 17th, NE on Wynkoop to Station	0.4
	Denver Union Station (Amtrak)	2	From Station: on 18th Street (OW pair with 17th Street) returning to Blake Street connector	0
INTERCITY BUS TERMINALS	Denver Greyhound Bus Terminal	1	From I-25: SE on 20th Street, SW on Arapahoe to Terminal on 19th Street	1
	Denver Greyhound Bus Terminal	2	From Broadway: NE on 19th Street to Station	0.3
	Denver Greyhound Bus Terminal	3	From Station: SE on 20th Street to Broadway (OW pair with 19th Street connector)	0
	Denver Greyhound Bus Terminal	4	From 20th: SW on Curtis, NW on 19th (OW pair with 20th Street/Arapahoe Street connector)	0
PUBLIC TRANSIT STATIONS	Broadway Transit Station & Park-n-Ride	1	From I-25: S 0.1 mi on Broadway to Station Entrance	0.1
	Broomfield Park-n-Ride	1	Served by an existing NHS route	0
	Civic Center Transit Station	1	Served by an existing NHS route	0
	Market Street Transit Station	1	From Speer Blvd: NE 0.3 mi on Market to Station at 16th Street	0.3
	Market Street Transit Station	2	From 20th Street: SW on Blake to Station at 16th Street	0.3
	Market Street Transit Station	3	From Station: NE on Market to 20th (OW pair with connector on Blake from 20th to Station)	0
	Market Street Transit Station	4	From Station: SW on Blake to Speer (OW pair with Market from Speer to Station)	0
	Southmoor Park-n-Ride	1	From SH 30 (Hampden Ave): S 0.2 mi on S. Monaco Street to Lot Entrance at Jefferson Ave.	0.2

	Stapleton Park-n-Ride	1	From I-70: S 1.1 mi on Quebec Street, E 0.3 mi on Airport Way to Lot Entrance on Syracuse Street	1.8
	Table Mesa Park-n-Ride	1	Served by an existing NHS route	0
	Thornton Park-n-Ride	1	Served by an existing NHS route	0
	Wagon Road Park-n-Ride	1	Served by an existing NHS route	0
	Westminster Center Park-n-Ride	1	Served by an existing NHS route	0

Source: Federal Highway Administration

E.6 Freight Needs Identified in Previous CDOT Studies

This section describes the freight needs that were identified in some of the more recent and major planning and environmental studies. They are discussed separately for each project that was reviewed.

CDOT Rail Needs

In 2003, under a public-private partnership basis, CDOT, in cooperation with the Union Pacific Railroad (UP) and the BNSF Railway (BNSF), initiated the Public Benefits and Costs Study (Public Benefits Study) to analyze the impact of consolidating and relocating certain freight lines and operations from the congested Front Range. The Public Benefits Study concluded that the citizens of Colorado would accrue more than sufficient benefits to warrant the investment of public dollars in the proposed relocation project.

In 2007, CDOT initiated the Colorado Rail Relocation Implementation Study (R2C2) to analyze the possible rail bypass project costs and also to determine the railroad operations savings and costs associated with such potential bypass routes. Two hypothetical alignments were identified for three purposes: 1) to determine order of magnitude construction costs of a potential "bypass route;" 2) compare order of magnitude railroad operational savings operating on a new bypass route as opposed to operating on the Joint Line (the existing rail route from Denver to Pueblo); and 3) identify environmental resources that may be encountered in eastern Colorado if a rail bypass project were to be constructed.

This study concluded that there was the potential for diverting the majority of heavy freight traffic from the Front Range communities and thereby possibly opening up the Joint Line for intercity passenger rail service results in a strong recommendation for

further study. The study also identified the following freight-related needs for further investigation:

- Need to combine the findings of R2C2 and the I-25 portions of the Rocky Mountain Rail Authority Passenger Study
- More detailed engineering of alignments is needed to define and minimize potential community impacts
- Additional environmental analyses also are needed to progress the initial environmental scan done in R2C2.
- In the event that "Next Steps" lead to further study and analysis of a proposed north-south railroad bypass, all key variables such as trains per day using the bypass, diesel fuel and gasoline costs, cost of capital, wages, current construction-related unit costs, trackage rights assumptions, etc. will need to be updated in the models and templates utilized in this study.

Freight Data Needs

In 2007 CDOT conducted the Freight Data Synthesis which built upon the 2005 Freight Data Assessment. The primary finding of this research was that there are freight data needs in the State that would significantly improve freight transportation planning. First and foremost, was the need for improved origin-destination data to be collected on the interstates and key freight-intensive state highways in Colorado. This type of data was found to be significantly beneficial for several studies in other regions, including corridor studies, truck-rail diversion studies, safety studies, and economic development studies. The benefit of these data for corridor studies is particularly relevant for Colorado due to the corridor-based planning methodology that is practiced for long-range transportation planning in the State.

The research in the study also indicated that there were several other freight-related studies that would be beneficial to be undertaken in Colorado. These include a freight-focused vehicle classification count program, a truck safety analysis, and a freight-focused economic analysis. These types of studies were found to be both important in other regions and topics of interest for freight transportation planners in the State.

Ports-to-Plains Corridor Study

The Ports-to-Plains Corridor starts in Denver and travels along I-70 east to Limon where it follows U.S. 287 South to the Colorado border with Oklahoma. It continues through Oklahoma to Texas and ultimately terminates in Laredo, Texas. The corridor also includes a feeder segment that runs from Raton, New Mexico to Dumas, Texas. The corridor is nearly 1,400 miles long and consists of 511 miles of four- to six-lane roadway, 755 miles of two-lane roadway, and 113 miles of roadway in metropolitan areas. A coalition of State

DOTs in Colorado, New Mexico, Oklahoma, and Texas have come together to study this corridor. This most recent study was developed to develop an understanding of how to enhance the efficiency of the Ports to Plains Corridor. The study contains several elements that are designed to improve the transportation network's ability to move people and goods. The Ports to Plains Corridor includes the following needed construction elements:

- Widening 755 miles of two-lane roads to four-lane divided roads;
- Constructing 15 relief routes around larger towns;
- Adding amenities needed by commercial vehicle operators;
- Improving or constructing connective interchanges;
- Improving or constructing overpasses for railroad crossings;
- Replacing obsolete or deficient bridges;
- Installing corridor-specific signs; and
- Integrating an intelligent transportation system.

I-70 West Vail Pass

The I-70 West Vail Pass Draft Programmatic EIS identified the need for several freight-related improvements in large part due to the steep grades on I-70 and the large differential in travel speeds in part due to the relatively high percentage of trucks along this corridor. The need was supported by data relating to the number of accidents, a comparison of accident potential on similar highways in Colorado, as well as prevalent accident types on West Vail Pass. The study found that:

- Compared to adjacent segments of I-70, West Vail Pass has a higher number of total accidents. A total of 621 accidents occurred between 2002 and 2004 on West Vail Pass (MP 179.6 to 190.1). The 10-mile stretch of West Vail Pass experiences more accidents than 18 miles of adjacent highway.

- Compared to similar highways statewide, West Vail Pass is more prone to accidents than sections of I-70 adjacent to the project. The eight miles of I-70 west of the study area are less prone to accidents than similar highways statewide. The ten miles of I-70 east of the study area are substantially more prone to accidents than similar highways statewide, although less than West Vail Pass.

- Rear-end and side-swipe accidents are the most commonly occurring multivehicle accidents on West Vail Pass. These accident types are a good indicator of speed differences between vehicles. These speed differences can result in erratic, evasive driving maneuvers leading to safety concerns. Eighty-seven percent of multivehicle accidents on West Vail pass are either side-swipe, rear-end, or those involving stationary vehicles such as breakdowns or trucks installing chains.

I-70 East

The I-70 East Draft EIS project includes proposed improvements to the I-70 Corridor where it traverses northeast Denver, Colorado, from I-25 on the west to Tower Road on the east. The project limits extend along I-70 between I-25 and Tower Road and the project area covers established neighborhoods on the west end of the corridor and emerging residential and commercial areas on the east. It includes portions of Denver, Commerce City, Aurora, Adams County, and several Denver neighborhoods, including Globeville, Five Points, Elyria and Swansea, Cole, Clayton, Northeast Park Hill, Stapleton, Montbello, Green Valley Ranch, and Gateway.

The purpose of the project is to implement a transportation solution that improves safety, access, and mobility and addresses congestion on I-70. The need for this project results from the following issues:

1. Increased transportation demand.
2. Limited transportation capacity.
3. Safety concerns.
4. Transportation infrastructure deficiencies.

In addition to accommodating passenger travel, the I-70 Corridor is home to many industrial and warehousing businesses. These businesses account for much of the trucking and freight operations located in the corridor. Between 7 and 14 percent of the traffic on I-70 is truck traffic. East of Peña Boulevard, truck traffic accounts for approximately 14 percent of the total traffic. Truck access to these established areas and future activity centers is important for future economic development.

I-25 North EIS

The purpose of the project is to meet long-term travel needs between the Denver Metro Area and the rapidly growing population centers along the I-25 corridor north to the Fort Collins-Wellington area. To meet long-term travel needs, the project must improve safety, mobility, and accessibility, and provide modal alternatives and interrelationships. The need for the project can be summarized in the following four categories:

- Increased frequency and severity of crashes
- Increasing traffic congestion leading to mobility and accessibility problems
- Aging and functionally obsolete infrastructure
- Lack of modal alternatives

The project needs relate differently to highway and transit components of the solutions. Highway alternatives were evaluated in addressing all four of these needs. These highway needs also addressed the need to improve congestion and safety to meet the

needs of the freight community. Transit alternatives were evaluated in addressing two of the needs: increasing traffic congestion leading to mobility and accessibility problems, and lack of modal alternatives.

U.S. 160 Final EIS

This EIS was conducted on U.S. 160 in La Plata County, Colorado. This is one of the locations found to have a high volume of truck traffic and a V/C ratio equal or above 0.85 in 2027. The project length on U.S. 160 would be 16.2 miles, extending from milepost (MP) 88.0, located east of Durango, to MP 104.2, located east of Bayfield. The project length on U.S. 550 would be 1.2 miles, extending from MP 16.6, located at the U.S. 160/U.S. 550 (south) intersection, to MP 15.4, located south of the U.S. 550/County Road (CR) 220 intersection.

Much of this corridor was found to have an unacceptable V/C ratio in part due to the high percentage of trucks and recreational vehicles, directional distribution of traffic, rolling terrain, high density of access points, and limited passing opportunities. Additionally, existing maintenance issues include chronic winter roadway icing on some segments, sloughing of roadside cut slopes onto the highway, undersized or damaged culverts, poor roadway surface drainage, difficult snow removal conditions, removal of wildlife hit on the highway, and generally poor pavement conditions. Each of these road characteristics illustrate the need for freight-related improvements to the road condition.

Within the majority of the project corridor, U.S. 160 is a two-lane highway with 12-foot-wide traveling lanes. Trucks were found to comprise more than five percent of the current traffic volume. More than 38 percent of the alignment has highway grades in excess of three percent. Limited passing lanes are present at three locations; two eastbound and one westbound. Outside of these areas, passing opportunities are very limited due to horizontal and vertical roadway alignment deficiencies and poor sight distance conditions. This demonstrates the need for road geometry and capacity enhancement considerations to improve the commingling of truck and auto traffic.

SH-83/SH86 Corridor Optimization Plan

This study was undertaken in February of 2003. The study area was along State Highways 83 and 86, from E-470 in Parker to SH 105 in El Paso County, and from Castle Rock to Kiowa. SH83 was found to be a corridor with high truck volumes and high V/C ratios. The transportation system in the study area is characterized by a lack of options. The roadway network has substantial gaps at both the local and regional level, and there are few opportunities to use other modes of travel. In a study area approximately 25 miles wide east to west and 75 miles long north to south, State Highways 83 and 86 constitute the only major roadways. Filling the gaps in the roadway network has been complicated by the numerous drainage ways in the area, as well as by pockets of long-established development. Freight traffic is beginning to divert from the major roadways surrounding the study area to the few continuous corridors within the study area. These facilities are

physically unsuited for freight movement and pass through the core of several communities. This illustrates the need for truck route management in this study area. Congestion also is a growing problem in the study area. The Kiowa-Bennett Road, and the Elbert Road and adjacent uses are burdened by increases in freight traffic.

E.7 Key Findings

Overall freight moving to, from, within, and through Colorado amounted to 354 million tons in 2004, and will nearly double to 693 million tons by 2035. Most of this freight (by tonnage) consists of intrastate and through movements. Intrastate movements are dominated by minerals and other heavy, resource-based commodities (which may exacerbate infrastructure deterioration). Colorado also experiences a high level of through freight movements which impacts the State's transportation system even though they are not directly related to economic activity in the State.

At present, roadways that are both congested and have heavy truck traffic are overwhelmingly located in the Denver area. However, freight activity is expected to spread out more from Denver in the coming years, especially along the I-25 and I-70 corridors. Much of this growth will be the result of increasing drayage movements in urban areas, primarily trucks moving goods from warehouses and distribution centers to retail outlets. Growing freight-related congestion in the Denver Area, Pikes Peak, Intermountain, and North Front Range TPRs is likely to exacerbate existing congestion while also impeding the efficient flow of freight in Colorado, which may have detrimental economic impacts. CDOT should therefore monitor truck traffic levels in Denver and other urbanized areas to spot potential problem areas in advance, and consider potential mitigation measures such as intelligent transportation systems (ITS) technology.

There also is a significant portion of the road infrastructure that is in poor condition and has a high volume of truck activity. This indicates the need for improved pavement maintenance with a focus on freight-intensive corridors and segments.

There have been several corridor studies in Colorado (both general planning and environmental) that have touched on freight needs. These needs include congestion relief, safety improvements, reduction in truck-auto interaction, and rerouting of truck traffic. These needs seem to be recurring themes throughout the corridor study efforts on the corridors with relatively high volumes of truck traffic.

There have been several rail studies over the past decade in Colorado which indicate the need for a systemwide understanding of rail flows in the State and an analysis of truck-rail diversion issues in the State. Both of these items would be inputs to the current rail relocation efforts in the State.

Freight data needs have been cited in multiple studies as being important for supporting freight planning. In particular, the need for improved truck origin-destination data and

the need for an understanding of the relationship between freight and the economy are particularly notable.

F. Safety Analysis

This technical memorandum discusses the safety analysis performed for the Colorado Statewide Freight Roadmap. The memorandum is divided into the following sections:

- **Statewide Crashes –** Highway crashes and fatalities are discussed on a statewide basis.
- **Crashes by Corridor –** Crashes along the interstate and National Highway System (NHS) corridors are discussed, with the intestates broken down into I-70, I-25, and I-76 corridors and each discussed separately.
- **Crashes by Transportation Planning Region (TPR) and Metropolitan Planning Organization (MPO) –** Crashes are analyzed comparing Colorado's TPRs and MPOs.
- **Truck-Involved Crash Locations and Types –** Analysis of where and how truck-involved crashes are occurring.
- **Truck-Involved Fatal Crash Locations and Types –** Analysis of where and how truck-involved fatal crashes are occurring.

The memorandum also summarizes the results of the safety analysis and discusses implications for traffic safety in the State of Colorado. The vehicle miles traveled (VMT) data used for this analysis is based on the Colorado DOT's CORIS database. The crash data is based on the Colorado statewide crash database.

F.1 Methodology

The two basic components for the safety analysis are:

1. **Number of crashes by accident type –** We classified accidents in the Colorado accident databases according to whether a truck was involved (truck-involved) or whether they only involved passenger vehicles (auto-only).
2. **Vehicle miles traveled (VMT) –** We used total automobile and truck vehicle miles traveled data developed from the Colorado Roadway Information System (CORIS) database combined with GIS road network files, all of which was input into a GIS platform.

Number of Crashes

Colorado tracks all accidents on state roadways on an annual basis and records them in a database. We obtained data for each of the six years from 1999 to 2004. In the Colorado accident databases, there are the following 15 types of vehicles:

- Passenger cars/vans
- Passenger cars/vans with trailers
- Pickup trucks/utility vans
- Pickup trucks/utility vans with trailers
- Trucks – GVW 10,000 lbs or less
- Trucks – GVW > 10,000 lbs and buses over 15 passengers
- Motor homes
- Other
- School buses (less than 15 people)
- Nonschool buses (less than 15 people)
- Motorcycles
- Bicycles
- Motorized bicycles
- Farm equipment
- Hit and run – unknown

For each accident, the database records the vehicle types for up to three vehicles involved in the accident. In developing our accident counts, we excluded all accidents that did not involve at least one passenger car/van, pickup truck, or commercial truck (see the shaded areas of the bullet list). We defined auto-only accidents as those that only involved one or more cars, vans, or pickup trucks. Any accident that involved a commercial truck, regardless of weight rating, was counted as a truck-involved accident. Therefore, truck-involved accidents also may involve passenger vehicles, but no auto-only accident involves a commercial truck. Accidents that only involved vehicle types other than passenger cars or trucks and commercial trucks (i.e., the nonshaded areas) are not included in the analysis.

It should be noted that several safety-related studies compare truck-involved crashes to auto-involved crashes. This type of disaggregation is most useful when comparing the safety of trucks to the safety of autos. This method does however involve double counting of some crashes since crashes that involve both a truck and an auto are included in both categories. In this memo, we avoid that double counting by using auto-only crashes rather than auto-involved crashes. This allows us to examine trucks and autos separately. However, because of our chosen methodology, it should be noted that **the results in this memorandum should not be used to compare the operating safety of trucks relative to autos**.

Vehicle Miles Traveled (VMT)

We used the CORIS database to compute VMT. CORIS tracks the characteristics of the CDOT state highway network on an annual basis. The database includes roadway information for all CDOT-maintained highways in the State, segmented by mileposts. The data parameters used for this analysis included average annual daily traffic (AADT), the percentage of trucks in the traffic mix, and the length of each segment. We obtained the CORIS file for each year in the analysis (1999 to 2004). We used this data to calculate total VMT, truck VMT, and automobile VMT as follows:

- Total VMT was estimated by multiplying the segment AADT by 365 to get an annual traffic estimate. That estimate was then multiplied by the length of the segment to get annual vehicle miles traveled.

- Truck VMT was developed using a similar method, but the annual traffic estimate was multiplied by the percentage of trucks to arrive at total annual truck traffic for the segment. Finally, we multiplied this figure by the length of the segment to get annual truck vehicle miles traveled.

- Automobile VMT estimates were derived by subtracting truck VMT from total VMT.

Accident Rates

We calculated accident rates by dividing the number of each accident type (auto-only or truck-involved) by the appropriate vehicle miles traveled measurement, in millions. These calculations were developed for the State as a whole, 15 transportation planning regions (TPR), and five metropolitan planning organizations (MPO).

F.2 Statewide Crashes

As shown in Table F.1, the total number of auto-only crashes in Colorado has been steadily increasing from 47,510 in 1999 to 54,949 in 2004. The auto-only crash rate has fluctuated between 2.12 and 2.27 crashes per million VMT. Truck-involved crashes have had more volatility than auto-only crashes. They have fluctuated from a low of 4,139 in 2000 and a high of 4,802 in 2002. The truck-involved crash rate has varied from a low of 1.63 and a high of 1.91 truck-involved crashes per million truck VMT. The truck-involved crash rate from 1999 to 2004 was 18 percent lower than the auto-only crash rate. The implication of the statewide crash data is that trucks get into crashes less often than autos. This is consistent with the national data on truck and auto crashes.

Between 1999 and 2004, auto-only fatal crashes have fluctuated between a low of 259 in 1999 and a high of 369 in 2002 (see Table F.2). During the same period, the truck-involved fatal crashes have fluctuated between a low of 46 in 2002 and a high of 67 in 2001. The

truck-involved fatal crash rate from 1999 to 2004 was 0.0219 fatal crashes per million truck VMT. This is 67 percent higher than the auto-only fatality rate of 0.0131 during the same time period. Therefore, even though trucks have a lower crash rate than autos, they have a much higher fatal crash rate compared to autos supporting the notion that truck-involved crashes are much more severe than auto-only crashes.

Table F.1 Statewide Crashes and Crash Rates
1999 to 2004

Year	Auto-Only Crashes	Auto-Only Crash Rate (Crashes/Million VMT)	Truck-Involved Crashes	Truck-Involved Crash Rate (Crashes/Million VMT)
1999	47,510	2.13	4,311	1.76
2000	47,996	2.12	4,139	1.63
2001	52,515	2.27	4,539	1.83
2002	53,939	2.26	4,802	1.89
2003	53,871	2.26	4,620	1.91
2004	54,949	2.19	4,792	1.85
Total	**310,780**	**2.21**	**27,203**	**1.81**

Table F.2 Statewide Fatal Crashes and Crash Rates
1999 to 2004

Year	Auto-Only Fatal Crashes	Auto-Only Fatal Crash Rate (Crashes/Million VMT)	Truck-Involved Fatal Crashes	Truck-Involved Fatal Crash Rate (Crashes/ Million VMT)
1999	259	0.0116	52	0.0212
2000	309	0.0137	52	0.0205
2001	319	0.0138	67	0.0270
2002	369	0.0155	46	0.0181
2003	297	0.0124	53	0.0220
2004	298	0.0119	58	0.0223
Total	**1,851**	**0.0131**	**328**	**0.0219**

F.3 Crashes by Corridor

Tables F.3 through F.6 show the crash rates along I-70, I-25, I-76, and other state highways that are NHS corridors in Colorado. Roughly 75,000 of Colorado's 311,000 auto-only crashes (24 percent) between 1999 and 2004 occurred on I-70, I-25, and I-76. These three interstates were the locations for an even higher percentage of the State's truck-involved crashes with 10,668 of Colorado's 27,203 truck-involved crashes occurring on these three interstates. The other NHS corridors in the State were responsible for 54 percent of the State's auto-only crashes and 42 percent of the State's truck-only crashes.

The crash rates on the interstates were lower than the statewide crash rate on a per VMT basis. For I-70, I-25, and I-76, the respective auto-only crash rates were 1.49, 1.56, and 1.15 crashes per million VMT between 1999 and 2004. These are all lower than the statewide auto-only crash rate of 2.21. Similarly, the truck-involved crash rates on the three interstates were 1.42, 1.68, and 0.83 crashes per million VMT during the same time period for I-70, I-25, and I-76. These are all much lower than the 1.81 truck-involved crashes per million VMT for the entire State.

For the other NHS corridors, both the auto-only and truck-involved crash rates were significantly higher than for the rest of the State. Particularly noteworthy is that the truck-involved crash rate on the other NHS corridors was 2.41 crashes per million truck VMT, which is 33 percent higher than the 1.81 truck-involved crash rate for the entire State. The implication of this data is that the interstates are relatively the safest location for trucks to operate, while the noninterstate NHS corridors are the least safe location for trucks to operate.

Table F.3 I-70 Crash Rates Based on VMT

1999 to 2004

Year	Auto-Only	Truck-Involved	Auto-Only Crash Rate (Crashes/Million VMT)	Truck-Involved Crash Rate (Crashes/Million VMT)
1999	4,624	777	1.65	1.39
2000	4,399	749	1.56	1.32
2001	4,311	764	1.45	1.51
2002	4,597	800	1.43	1.39
2003	4,747	764	1.49	1.53
2004	4,739	778	1.39	1.39
Total	**27,417**	**4,632**	**1.49**	**1.42**

Table F.4 I-25 Crash Rates Based on VMT

1999 to 2004

Year	Auto-Only	Truck-Involved	Auto-Only Crash Rate (Crashes/Million VMT)	Truck-Involved Crash Rate (Crashes/Million VMT)
1999	6,848	832	1.56	1.66
2000	6,754	772	1.51	1.51
2001	7,267	836	1.58	1.62
2002	7,231	930	1.56	1.79
2003	7,135	878	1.55	1.69
2004	7,489	946	1.58	1.78
Total	**42,724**	**5,194**	**1.56**	**1.68**

Table F.5 I-76 Crash Rates Based on VMT

1999 to 2004

Year	Auto-Only	Truck-Involved	Auto-Only Crash Rate (Crashes/Million VMT)	Truck-Involved Crash Rate (Crashes/Million VMT)
1999	741	124	1.28	0.79
2000	552	96	0.92	0.57
2001	676	144	1.14	0.89
2002	744	140	1.09	0.80
2003	815	169	1.32	1.06
2004	866	169	1.16	0.87
Total	**4,394**	**842**	**1.15**	**0.83**

Table F.6 NHS Corridors Crash Rates Based on VMT (Excluding I-70, I-25, and I-76)
1999 to 2004

Year	Auto-Only	Truck-Involved	Auto-Only Crash Rate (Crashes/Million VMT)	Truck-Involved Crash Rate (Crashes/Million VMT)
1999	25,016	1,788	2.70	2.35
2000	25,874	1,807	2.74	2.24
2001	28,349	1,967	2.93	2.44
2002	28,931	2,011	2.94	2.55
2003	28,808	1,933	2.86	2.46
2004	29,723	2,007	2.81	2.43
Total	**166,701**	**11,513**	**2.83**	**2.41**

F.4 Crashes by TPR and MPO

In this section, crash rates for Colorado's TPRs and MPOs are calculated for the entire six-year period from 1999 to 2004. Tables providing detailed crash data for each individual year and each TPR and MPO are included at the end of this memorandum.

It is important to note that spatial analysis conducted in this section required the joining of two databases: 1) the CDOT CORIS database which includes roadway information in geospatial format; and 2) GIS layers describing the boundaries and roadways that are included in each TPR and MPO. These databases did not perfectly match and therefore some of the crashes in the statewide database were not easily locatable into a TPR or MPO. Therefore the analysis in this section is most relevant for comparisons between TPRs and MPOs, while comparisons to statewide should be treated with caution.

Figure F.1 shows the crash rates for auto-only and truck-involved crashes for each TPR in the State. The figure shows that the Southwest TPR has an extremely high crash rate for both auto-only and truck-involved crashes relative to the other TPRs. This is because there were an extraordinarily high number of crashes reported for this TPR during the six-year period. The total number of accidents in the Southwest TPR was 32,389, which is second only to Denver and far more than the neighboring Gunnison Valley TPR (6,337), which has nearly the same VMT. A brief analysis of the Southwest TPR data revealed that some crash types may be over reported, particularly rear-end collisions. Of the 32,389 crashes, 43 percent (13,881) were rear-end collisions. By comparison, only 18 percent of

the Gunnison Valley TPR incidents were rear-end crashes. This may therefore represent problems with the underlying data.

The Greater Denver Area TPR has the second highest auto-only and truck-involved crash rates in the State. It is interesting to note that the Greater Denver TPR is one of the few TPRs where the truck-involved crash rate is higher than the auto-only crash rate.

Overall, truck-involved crashes have lower rates than auto-only crashes, coinciding with the statewide pattern observed. The fatal crash rates (Figure F.2) display the opposite pattern with truck-involved fatal crash rates higher than auto-only fatal crash rates in most TPRs. This also is similar to the statewide pattern. This further reinforces the notion that trucks are less likely to be involved in a crash, but when they are involved in a crash, it is more severe.

Figures F.3 and F.4 show the crash rates and fatal crash rates for Colorado's MPOs. The Denver Regional Council of Governments has the highest truck-involved crash rates while North Front Range has the highest fatality crash rates for truck-involved crashes. It is interesting to note that the truck-involved fatal crash rate is significantly higher than the auto-only fatal crash rate in the North Front Range MPO. A map of the fatal crashes in the North Front Range MPO is included as Figure F.5. The map shows that a high percentage of the truck-involved fatal crashes in this MPO are occurring on I-25. Future analysis may be warranted at this location to determine the cause of truck-involved crashes and potential solutions.

Figure F.1 Crash Rates by TPR Based on Millions of VMT

1999 to 2004 Totals

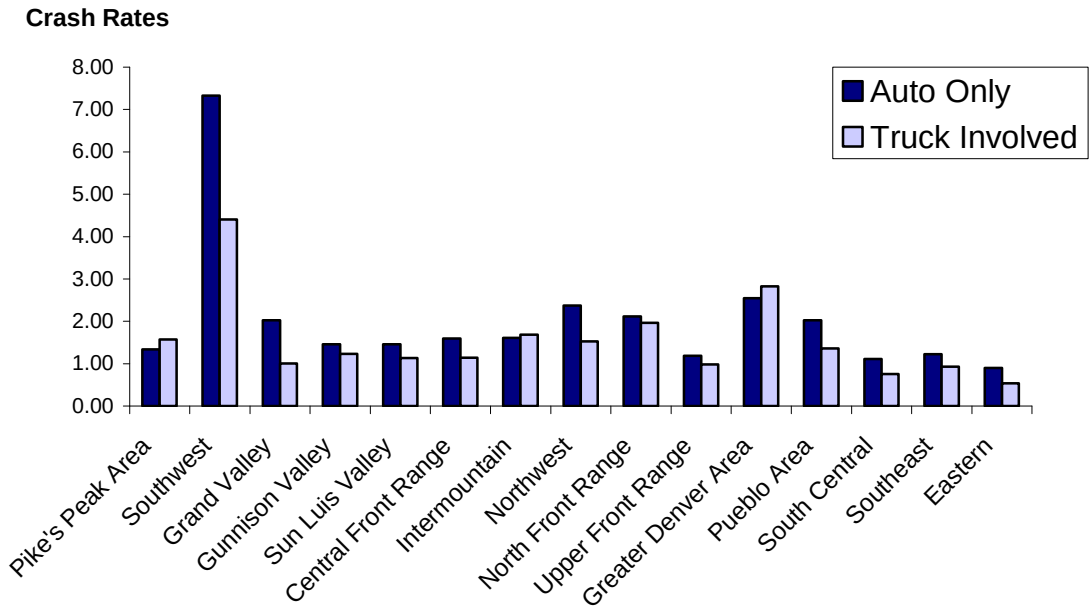


Figure F.2 Fatal Crash Rates by TPR Based on Millions of VMT

1999 to 2004 Totals

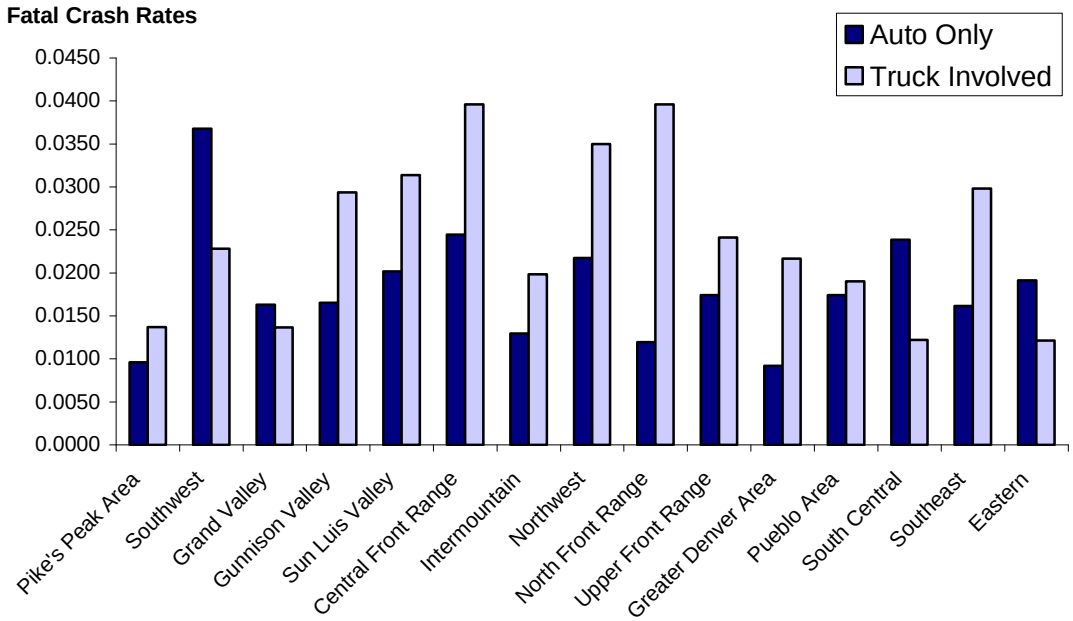


Figure F.3 Crash Rates by MPO Based on Millions of VMT

1999 to 2004

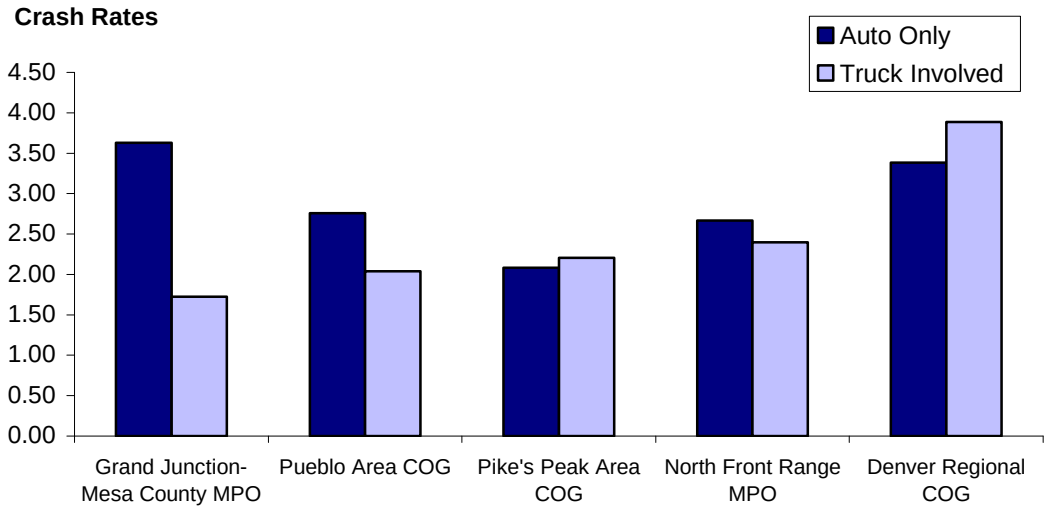


Figure F.4 Fatal Crash Rates by MPO Based on Millions of VMT

1999 to 2004

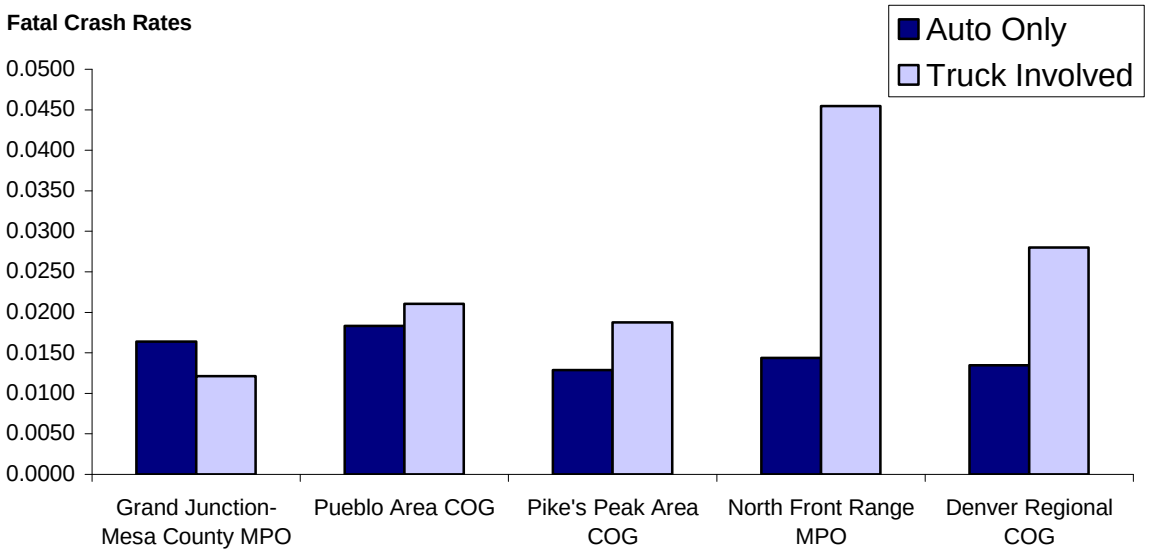
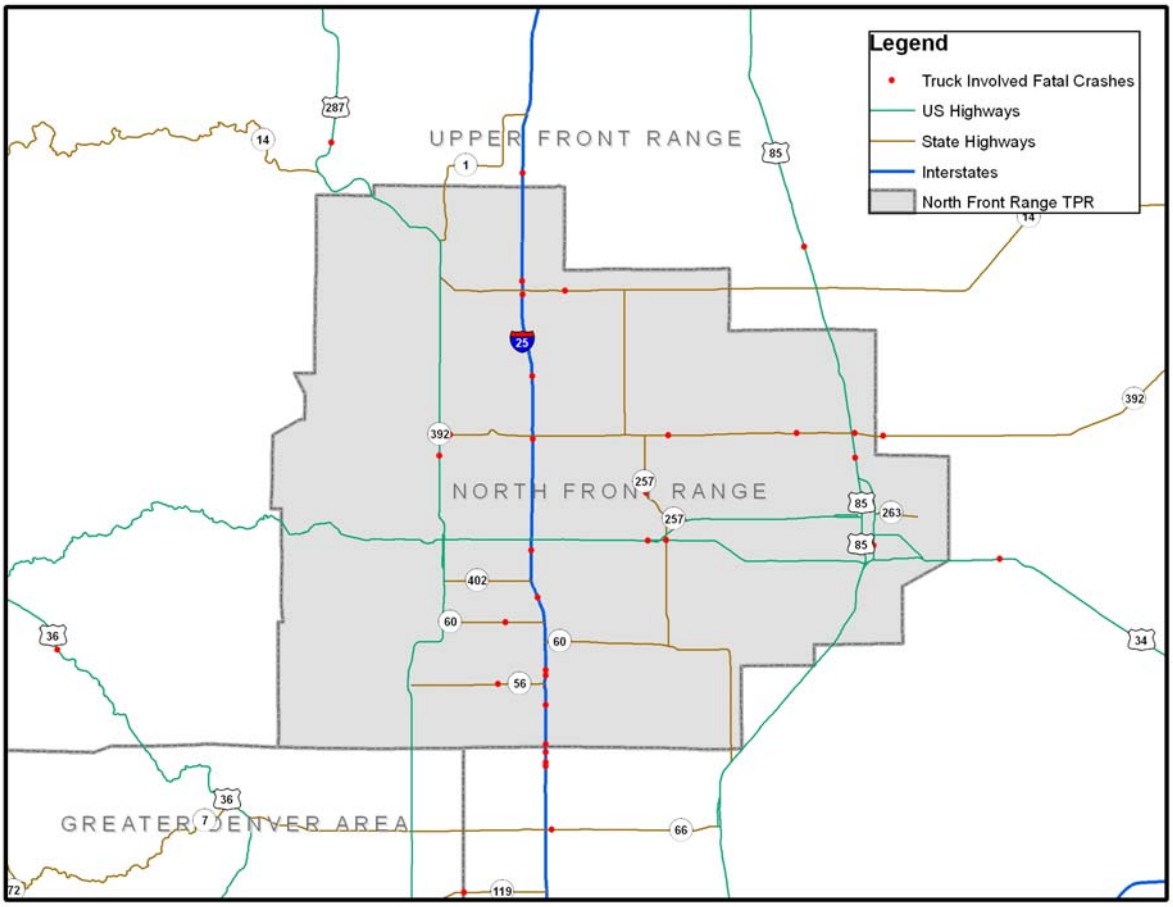


Figure F.5 Truck-Involved Fatal Crashes in North Front Range



F.5 Truck-Involved Crash Types

Table F.7 shows truck-involved crashes by crash type between 1999 and 2004 in Colorado. While there are over 20 categories of crash types that are tracked in the statewide crash database, two crash types are dominant for truck-involved crashes. The most common truck-involved crashes are rear-end and side swipe crashes in the same direction. These two crash types accounted for over half of all truck-involved crashes during the six-year time period.

Among all the truck-involved crashes in Colorado, 63 percent are caused by the truck driver (Table F.8). For truck-involved crashes that also involved an automobile, the number of truck at-fault crashes decreases from 63 percent to 43. This indicates that when automobiles are involved in a truck crash, the other vehicles are more often responsible for causing the crash.

Table F.9 shows that for roughly two-thirds of the truck at-fault crashes, "None Apparent" was recorded by the police officer as the cause of the crash. It is unclear why this was marked in such a high percentage of crashes, but it indicates that there may need to be more training on the importance of collecting detailed crash information at the crash scene by the arriving officer.

The wide range of accident types provides the opportunity for several different types of analyses of accident types by location, time of day, vehicle type, and road conditions. Due to resource limitations on this study, we provided additional analysis on only two accident types that were noted to be of particular interest to the project team prior to when this analysis was conducted. The two specific accident types are: Asleep-At-the-Wheel accidents and Travel Speeds Prior to Crash.

Asleep At the Wheel

Of all truck-involved crashes that are caused by falling asleep, 56 percent of 508 crashes are caused by the truck driver falling asleep, while the remaining 44 percent are caused by drivers in automobiles falling asleep. However, for most truck driver falling asleep crashes, the truck is the only vehicle involved in the crash. Table F.9 shows that there were 286 asleep at wheel crashes caused by trucks between 1999 and 2004. Only 19 percent of those crashes (45 of the 286) involved another vehicle, while the remaining 81 percent were truck-only crashes.

Figure F.6 shows the location of truck-involved asleep at wheel crashes in Colorado. As the figure shows, the vast majority of these types of crashes occurred on the interstate system. This is consistent with the notion of long-haul truck drivers being more likely to fall asleep, since they primarily utilize the interstate system within Colorado. Table F.10 summarizes the asleep at wheel crashes by TPR. The table indicates that in percentage terms, asleep at the wheel crashes tend to happen the most in rural TPRs.

Table F.11 shows asleep at the wheel crashes by MPO. As with the TPRs, rural areas tend to have higher rates of truck-involved asleep at the wheel crashes, on a percentage basis.

Travel Speeds Prior to Crash

Travel speed at the time of crashes is estimated by the patrol officer arriving to the scene of a crash. Table F.12 shows that 35 percent of truck-involved crashes occur when the truck was traveling at less than 35 miles per hour (mph) and less than 25 percent of all crashes occur with the truck driver driving at 55 mph or more. This indicates that most truck-involved crashes are slow speed events.

Table F.7 Distribution of Truck Crashes by Crash Type
1999 to 2004

Crash Types	1999	2000	2001	2002	2003	2004	Total	Percent Total
Rear-End	1,175	1,188	1,282	1,429	1,189	1,246	**7,509**	**27.60**
Sideswipe Same Direction	1,181	1,124	1,242	1,294	1,290	1,371	**7,502**	**27.58**
Broadside	287	304	309	355	294	288	**1,837**	**6.75**
Overturning	282	233	202	186	236	217	**1,356**	**4.98**
Other Noncollision	145	175	178	152	168	210	**1,028**	**3.78**
Involving Other Object	103	76	126	175	242	216	**938**	**3.45**
Approach Turn	134	167	157	152	134	153	**897**	**3.30**
Parked Motor Vehicle	105	115	116	106	126	131	**699**	**2.57**
Overtaking Turn	120	127	118	118	104	98	**685**	**2.52**
Wild Animal	72	56	78	111	129	104	**550**	**2.02**
Sideswipe Opposite Direction	92	82	85	105	81	102	**547**	**2.01**
Guard Rail	32	66	75	69	56	94	**392**	**1.44**
Sign	62	43	50	51	70	71	**347**	**1.28**
Head-On	51	42	64	42	43	73	**315**	**1.16**
Light/Utility Pole	54	44	42	35	51	46	**272**	**1.00**
Median Barrier	23	38	38	50	32	60	**241**	**0.89**
Fence	59	18	29	28	53	32	**219**	**0.81**
Embankment	39	21	46	34	39	31	**210**	**0.77**
Delineator Post	26	15	72	58	21	16	**208**	**0.76**
Domestic Animal	44	21	35	45	34	27	**206**	**0.76**
Other Fixed Object	30	32	39	29	31	40	**201**	**0.74**
Traffic Signal Pole	46	32	23	32	32	25	**190**	**0.70**
Road Maintenance Equipment	28	15	13	17	29	20	**122**	**0.45**
Bridge Abutment	21	21	6	26	19	17	**110**	**0.40**
Pedestrian (All Other)	17	9	19	13	18	19	**95**	**0.35**
Bridge Rail	17	15	13	7	26	13	**91**	**0.33**
Curb	5	5	24	9	8	15	**66**	**0.24**
Barricade	12	9	7	9	14	7	**58**	**0.21**
Tree	8	11	11	8	12	5	**55**	**0.20**

Table F.7 Distribution of Truck Crashes by Crash Type
1999 to 2004

Crash Types	1999	2000	2001	2002	2003	2004	Total	Percent Total
Large Boulder	6	3	2	13	5	11	**40**	**0.15**
Wall/Building	6	7	7	5	6	7	**38**	**0.14**
Bicycle	6	10	4	5	6	5	**36**	**0.13**
Culvert/Headwall	10	5	7	7	2	3	**34**	**0.12**
Mailbox	2		6	3	5	4	**20**	**0.07**
Crash Cushion		3	4	5	4	1	**17**	**0.06**
Pedestrian (School Age)			3	2	1	1	**7**	**0.03**
Column/Pier	1	1		2	1	1	**6**	**0.02**
Railway Vehicle	2	1		2			**5**	**0.02**
Unknown	1		2				**3**	**0.01**
Motorized Bicycle	1					1	**2**	**0.01**
Total	**4,311**	**4,139**	**4,539**	**4,802**	**4,620**	**4,792**	**27,203**	**100.00**

Table F.8 Truck At-Fault Crashes
1999 to 2004

	Total Truck-Involved Crashes	Total Truck At-Fault Crashes	Percent Truck At-Fault
1999	4,311	2,751	64%
2000	4,139	2,546	62%
2001	4,539	2,838	63%
2002	4,802	3,004	63%
2003	4,620	2,910	63%
2004	4,792	3,022	63%
Total	**27,203**	**17,071**	**63%**

Table F.9 Truck At-Fault Crashes by Cause
1999 to 2004

Crash Causes	Truck at Fault – Other Vehicle Involved	Truck at Fault – Truck Only
Asleep at the Wheel	45	241
Distracted by Passenger	17	7
Driver Emotionally Upset	19	4
Driver Fatigue	47	49
Driver Inexperience	325	346
Driver Preoccupied	1,624	463
Driver Unfamiliar with Area	316	343
Evading Law Enforcement Officer	3	3
Illness	21	34
None Apparent	8,680	3,605
Physical Disability	8	3
Unknown	656	212
Total	**11,761**	**5,310**

Figure F.6 Location of Truck at Fault Asleep at Wheel Crashes

1999 to 2004

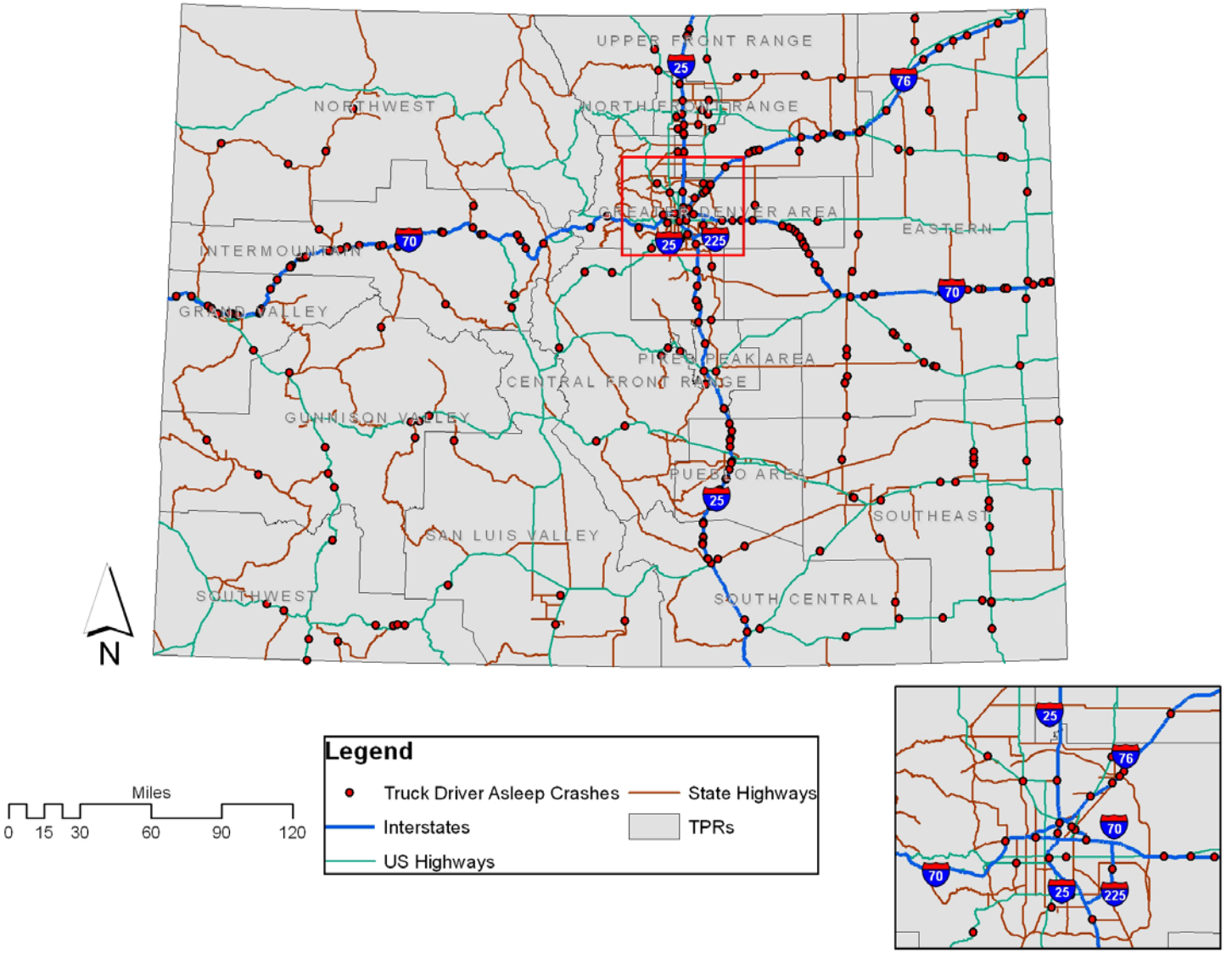


Table F.10 Asleep At Wheel Crashes by TPR

1999 to 2004

TPR	Total	Truck-Involved	Truck At-Fault	Percent Truck-involved	Percent Truck At-Fault
Eastern	512	81	57	15.8%	11.1%
South Central	170	21	16	12.4%	9.4%
Southeast	186	29	23	15.6%	12.4%
Grand Valley	218	22	15	10.1%	6.9%
Pueblo Area	245	24	16	9.8%	6.5%
Upper Front Range	540	64	33	11.9%	6.1%
Gunnison Valley	210	13	11	6.2%	5.2%
Central Front Range	229	12	7	5.2%	3.1%
Southwest	392	17	10	4.3%	2.6%
Intermountain	588	42	30	7.1%	5.1%
San Luis Valley	225	10	5	4.4%	2.2%
North Front Range	293	21	12	7.2%	4.1%
Northwest	222	5	4	2.3%	1.8%
Pikes Peak Area	304	17	8	5.6%	2.6%
Greater Denver Area	1,945	128	49	6.6%	2.5%

Table F.11 Asleep At Wheel Crashes by MPO

MPO	Total	Truck-Involved	Truck At-Fault	Percent Truck-Involved	Percent Truck At-Fault
Denver Regional COG	1,784	113	37	6.3%	2.1%
Grand Junction	75	8	6	10.7%	8.0%
North Front Range	286	22	12	7.7%	4.2%
Pueblo COG	130	14	8	10.8%	6.2%
Pikes Peak COG	262	15	7	5.7%	2.7%

Table F.12 Truck-Involved Crashes Speed Distribution

Speed	1999	2000	2001	2002	2003	2004	Total	Percent Total
Less than 35 m.p.h.	1,573	1,551	1,625	1,686	1,514	1,678	9,627	**35.4**
35 to 44.9 m.p.h.	456	430	466	520	457	458	2,787	**10.3**
45 to 54.9 m.p.h.	506	431	478	490	509	494	2,908	**10.7**
55 to 64.9 m.p.h.	500	489	576	593	596	616	3,370	**12.4**
65 to 74.9 m.p.h.	458	377	557	585	655	703	3,335	**12.3**
75 m.p.h. or More	30	23	31	28	26	33	171	**0.6**
Unknown	788	838	806	900	863	810	5,005	**18.4**
Total	**4,311**	**4,139**	**4,539**	**4,802**	**4,620**	**4,792**	**27,203**	**100.0**

F.5 Truck-Involved Fatal Crash Locations and Types

This section discusses the locations and types of truck-involved fatal crashes. Figure F.7 shows the location of truck-involved fatal crashes between 1999 and 2004. It shows a concentration of these crashes in the Denver metropolitan region, but also a significant amount in rural locations and off-interstate locations. Therefore, truck-involved fatal crashes appear to be impacting all regions throughout the State.

Table F.13 lists the largest types of fatal crashes. Head-on collisions are the most common type of truck-involved fatal crashes with 81 fatal crashes between 1999 and 2004 constituting roughly 25 percent of all truck-involved fatal crashes. Table F.7 shows that there were only 315 truck-involved head-on collisions in the State during the six-year period. Therefore, almost 26 percent of head-on collisions in the State resulted in fatal crashes. This can be compared to rear-end collisions which are the second highest fatal crash type with 46 fatal crashes between 1999 and 2004. Only 46 of the 7,509 (0.6 percent) truck-involved rear-end crashes were fatal. Broadside crashes are the third highest fatal crash type with 32 fatal crashes between 1999 and 2004. However, only 1.7 percent of the total 1,837 truck-involved broadside crashes were fatal. The implication of this analysis is that the most efficient method of reducing truck-involved fatal crashes is to reduce head-on collisions. This indicates that solutions such as medians and rumblestrips located between opposing traffic streams should be a consideration for safety improvement projects.

Table F.14 shows that only 17 percent of truck-involved fatal crashes occur while the truck was moving at a speed below 35 mph. This can be compared with the 35 percent of all

truck-involved crashes occurring at this speed. This indicates that vehicle speed also is a contributing factor to truck-involved fatalities, since low vehicle speeds have disproportionately high survivor rates relative to higher speeds. Over one-half of all of the truck-involved fatal crashes occur at speeds of 55 mph or higher. This can be compared to only 25 percent of all truck-only involved crashes occurring at these speeds.

Figure F.7 Location of Truck-Involved Fatalities

1999 to 2004

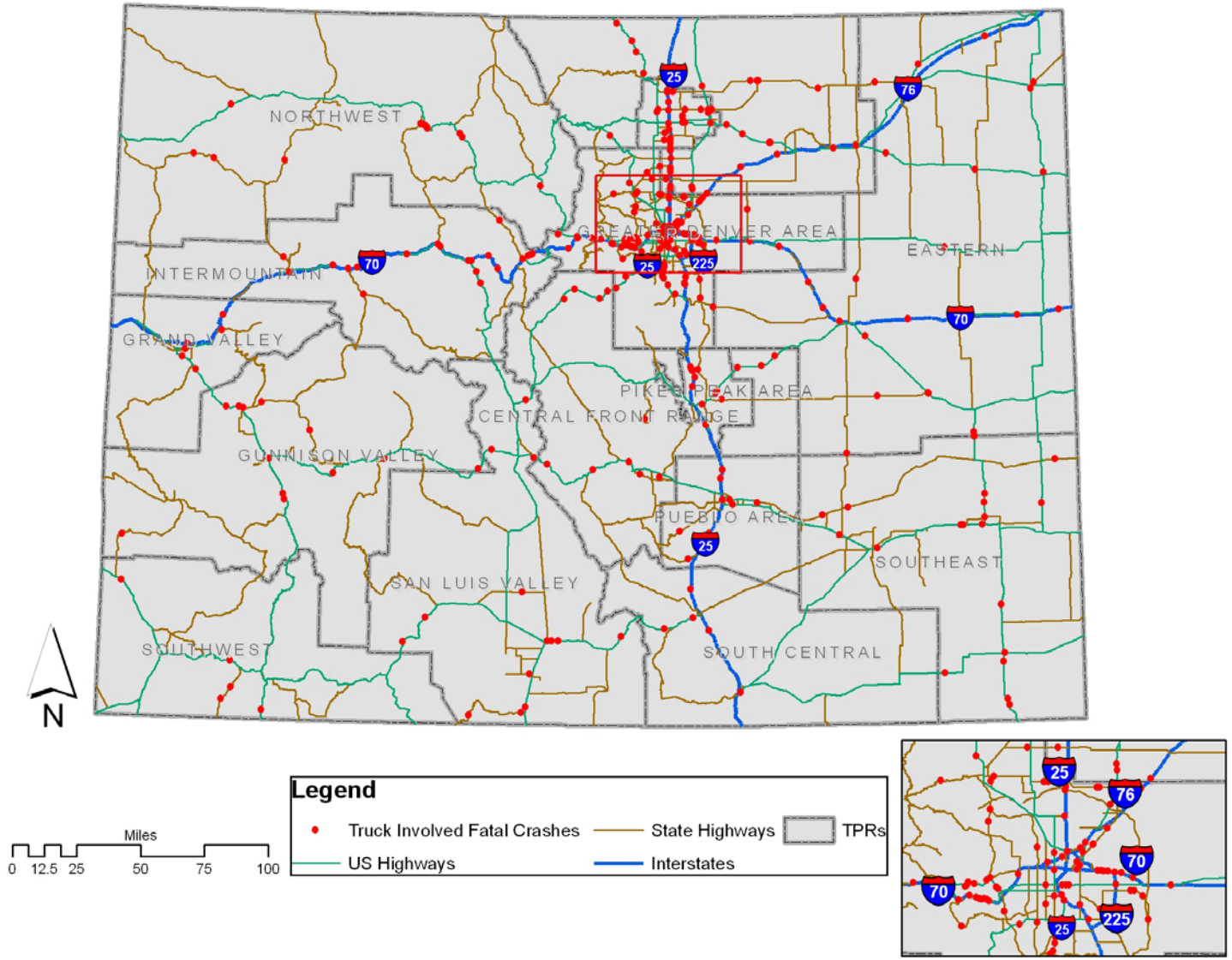


Table F.13 Distribution of Truck Involved Fatal Crashes by Crash Types
1999 to 2004

Crash Type	1999	2000	2001	2002	2003	2004	Total	Percent Total
Head-On	11	8	21	11	12	18	81	**24.7**
Rear-End	8	7	8	10	9	4	46	**14.0**
Broadside	3	7	4	6	5	7	32	**9.8**
Overturning	7	5	8	6	3	3	32	**9.8**
Sideswipe Opposite Direction	6	5	5	1	3	3	23	**7.0**
Sideswipe Same Direction	2	5	3	2	5		17	**5.2**
Pedestrian (All Other)	1	3	5	1	2	4	16	**4.9**
Approach Turn	4	1	3	1	2	4	15	**4.6**
Overtaking Turn	3	3	1	2	1	5	15	**4.6**
Parked Motor Vehicle	2	1	2	1	1	1	8	**2.4**
Fence	3				3		6	**1.8**
Guard Rail		1	3			2	6	**1.8**
Other Noncollision			2	1	2	1	6	**1.8**
Involving Other Object				1	1	1	3	**0.9**
Median Barrier		1	1	1			3	**0.9**
Road Maintenance Equipment	1				1	1	3	**0.9**
Sign		1			1	1	3	**0.9**
Bicycle		1				1	2	**0.6**
Bridge Abutment						2	2	**0.6**
Bridge Rail	1				1		2	**0.6**
Light/Utility Pole				1	1		2	**0.6**
Culvert/Headwall				1			1	**0.3**
Domestic Animal		1					1	**0.3**
Railway Vehicle		1					1	**0.3**
Tree			1				1	**0.3**
Wild Animal		1					1	**0.3**
Total	**52**	**52**	**67**	**46**	**53**	**58**	**328**	**100.0**

Table F.14 Truck Involved Fatal Crashes by Speed

Speed	1999	2000	2001	2002	2003	2004	Total	Percent Total
Less than 35 m.p.h.	11	7	10	8	9	13	58	**17.7**
35 to 44.9 m.p.h.	3	3	6	6	1	2	21	**6.4**
45 to 54.9 m.p.h.	7	6	3	6	5	4	31	**9.5**
55 to 64.5 m.p.h.	6	13	21	6	9	15	70	**21.3**
65 to 74.9 m.p.h.	11	14	12	10	18	9	74	**22.6**
More than 75 m.p.h.	8	4	9	6	8	10	45	**13.7**
Unknown	6	5	6	4	3	5	29	**8.8**
Total	**52**	**52**	**67**	**46**	**53**	**58**	**328**	**100.0**

F.6 Summary of Results

Based on the above analysis, a summary of the key results can be described as follows:

- The statewide auto-only crash rates, auto-only fatal crash rates, truck-involved crash rates, and truck-involved fatal crash rates were stable between 1999 and 2004. There is no trend towards increasing or decreasing rates on a per VMT basis.
- Crash rates and fatal crash rates vary significantly by MPO and TPR. Further study is needed to determine the reason for this variability, particularly as it relates to the Southwest TPR. This may represent problems with the data.
- It is unclear why crash rates for
- Truck-involved crash rates are slightly lower than auto-only crash rates, but truck-involved fatal crash rates are higher than auto-only fatal crash rates. This indicates that though they are less frequent on a VMT basis, truck-involved crashes tend to be more severe.
- Interstates have lower truck-involved crash rates than the overall statewide truck-involved crash rates. Noninterstate NHS corridors have higher crash rates than the statewide rates.
- In truck-auto crashes, truck drivers are less often at-fault relative to auto drivers.

- Head-on collisions are a major generator for truck-involved fatal crashes. They are the most common type of crash and an extraordinarily high percentage of truck-involved head-on collisions result in fatal crashes.

- High-travel speeds are positively correlated to truck-involved fatal crashes.

Table F.15 Crashes and Crash Rates (per million VMT) by TPR

1999 to 2004

Crashes					Fatalities				
Year	Auto-Only	Truck-Involved	Auto-Only Crash Rate	Truck-Involved Crash Rate	Year	Auto-Only	Truck-Involved	Auto-Only Fatality Rate	Truck-Involved Fatality Rate
Pikes Peak Area									
1999	1,730	167	1.13	1.62	1999	13	2	0.0085	0.0194
2000	2,390	226	1.59	2.24	2000	25	4	0.0166	0.0397
2001	2,629	228	1.73	1.81	2001	18	3	0.0118	0.0239
2002	3,033	277	1.81	2.02	2002	18	0	0.0107	0.0000
2003	2,821	230	1.70	1.74	2003	22	2	0.0132	0.0152
2004	2,726	246	1.56	1.76	2004	14	1	0.0080	0.0072
Total	**15,329**	**1,374**	**1.59**	**1.86**	**Total**	**110**	**12**	**0.0114**	**0.0163**
Southwest									
1999	4,564	321	8.13	4.71	1999	15	0	0.0267	0.0000
2000	5,058	332	8.67	4.70	2000	32	1	0.0548	0.0142
2001	5,395	340	9.12	5.27	2001	18	2	0.0304	0.0310
2002	4,957	303	8.78	5.37	2002	37	1	0.0656	0.0177
2003	5,187	308	8.81	5.73	2003	23	2	0.0391	0.0372
2004	5,299	325	8.64	5.83	2004	28	4	0.0456	0.0717
Total	**30,460**	**1,929**	**8.69**	**5.22**	**Total**	**153**	**10**	**0.0437**	**0.0271**
Grand Valley									
1999	1,160	70	2.58	1.19	1999	8	3	0.0178	0.0508
2000	1,066	68	2.31	1.13	2000	7	0	0.0152	0.0000
2001	1,116	66	2.37	1.10	2001	16	0	0.0340	0.0000
2002	1,222	72	2.42	1.09	2002	18	0	0.0357	0.0000
2003	1,188	82	2.39	1.41	2003	3	1	0.0060	0.0172
2004	1,314	84	2.34	1.25	2004	5	2	0.0089	0.0298
Total	**7,066**	**442**	**2.40**	**1.19**	**Total**	**57**	**6**	**0.0194**	**0.0162**

Table F.15 Crashes and Crash Rates (per million VMT) by TPR
1999 to 2004 (continued)

Crashes					Fatalities				
Year	Auto-Only	Truck-Involved	Auto-Only Crash Rate	Truck-Involved Crash Rate	Year	Auto-Only	Truck-Involved	Auto-Only Fatality Rate	Truck-Involved Fatality Rate
Gunnison Valley									
1999	759	63	1.41	0.97	1999	10	2	0.0186	0.0307
2000	710	67	1.32	1.05	2000	8	2	0.0149	0.0312
2001	1,003	74	1.73	1.26	2001	15	3	0.0258	0.0511
2002	1,147	93	2.06	1.85	2002	13	2	0.0234	0.0397
2003	1,115	103	1.96	2.01	2003	9	2	0.0158	0.0391
2004	1,101	102	1.89	1.87	2004	11	1	0.0189	0.0183
Total	**5,835**	**502**	**1.73**	**1.46**	**Total**	**66**	**12**	**0.0196**	**0.0349**
San Luis Valley									
1999	798	85	1.67	1.17	1999	14	2	0.0293	0.0274
2000	647	69	1.41	0.97	2000	7	3	0.0152	0.0424
2001	853	70	1.80	1.17	2001	10	0	0.0211	0.0000
2002	896	92	1.76	1.60	2002	12	4	0.0236	0.0697
2003	931	100	1.82	1.80	2003	16	3	0.0312	0.0541
2004	1,015	89	1.91	1.50	2004	12	2	0.0226	0.0336
Total	**5,140**	**505**	**1.73**	**1.34**	**Total**	**71**	**14**	**0.0240**	**0.0372**
Central Front Range									
1999	800	56	1.74	1.07	1999	9	1	0.0196	0.0190
2000	709	59	1.54	1.11	2000	12	3	0.0261	0.0566
2001	842	42	1.89	0.91	2001	15	3	0.0337	0.0649
2002	842	63	1.86	1.53	2002	21	2	0.0464	0.0487
2003	927	80	2.05	1.92	2003	8	2	0.0177	0.0481
2004	1,022	75	2.26	1.78	2004	14	2	0.0309	0.0474
Total	**5,142**	**375**	**1.89**	**1.36**	**Total**	**79**	**13**	**0.0290**	**0.0470**
Intermountain									
1999	2,421	303	1.90	1.97	1999	29	3	0.0227	0.0195
2000	2,295	230	1.79	1.48	2000	21	4	0.0164	0.0257
2001	2,356	306	1.76	1.98	2001	20	3	0.0149	0.0194
2002	2,944	356	2.08	2.13	2002	25	5	0.0177	0.0299

Table F.15 Crashes and Crash Rates (per million VMT) by TPR
1999 to 2004 (continued)

Crashes					Fatalities				
Year	Auto-Only	Truck-Involved	Auto-Only Crash Rate	Truck-Involved Crash Rate	Year	Auto-Only	Truck-Involved	Auto-Only Fatality Rate	Truck-Involved Fatality Rate
Intermountain (continued)									
2003	2,920	340	2.06	2.34	2003	19	5	0.0134	0.0344
2004	2,840	333	1.84	2.11	2004	13	2	0.0084	0.0127
Total	**15,776**	**1,868**	**1.91**	**2.00**	**Total**	**127**	**22**	**0.0154**	**0.0236**
Northwest									
1999	937	76	2.18	1.42	1999	15	2	0.0320	0.0310
2000	887	66	2.19	1.29	2000	7	2	0.0175	0.0363
2001	1,274	91	3.04	1.84	2001	12	2	0.0292	0.0365
2002	1,409	96	3.25	2.11	2002	13	2	0.0304	0.0405
2003	1,395	97	3.22	2.30	2003	8	3	0.0187	0.0646
2004	1,415	96	2.95	2.04	2004	12	1	0.0254	0.0193
Total	**7,317**	**522**	**2.82**	**1.81**	**Total**	**67**	**12**	**0.0257**	**0.0373**
North Front Range									
1999	2,220	183	2.42	2.32	1999	9	3	0.0098	0.0381
2000	2,190	164	2.27	1.97	2000	11	3	0.0114	0.0361
2001	2,687	220	2.69	2.38	2001	13	3	0.0130	0.0325
2002	2,704	225	2.57	2.40	2002	14	3	0.0133	0.0320
2003	2,847	218	2.64	2.42	2003	21	7	0.0195	0.0778
2004	2,725	228	2.42	2.43	2004	19	6	0.0169	0.0638
Total	**15,373**	**1,238**	**2.51**	**2.33**	**Total**	**87**	**25**	**0.0142**	**0.0470**
Upper Front Range									
1999	1,428	200	1.31	1.00	1999	20	6	0.0184	0.0301
2000	1,252	160	1.08	0.75	2000	21	3	0.0182	0.0141
2001	1,738	252	1.48	1.30	2001	24	12	0.0204	0.0618
2002	1,860	277	1.49	1.38	2002	30	4	0.0241	0.0199
2003	1,889	246	1.61	1.37	2003	30	3	0.0255	0.0167
2004	1,844	252	1.45	1.25	2004	22	6	0.0174	0.0298
Total	**10,011**	**1,387**	**1.41**	**1.17**	**Total**	**147**	**34**	**0.0207**	**0.0286**

Table F.15 Crashes and Crash Rates (per million VMT) by TPR
1999 to 2004 (continued)

Crashes					Fatalities				
Year	Auto-Only	Truck-Involved	Auto-Only Crash Rate	Truck-Involved Crash Rate	Year	Auto-Only	Truck-Involved	Auto-Only Fatality Rate	Truck-Involved Fatality Rate
Greater Denver Area									
1999	27,531	2,317	2.97	3.44	1999	81	16	0.0087	0.0238
2000	28,117	2,317	2.99	3.34	2000	114	17	0.0121	0.0245
2001	29,545	2,389	3.08	3.34	2001	113	29	0.0118	0.0405
2002	29,764	2,499	3.08	3.36	2002	120	17	0.0124	0.0229
2003	29,500	2,412	3.00	3.29	2003	95	14	0.0097	0.0191
2004	30,337	2,531	3.00	3.36	2004	109	18	0.0108	0.0239
Total	**174,794**	**14,465**	**3.02**	**3.35**	**Total**	**632**	**111**	**0.0109**	**0.0257**
Pueblo Area									
1999	1,553	103	2.57	1.46	1999	19	4	0.0315	0.0566
2000	1,397	104	2.25	1.43	2000	7	2	0.0113	0.0275
2001	1,501	107	2.25	1.62	2001	11	0	0.0165	0.0000
2002	1,564	118	2.34	1.86	2002	16	0	0.0239	0.0000
2003	1,659	106	2.56	1.78	2003	18	0	0.0278	0.0000
2004	1,751	104	2.46	1.57	2004	10	3	0.0141	0.0453
Total	**9,425**	**642**	**2.40**	**1.61**	**Total**	**81**	**9**	**0.0207**	**0.0226**
South Central									
1999	386	79	1.73	1.30	1999	7	2	0.0314	0.0329
2000	236	43	1.01	0.70	2000	8	0	0.0343	0.0000
2001	295	42	1.16	0.74	2001	8	0	0.0314	0.0000
2002	405	35	1.46	0.65	2002	10	0	0.0360	0.0000
2003	349	56	1.27	1.04	2003	5	1	0.0182	0.0185
2004	381	55	1.31	0.96	2004	6	2	0.0206	0.0348
Total	**2,052**	**310**	**1.32**	**0.90**	**Total**	**44**	**5**	**0.0283**	**0.0145**
Southeast									
1999	462	111	1.62	1.31	1999	2	2	0.0070	0.0236
2000	350	75	1.16	0.76	2000	11	4	0.0364	0.0407
2001	492	125	1.76	1.32	2001	9	3	0.0322	0.0317
2002	437	124	1.53	1.31	2002	4	3	0.0140	0.0318

Table F.15 Crashes and Crash Rates (per million VMT) by TPR
1999 to 2004 (continued)

Crashes					Fatalities				
Year	Auto-Only	Truck-Involved	Auto-Only Crash Rate	Truck-Involved Crash Rate	Year	Auto-Only	Truck-Involved	Auto-Only Fatality Rate	Truck-Involved Fatality Rate
Southeast (continued)									
2003	409	93	1.50	0.99	2003	4	4	0.0146	0.0427
2004	344	93	1.16	0.94	2004	3	4	0.0102	0.0403
Total	**2,494**	**621**	**1.45**	**1.10**	**Total**	**33**	**20**	**0.0192**	**0.0354**
Eastern									
1999	759	176	1.17	0.66	1999	8	4	0.0123	0.0150
2000	691	159	1.02	0.56	2000	18	4	0.0266	0.0140
2001	788	187	1.14	0.75	2001	17	4	0.0247	0.0161
2002	753	172	1.00	0.65	2002	18	3	0.0238	0.0114
2003	732	149	1.06	0.61	2003	16	4	0.0232	0.0165
2004	833	179	1.03	0.62	2004	20	4	0.0248	0.0138
Total	**4,556**	**1,022**	**1.07**	**0.64**	**Total**	**97**	**23**	**0.0227**	**0.0144**
Grand Junction-Mesa County MPO									
1999	950	41	4.73	2.04	1999	4	2	0.0199	0.0993
2000	902	41	4.25	1.94	2000	2	0	0.0094	0.0000
2001	906	44	4.35	2.08	2001	6	0	0.0288	0.0000
2002	1,020	52	4.38	1.99	2002	8	0	0.0344	0.0000
2003	929	49	4.16	2.14	2003	1	0	0.0045	0.0000
2004	1,044	57	4.06	2.09	2004	5	0	0.0194	0.0000
Total	**5,751**	**284**	**4.31**	**2.05**	**Total**	**26**	**2**	**0.0195**	**0.0144**
Pueblo Area COG									
1999	1,289	79	3.44	2.24	1999	11	2	0.0294	0.0567
2000	1,218	82	3.13	2.28	2000	5	1	0.0118	0.0278
2001	1,256	85	3.00	2.60	2001	10	0	0.0221	0.0000
2002	1,338	89	3.22	2.74	2002	10	0	0.0223	0.0000
2003	1,410	76	3.50	2.50	2003	10	0	0.0231	0.0000
2004	1,470	73	3.36	2.21	2004	7	2	0.0149	0.0605
Total	**7,981**	**484**	**3.27**	**2.42**	**Total**	**53**	**5**	**0.0217**	**0.0250**

Table F.15 Crashes and Crash Rates (per million VMT) by TPR
1999 to 2004 (continued)

Crashes					Fatalities				
Year	Auto-Only	Truck-Involved	Auto-Only Crash Rate	Truck-Involved Crash Rate	Year	Auto-Only	Truck-Involved	Auto-Only Fatality Rate	Truck-Involved Fatality Rate
Pikes Peak Area COG									
1999	1,716	166	1.86	2.46	1999	12	1	0.0130	0.0148
2000	2,282	213	2.48	3.17	2000	19	4	0.0192	0.0596
2001	2,504	216	2.78	2.66	2001	12	3	0.0122	0.0370
2002	2,901	253	2.74	2.72	2002	17	0	0.0148	0.0000
2003	2,710	214	2.55	2.35	2003	18	2	0.0156	0.0219
2004	2,616	230	2.40	2.45	2004	13	1	0.0110	0.0107
Total	**14,729**	**1,292**	**2.47**	**2.62**	**Total**	**91**	**11**	**0.0153**	**0.0223**
North Front Range MPO									
1999	2,200	181	3.06	2.90	1999	9	3	0.0125	0.0481
2000	2,166	162	2.89	2.47	2000	10	3	0.0123	0.0458
2001	2,650	213	3.42	2.91	2001	13	3	0.0153	0.0410
2002	2,671	219	3.24	2.90	2002	14	2	0.0156	0.0265
2003	2,818	215	3.35	2.97	2003	20	7	0.0219	0.0967
2004	2,683	223	3.00	2.89	2004	16	5	0.0165	0.0648
Total	**15,188**	**1,213**	**3.16**	**2.85**	**Total**	**82**	**23**	**0.0171**	**0.0540**
Denver Region COG									
1999	26,757	2,229	3.97	4.69	1999	77	14	0.0114	0.0295
2000	27,477	2,227	3.92	4.51	2000	184	15	0.0245	0.0304
2001	28,906	2,284	4.04	4.52	2001	108	26	0.0141	0.0514
2002	29,043	2,415	4.04	4.58	2002	113	15	0.0146	0.0284
2003	28,768	2,305	4.05	4.59	2003	93	12	0.0122	0.0239
2004	29,517	2,420	4.08	4.79	2004	103	18	0.0133	0.0357
Total	**170,468**	**13,880**	**4.02**	**4.61**	**Total**	**678**	**100**	**0.0160**	**0.0332**

G. Colorado Energy Development

Felsburg Holt & Ullevig (FHU), in association with BBC Research & Consulting, currently is conducting a study for CDOT to assess the impacts of energy development on the State's transportation system. The first phase of the project focuses on the direct impacts of crude oil, natural gas, oil shale, coal bed methane, and uranium development. Phase 2 will address the impacts associated with the development of renewable energy sources, including wind, solar, and biofuels. Phase 2 also will address the indirect impacts of energy development and will identify types of improvements that may be needed to address the direct impacts. The following sections describe the work that has been completed and our approach for future work for the two phases.

G.1 Phase 1

To be able to estimate the potential future impacts of energy development on the transportation system, it is important to first understand how the energy industry works and its relationship to transportation needs. The first tasks in the study were to collect available data from previously completed studies that correlate energy development with transportation impacts and to conduct interviews with key persons in the energy development industry. The final task in Phase 1 is to develop a model that quantifies the transportation impacts of energy development.

Literature Review

The literature review focused on previously completed studies on energy development in the Western United States. Studies ranged from Environmental Impact Statements (EIS) to Undiscovered Resource Assessments to Reasonable Foreseeable Development Scenarios. The literature review yielded results on two distinct subjects: 1) Transportation Impacts of Energy Development; and 2) Employment Impacts of Energy Development. From the literature review, it became apparent that transportation impacts vary from one well to the next; a consensus has not been established on a single methodology. In addition, the scope of transportation impact estimates varies. Some studies only look at trips directly involved in the construction of a well, while others look at trips transporting construction materials from other states. A separate memo summarizes the information found through the literature review task.

Key Person Interviews

Knowledgeable representatives from the energy industry, professional trade organizations, local governments, and regulatory agencies have been interviewed to gather additional information on industry operations, current and projected production levels, and the degree to which each energy sector uses Colorado state highways. While a number of key person interviews have been completed, this task is still underway, and we are pursuing interviews with additional energy industry representatives. A summary of the key person interviews to date is attached.

Energy Development Impacts Model

We currently are in the process of developing a model that is designed to correlate energy development activity for natural gas, crude oil, coal bed methane, oil shale, and uranium with transportation system usage. Through the key person interviews, it became clear that we would not be able to develop reliable energy development projections given current economic uncertainties. Rather than tying the model to specific energy development projection levels, the model will act as a tool to evaluate the transportation impacts associated with given input values. This approach will ensure the long-term utility of the model as the energy industry evolves in Colorado.

The diagram shown on Figure G.1 provides a visual outline of the model inputs, factors, and outputs. The model can be divided into two discreet modules: a trip generation module, and a corridor allocation module. The purpose of the trip generation module is to estimate the number of annual trips in each of seven economic basins in the State (refer to Figure G.2 based on a set of input values, including the energy source, the level of development, the location (basin), and the timing of development. The trip generation module also will output the mix of vehicles for each development phase. The energy development phases include: development (site development, drilling and completion), production (operation and maintenance), and reclamation (well retirement).

The second module of the model, the corridor allocation module, uses the outputs from the trip generation module and assign the energy development trip estimates to the state highways in Colorado that have been identified as heavily impacted corridors (refer to Figure G.2. The allocation to the impacted corridors is based on access to energy sources, the location of nearest population centers (from which employee and short-haul trips will likely originate), and likely routes for long-haul trips. The final outputs from the model will be provided for each of the heavily impacted corridors and will include trips per day, vehicle miles of travel (VMT), and light, medium, and heavy truck volumes.

To demonstrate the utility of the model, an example scenario of energy projections will be used. The example scenario of future energy development will be based on historic trends provided by the Colorado Oil and Gas Conservation Commission (COGCC).

G.2 Phase 2

Additional Energy Sources

As a part of Phase 2, we have expanded on the energy sources and are in the process of completing a similar inventory and analysis of direct transportation impacts associated with wind, solar, and biofuels. The inventory entails a literature review, data collection, and key person interviews for the additional energy sources. The transportation impacts per unit of energy development activity will be quantified for the additional energy sources and incorporated into the overall transportation impacts model. Because solar, wind, and biofuels are relatively new energy technology, the data available on transportation linkages and future activity projections for these energy sources will likely be limited. The full potential for integration of these new energy sources into the Phase 1 model will not be known until after the literature review and interviews are completed. Consistent with our approach to Phase 1, we will view the model as more of an academic exercise that will not provide a set of forecasts, but rather will act as a tool to evaluate the transportation impacts associated with given input values.

The coal element of the study will focus on the development and production of coal and how the transfer of materials from mines to the railroad might impact the state highway system. We also will look into the impact of moving equipment used in coal mine development on the state highway system. We do not expect a lot of coal development activity and therefore the transportation impacts of coal will not be incorporated into the model.

Indirect Job Growth

Phase 1 covers only the direct transportation impacts of energy development. Direct impacts include the traffic produced by energy exploration, extraction and facility maintenance and reclamation. Traffic generated by job and population growth that accompany energy development is considered an indirect transportation impact.

Using the energy activity projections and data obtained during the literature review, we will correlate direct energy-related employment to the level of energy development. We will then correlate indirect job growth to direct energy employment using multiplier data obtained from the Department of Local Affairs (DOLA) and previously completed energy development studies in affected regions in Colorado. Indirect job growth for all energy sources (including the additional renewable energy sources to the extent possible) will be calculated. The results of the indirect job growth projections will be reported by the seven economic basins and will be variable depending upon the level of future energy development.

This task will not include projections of household growth, nor will it include estimates of transportation impacts associated with the indirect growth that results from energy development.

Improvement Types and Costs

Phase 1 aims to quantify the direct impacts of energy development on the State's transportation system in terms of additional trips and vehicle miles of travel. This task will address both the types of improvements that may be needed to address the impacts and the associated costs.

The type of improvement projects needed to mitigate the *direct* impacts of energy development will be identified in each of the heavily impacted corridors in the State. The improvement types will be general in nature similar to the midterm implementation strategies included in the Statewide Plan. Planning level per-mile cost estimates for the various improvement types will be provided. This task will provide valuable information on energy development impacts that could be incorporated into the next iteration of the Regional Transportation Plans (RTP) and the Statewide Plan.

G.3 Relevance for Colorado Statewide Freight roadmap

There are two key developments from this study that will be important for future freight planning efforts at CDOT. First, an important set of freight stakeholders has been identified and engaged in transportation planning. Through this outreach, we have developed a correlation between energy development and truck traffic on the state highway system. These stakeholders should be engaged on a regular basis to ensure their inclusion in the statewide freight planning process. Second, the completion of the Energy Development Transportation Impact Model will be a valuable tool for estimating the truck activity generated from the energy sector in the State. This tool will allow for tying corridor improvements to travel time and cost savings to the energy sector. It also can be used as a framework in future freight planning efforts to understand the impacts of corridor improvements on other sectors of the economy.

Figure G.1 Schematic of Energy Development Transportation Impacts Model

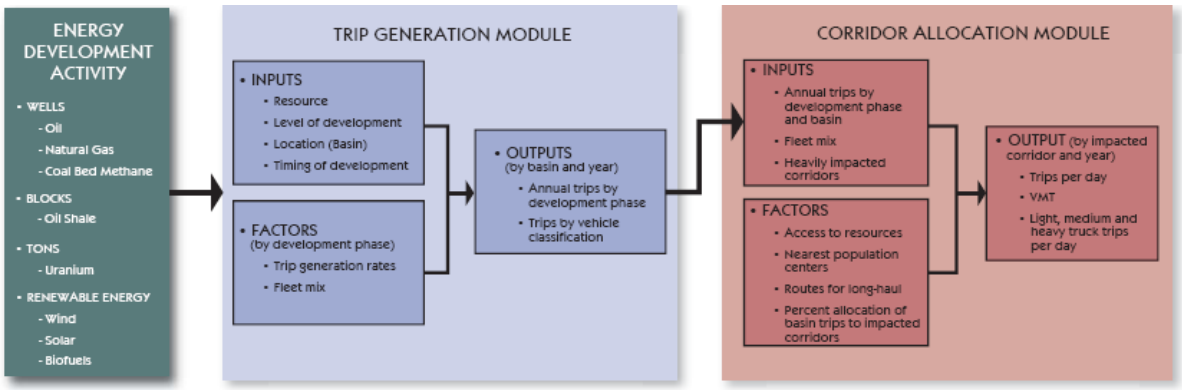
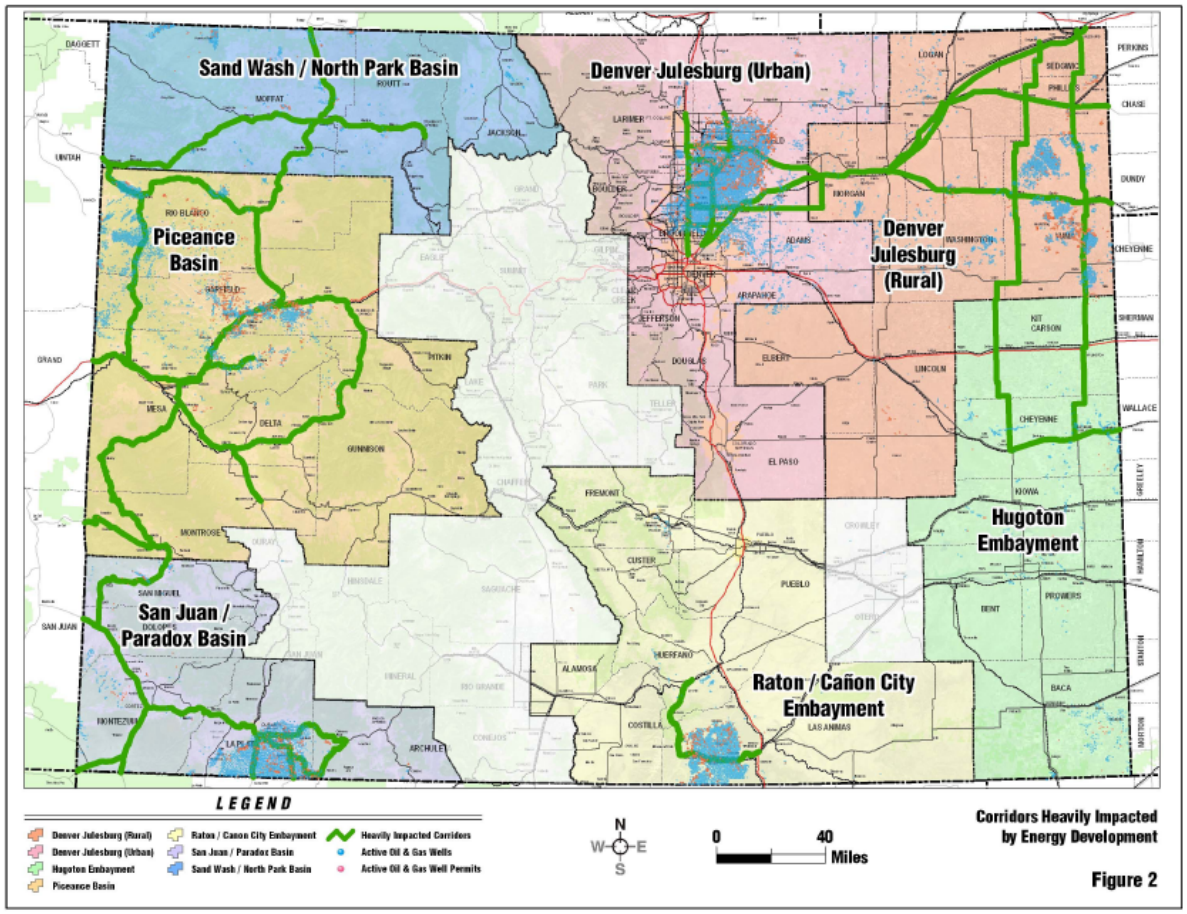


Figure G.2 Corridors Heavily Impacted by Energy Development
(shown in green)



H. Definitions of Freight-Related Terms

The private sector freight industry and public sector freight transportation planners often have different meanings for the same word. Additionally, each party has many freight terms which are not used at all by the other party. This appendix provides a unified list of freight terms, definitions, and acronyms based on information collected from the following public sector and private sector sources:

- FHWA Freight Glossary and Acronyms;
- Pacific Analysis Freight Web Site Freight Shipping Terms and Definitions – http://www.freightshippingcenter.com/freightshippingterms.php;
- Network FOB Inc. Glossary of Freight Terms – http://www.networkfob.com/glossary_of_freight_terms.htm; and
- Federal Express Terms and Conditions – http://fedex.com/us/services/terms/.

It is the intention that this glossary be used as a reference document when developing and reviewing material generated by either the public or private sector.

H.1. Definitions

Accessorial – A service that is not considered 'standard' will incur additional fees. Accessorial charges may include, but are not limited to: arrival notification, inside delivery, insurance, liftgate service, COD, hazardous materials, fuel surcharge.

Aggregate Shipment – Numerous shipments from different shippers to one consignee that are consolidated and treated as a single consignment.

Airbill – Any shipping document, manifest, label, stamp, electronic entry, or similar item used to tender air shipments for transportation.

Average Annual Daily Truck Traffic (AADTT) – The total volume of truck traffic on a highway segment for one year, divided by the number of days in the year.

B/L Abbreviation for "Bill of Lading."

Backhaul – To haul a shipment back over part of a route it has traveled.

Barge – The cargo-carrying vehicle that inland water carriers primarily use. Basic barges have open tops, but there are covered barges for both dry and liquid cargoes.

Belly Cargo – Air freight carried in the belly of passenger aircraft.

Bill of Lading – Multiuse documents that are essential to conduct the day-to-day operations when transportation of supplies, materials, and personal property is required. These primary documents are used to procure freight and express transportation and related services from commercial carriers, including freight forwarders. What must be stated in a Bill of Lading? The name and address of: the carrier (the shipping company responsible for transport), the shipper (the consignor/sender, or his agent), the consignee (the buyer or his agent), places of departure and destination, description of the goods, instructions for the payment of freight (collect or prepaid), place and date issued, and Any other information relative to the shipment

Blind Shipment A – B/L wherein the paying customer has contracted with the carrier that shipper or consignee information is not given.

Blocked Trains – Railcars grouped in a train by destination so that segments (blocks) can be uncoupled and routed to different destinations as the train moves through various junctions. Eliminates the need to break up a train and sort individual railcars at each junction.

Bobtail – Movement of a tractor, without trailer, over the highway.

Bonded Freight – Freight moving under a bond to U.S. Customs or to the Internal Revenue Service, and to be delivered only under stated conditions.

Bonded Warehouse – A warehouse authorized by Customs authorities for storage of goods on which payment of duties is deferred until the goods are removed.

Bottleneck – A section of a highway or rail network that experiences operational problems such as congestion. Bottlenecks may result from factors such as reduced roadway width or steep freeway grades that can slow trucks.

Boxcar – A closed rail freight car.

Break Bulk – To unload and distribute a portion or all of the contents of a rail car, container, or trailer.

Broker – A person who arranges for transportation of loads for a percentage of the revenue from the load.

Brokerage – Freight forwarder/broker compensation as specified by ocean tariff or contract.

Bulk Cargo – Not in packages or containers; shipped loose in the hold of a ship without mark and count." Grain, coal, and sulfur are usually bulk freight.

Bulk-Freight Container – A container with a discharge hatch in the front wall; allows bulk commodities to be carried

Cabotage – A national law that requires costal and intercostal traffic to be carried in its own nationally registered, and sometimes built and crewed ships.

Capacity – The physical facilities, personnel and process available to meet the product of service needs of the customers. Capacity generally refers to the maximum output or producing ability of a machine, a person, a process, a factory, a product, or a service.

Cargo Ramp – A dedicated load/unload facility for cargo aircraft.

Carload – Quantity of freight (in tons) required to fill a railcar; amount normally required to qualify for a carload rate.

Car Pooling – Use of individual carrier/rail equipment through a central agency for the benefit of carriers and shippers.

Carrier – Any person or entity who, in a contract of carriage, undertakes to perform or to procure the performance of carriage by rail, road, sea, air, inland waterway or by a combination of such modes.

Cartage – Usually refers to intracity hauling on drays or trucks.

Centralized Dispatching – The organization of the dispatching function into one central location. This structure often involves the use of data collection devices for communication between the centralized dispatching function, which usually reports to the production control department and the shop manufacturing departments.

CFS Abbreviation for "Container Freight Station." – A shipping dock where cargo is loaded ("stuffed") into or unloaded ("stripped") from containers. Generally, this involves less than containerload shipments, although small shipments destined to same consignee are often consolidated. Container reloading from/to rail or motor carrier equipment is a typical activity.

Chassis – A frame with wheels and container locking devices in order to secure the container for movement.

CKD Abbreviation for "Completely Knocked Down." – Parts and subassemblies being transported to an assembly plant.

CL Abbreviation for "Carload" and "Containerload."

Class – Refers to the Classification rating or number that specifically identifies the approximate size, value and difficulty of transporting a particular type of product that can be shipped by a carrier.

Class I Carrier – A classification of regulated carriers based upon annual operating revenues-motor carrier of property greater than or equal to $5 million; railroads: greater than or equal to $50 million: motor carriers of passengers; greater than or equal to $3 million.

Class II Carrier – A classification of regulated carriers based upon annual operating revenues-motor carrier of property $1 to $5 million; railroads: $10 to $50 million: motor carriers of passengers; less than or equal to $3 million.

Class III Carrier – A classification of regulated carriers based upon annual operating revenues-motor carrier of property less than or equal to $1 million; railroads: greater than or equal to $10 million.

Classification – A publication such as Uniform Freight Classification (railroad) or the National Motor Freight Classification (motor carrier), that assigns ratings to various articles and provides bill of lading descriptions and rules.

Classification Yard – A railroad yard with many tracks used for assembling freight trains.

Clean Bill of Lading – A receipt for goods issued by a carrier with an indication that the goods were received in "apparent good order and condition," without damage or other irregularities. If no notation or exception is made, the B/L is assumed to be "clean."

Clearance – The size beyond which cars or loads cannot use Limits bridges, tunnels, etc.

Coastal Shipping – Also known as short-sea or coastwise shipping, describes marine shipping operations between ports along a single coast or involving a short-sea crossing.

Commodity – An Item that is traded in commerce. The term usually implies an undifferentiated product competing primarily on price and availability.

Common Carrier – A transportation company which provides service to the general public at published rates.

Conference – An association of ship owners operating in the same trade route who operate under collective conditions and agree on tariff rates.

Connecting Carrier – A carrier which has a direct physical connection with, or forms a link between two or more carriers.

Consignee – A person or company to whom commodities are shipped.

Consignee Mark – A symbol placed on packages for identification purposes; generally a triangle, square, circle, etc. with letters and/or numbers and port of discharge.

Consignment – 1) A stock of merchandise advanced to a dealer and located at his place of business, but with title remaining in the source of supply; and 2) A shipment of goods to a consignee.

Consignor – A person or company shown on the bill of lading as the shipper.

Consolidation – Cargo containing shipments of two or more shippers or suppliers. Containerload shipments may be consolidated for one or more consignees.

Consolidator – A person or firm performing a consolidation service for others. The consolidator takes advantage of lower full carload (FCL) rates, and savings are passed on to shippers.

Container – A truck trailer body that can be detached from the chassis for loading into a vessel, a rail car or stacked in a container depot. Containers may be ventilated, insulated, refrigerated, flat rack, vehicle rack, open top, bulk liquid or equipped with interior devices. A container may be 20 feet, 40 feet, 45 feet, 48 feet, or 53 feet in length, 8 feet 0 inches, or 8 feet 6 inches in width, and 8 feet 6 inches or 9 feet 6 inches in height.

Container Booking – Arrangements with a steamship line to transport containerized cargo.

Container Freight Station See CFS.

Container Load – A load sufficient in size to fill a container either by cubic measurement or by weight.

Container Manifest – Document showing contents and loading sequence of a container.

Container Pool – An agreement between parties that allows the efficient use and supply of containers. A common supply of containers available to the shipper as required.

Container Terminal – An area designated for the stowage of cargoes in container; usually accessible by truck, railroad, and marine transportation. Here containers are picked up, dropped off, maintained, and housed.

Container Yard (CY) – A materials handling/storage facility used for completely unitized loads in containers and/or empty containers. Commonly referred to as CY.

Container on Flatcar (COFC) – Containers resting on railway flatcars without a chassis underneath.

Containerized Cargo – Cargo that is transported in containers that can be transferred easily from one transportation mode to another.

Containerization – A shipment method in which commodities are placed in containers, and after initial loading, the commodities per se are not rehandled in shipment until they are unloaded at destination.

Contract Carrier – Carrier engaged in interstate transportation of persons/property by motor vehicle on a for-hire basis, but under continuing contract with one or a limited number of customers to meet specific needs.

Cost, Insurance, and Freight (CIF) – Cost of goods, marine insurance and all transportation (freight) charges are paid to the foreign point of delivery by the seller.

Cube Out – When a container or vessel has reached its volumetric capacity before its permitted weight limit.

Customhouse – A government office where duties are paid, import documents filed, etc., on foreign shipments.

Customhouse Broker – A person or firm, licensed by the treasury department of their country when required, engaged in entering and clearing goods through Customs for a client (importer).

Customs – Government agency charged with enforcing the rules passed to protect the country's import and export revenues.

Customs Bonded Warehouse – A warehouse authorized by Customs to receive duty-free merchandise.

Customs Entry – All countries require that the importer make a declaration on incoming foreign goods. The importer then normally pays a duty on the imported merchandise.

Customs Invoice – A form requiring all data in a commercial invoice along with a certificate of value and/or a certificate of origin. Required in a few countries (usually former British territories) and usually serves as a seller's commercial invoice.

Cut-Off Time – The latest time cargo may be delivered to a terminal for loading to a scheduled train or ship.

Deadhead – One leg of a move without a paying cargo load. Usually refers to repositioning an empty piece of equipment.

Deconsolidation Point – Place where loose or other noncontainerized or truckload cargo is ungrouped for delivery.

Demurrage – A penalty charge against shippers or consignees for delaying the carrier's equipment beyond the allowed free time. The free time and demurrage charges are set forth in the charter party or freight tariff.

Depot, Container – Container freight station or a designated area where empty containers can be picked up or dropped off.

Detention Fee – The carrier charges and fees applied when rail freight cars, ship, and carriers are retained beyond a specified loading or unloading time.

Destination – The place where carrier actually turns over cargo to consignee or his agent.

Devanning – The unloading of a container or cargo van.

Direct to Store – Process of shipping direct from a manufacturer's plant or distribution center to the customer's retail store, thus bypassing the customer's distribution center.

Dispatcher – An individual tasked to assign available transportation loads to available carriers.

Distribution Center (DC) – The warehouse facility which holds inventory from manufacturing pending distribution to the appropriate stores. Dolly – A set of wheels that support the front of a container; used when the automotive unit is disconnected.

Dock – A space used or receiving merchandise at a freight terminal.

Door-to-Door – The through transportation of a container or trailer and its contents from consignor to consignee. Also known as House to House. Not necessarily a through rate.

Double Drop – A type of open deck trailer which has a raised section at the front and rear and a "well" in the middle. Used for transporting very tall equipment.

Double-Stack – Railcar movement of containers stacked two high.

Doubles – Slang term for two pups (28-feet trailers) hooked together for transport.

Drayage – Drayage – Transporting of rail or ocean freight by truck to an intermediate or final destination; typically a charge for pickup/delivery of goods moving short distances (e.g., from marine terminal to warehouse). Charge made for local hauling by dray or truck. Same as Cartage.

Drop – A situation in which an equipment operator deposits a trailer or boxcar at a facility at which it is to be loaded or unloaded.

Dry Cargo – Cargo that is not liquid and normally does not require temperature control.

Dry-Bulk Container – A container constructed to carry grain, powder and other free-flowing solids in bulk. Used in conjunction with a tilt chassis or platform.

Dry Van – A trailer, generally 53 feet in length by 8 feet 6 inches wide by 9 feet 6 inches tall (13 feet 6 inches from ground). A dry van may be heated or vented but does not have refrigeration equipment.

Durable Goods – Generally, any goods whose continuous serviceability is likely to exceed three years.

EDI Abbreviation for "Electronic Data Interface." – Generic term for transmission of transactional data between computer systems. EDI is typically via a batched transmission, usually conforming to consistent standards.

Empty Repo Contraction for Empty Repositioning – The movement of empty containers.

ETA – Estimated time of arrival.

Export – Shipment of goods to a foreign country.

Flat Car – A rail car without a roof and walls.

Flat Rack/Flat Bed Container – A container with no sides and frame members at the front and rear. Container can be loaded from the sides and top.

FOB – See Free On Board. See also Terms of Sale, FOB.

FOB Freight – Allowed the same as FOB named inland carrier, except the buyer pays the transportation charge and the seller reduces the invoice by a like amount.

FOB Freight – Prepaid the same as FOB named inland carrier, except the seller pays the Freight charges of the inland carrier.

FAK Abbreviation for "Freight All Kinds." – Usually refers to full container loads of mixed shipments.

FEU – Abbreviation for "Forty-Foot Equivalent Units." Refers to container size standard of 40 feet. Two 20-foot containers or TEU's equal one FEU.

Flatbed – A trailer without sides used for hauling machinery or other bulky items. A type of open deck trailer. Generally 40-48 feet in length some maybe as long as 53 feet.

Flat Car A rail car without a roof and walls.

Flat Rack/Flat Bed Container – A container with no sides and frame members at the front and rear. Container can be loaded from the sides and top.

For-Hire Carrier – Carrier that provides transportation service to the public on a fee basis.

Free on Board (FOB – U.S. Domestic Use) – Shipped under a rate that includes costs of delivery to and the loading onto a carrier at a specified point. Also means the point at which title to the goods passes from seller to buyer.

Free on Board – (International Use) See Terms of Sale.

Free Port – A restricted area at a seaport for the handling of duty-exempted import goods. Also called a Foreign Trade Zone.

Free Trade Zone – A port designated by the government of a country for duty-free entry of any nonprohibited goods. Merchandise may be stored, displayed, used for manufacturing, etc., within the zone and re-exported without duties.

Freight – Refers to either the cargo carried or the charges assessed for carriage of the cargo.

Freight All Kinds (FAK) – Goods classified FAK are usually charged higher rates than those marked with a specific classification and is frequently in a container that includes various classes of cargo.

Freight Class – Refers to the National Motor Freight Classification (NMFC) and it is the category of your freight as defined by the National Motor Freight Traffic Association (NMFTA). Your shipment's freight class determines the carrier's shipping charges. It identifies the size, value, and difficulty of transporting your freight.

Freight Forwarder – A person whose business is to act as an agent on behalf of a shipper. A freight forwarder frequently consolidates shipments from several shippers and coordinates booking reservations.

FTL – FTL stands for Full Truck Load and refers to any shipment that takes up all or almost all of the truck's space. A FTL shipment can range from 5000 lbs and up, although some FTL carriers have a minimum weight requirement of 10,000 lbs or more. There are 2 types of FTL shipments: Full Loads, which completely fill the entire truck and Partial Loads, which almost fill the entire truck.

Fuel Surcharge (FSC) – An additional charge to the customer to make up for an increase in fuel prices.

Fuel-Taxed Waterway System – Eleven thousand miles of the U.S. waterway system designated by the Water Resources Development Act of 1986. Commercial users of this system pay a per gallon fuel tax which is deposited in the Inland Waterways Trust Fund and used to fund inland navigation projects each year.

Gross Vehicle Weight (GVW) – The combined total weight of a vehicle and its freight.

Gross Weight – Entire weight of goods, packaging and freight car or container, ready for shipment. Generally, 80,000 pounds maximum container, cargo, and tractor for highway transport.

GVW Abbreviation for "Gross Vehicle Weight" – The combined total weight of a vehicle and its container, inclusive of prime mover.

HAZ MAT – An industry abbreviation for "Hazardous Material."

Hazardous Material – A substance or material which the Department of Transportation has determined to be capable of posing a risk to health, safety, and property when stored or transported in commerce.

Hours of Service – Ruling that stipulates the amount of time a driver is allotted to work.

Hub – A common connection point for devices in a network. Referenced for a transportation network as in "hub and spoke" which is common in the airline and trucking industry.

Humping – The process of connecting a moving rail car with a motionless rail car within a rail classification yard in order to make up a train. The cars move by gravity from an incline or "hump" onto the appropriate track.

Import – To receive goods from a foreign country.

In Bond – Cargo moving under Customs control where duty has not yet been paid.

Inbound Logistics – The movement of materials from shippers and vendors into production processes or storage facilities.

Inland Carrier – A transportation line that hauls export or import traffic between ports and inland points.

Inside Delivery – When a driver is required to go beyond the front door or loading dock to pick up or deliver a load rather than remaining in his/her truck or on the loading dock.

Insulated Container – A container insulated on the walls, roof, floor, and doors, to reduce the effect of external temperatures on the cargo.

Interchange Point – A location where one carrier delivers freight to another carrier.

Interline Freight – Freight moving from origin to destination over the Freight lines of two or more transportation carriers.

Intermodal – Used to denote movements of cargo containers interchangeably between transport modes, i.e., motor, water, and air carriers, and where the equipment is compatible within the multiple systems.

Intermodal terminal – A location where links between different transportation modes and networks connect. Using more than one mode of transportation in moving persons and goods. For example, a shipment moved over 1000 miles could travel by truck for one portion of the trip, and then transfer to rail at a designated terminal.

Inventory – The number of units and/or value of the stock of good a company holds.

JIT Abbreviation for "Just-In-Time." – In this method of inventory control, warehousing is minimal or nonexistent; the container is the movable warehouse and must arrive "just-in-time"; not too early or too late.

Joint Rate – A rate applicable from a point on one transportation line to a point on another line made by agreement and published in a single tariff by all transportation lines over which the rate applies.

Just-in-Time (JIT) – Cargo or components that must be at a destination at the exact time needed. The container or vehicle is the movable warehouse.

Knocked Down (KD) – Articles which are taken apart to reduce the cubic footage displaced or to make a better shipping unit and are to be reassembled. In truck

transportation KD is defined as an object which when knocked down can be shipped at less than two-thirds of its normal size.

Knocked Down Flat (KDF) – Articles which are taken apart to reduce the cubic footage displaced or to make a better shipping unit and are to be reassembled. In truck transportation KDF is defined as an object which when knocked down can be shipped at less than one-third of its normal size.

Laden – Loaded aboard a vessel.

Lading – Refers to the freight shipped; the contents of a shipment.

Landbridge – Movement of cargo by water from one country through the port of another country, thence, using rail or truck, to an inland point in that country or to a third country. As example, a through movement of Asian cargo to Europe across North America.

LCL Abbreviation for "Less than Container Load." – The quantity of freight which is less than that required for the application of a container load rate. Loose Freight.

Level of Service (LOS) – A qualitative assessment of a road's operating conditions. For local government comprehensive planning purposes, level of service means an indicator of the extent or degree of service provided by, or proposed to be provided by, a facility based on and related to the operational characteristics of the facility. Level of service indicates the capacity per unit of demand for each public facility.

Lift-On/Lift-Off (lo/lo) Cargo – Containerized cargo that must be lifted on and off vessels and other vehicles using handling equipment.

Line-Haul – Transportation from one city to another as differentiated from local switching service.

Liner – A vessel sailing between specified ports on a regular basis.

Liquid Bulk Cargo – A type of bulk cargo that consists of liquid items, such as petroleum, water, or liquid natural gas.

Load Ratio – The ratio of loaded miles to empty miles. Also sometimes called load bars

Local Cargo – Cargo delivered to/from the carrier where origin/destination of the cargo is in the local area.

Lock – A channel where the water rises and falls to allow boats to travel a dammed river.

Logbook – A daily record of the hours an interstate driver spends driving, off duty, sleeping in the berth, or on duty not driving.

Logistics – All activities involved in the management of product movement; delivering the right product from the right origin to the right destination, with the right quality and quantity, at the right schedule and price. Logistics is that part of the supply chain process

that plans, implements, and controls the efficient, effective flow and storage of goods, services, and related information from the point of origin to the point of consumption in order to meet customers' requirements.

Logistics Trailer or Logistics Van – A type of trailer outfitted with special load protections and restraints. Typically logistics trailers will have a combination of E-Track, straps, pads, and other equipment. The term logistics trailer is a term of art and types of equipment carried vary.

LTL Less Than Truckload, also known as LCL – Is an acronym for Less-Than-Load, meaning cargo that is not of the quantity to require an entire truckload (TL) by itself. Typically, an LTL shipment ranges from 100 lbs to 20,000 lbs.

Lumpers – Individuals that assist a motor carrier owner operator in the unloading of property; quite commonly used in the food industry.

Manifest – Document that lists in detail all the bills of lading issued by a carrier or its agent or master for a specific voyage or trip. A detailed summary of the total cargo of a vessel or trailer.

Measurement Cargo – Freight on which transportation charges are calculated on the basis of volume measurement.

Microbridge – A cargo movement in which the water carrier provides a through service between an inland point and the port of load/discharge. The carrier is responsible for cargo and costs from origin on to destination. Also known as IPI or Through Service.

Mini Landbridge – An intermodal system for transporting containers by ocean and then by rail or motor to a port previously served as an all-water move (e.g., Hong Kong to New York over Seattle).

Mixed Container Load – A container load of different articles in a single consignment.

Moving Van – Similar to a logistics trailer except generally having a dropped floor to increase volume and ease loading from the ground.

Multimodal – Synonymous for all practical purposes with "Intermodal."

Neobulk Cargo – Shipments consisting entirely of units of a single commodity, such as cars, lumber, or scrap metal.

Node – A fixed point in a firm's logistics system where goods come to rest; includes plants, warehouses, supply sources, and markets.

Nonvessel Operating Common Carrier (NVOCC) – A cargo consolidator in ocean trades who will buy space from a carrier and subsell it to smaller shippers. The NVOCC issues bills of lading, publishes tariffs, and otherwise conducts itself as an ocean common carrier, except that it will not provide the actual ocean or intermodal service.

NOS Abbreviation for "Not Otherwise Specified."

On-Dock Rail – Direct shipside rail service. Includes the ability to load and unload containers/breakbulk directly from rail car to vessel.

Open Top Container – A container fitted with a solid removable roof or with a tarpaulin roof so the container can be loaded or unloaded from the top.

Optimum Cube – The highest level of cube utilization that can be achieved when loading cargo into a container.

Origin – Location where shipment begins its movement.

Original Bill of Lading (OBL) – A document which requires proper signatures for consummating carriage of contract. Must be marked as "original" by the issuing carrier.

Outbound Logistics – The process related to the movement and storage of products from the end of the production line to the end user.

Owner-Operator – Trucking operation in which the owner of the truck also is the driver.

Pallet – A platform with or without sides, on which a number of packages or pieces may be loaded to facilitate handling by a lift truck. Standard size is 42" x 48." Note what maybe "standard" to a shipper may not be industry standard size. Be sure and check what your shipper means by "standard"

Paper Ramp – A technical rail ramp, used for equalization of points not actually served. A truck will perform pickup and delivery to the nearest rail ramp and part of that pickup cost is subsidized by the railroad.

Parcel Receipt – An arrangement whereby a steamship company, under rules and regulations established in the freight tariff of a given trade, accepts small packages at rates below the minimum bill of lading, and issues a parcel receipt instead of a bill of lading.

Payee – A party named in an instrument as the beneficiary of the funds. Under letters of credit, the payee is either the drawer of the draft or a bank.

Payer – A party responsible for the payment as evidenced by the given instrument. Under letters of credit, the payer is the party on whom the draft is drawn, usually the drawee bank.

Per Diem – A charge, based on a fixed daily rate.

Pickup – The act of calling for freight by truck at the consignor's (shipper) shipping platform.

Piggy Packer – A mobile container-handling crane used to load/unload containers to/ from railcars.

Piggyback – A rail/truck service. A shipper loads a highway trailer, and a carrier drives it to a rail terminal and loads it on a flatcar; the railroad moves the trailer-on-flatcar combination to the destination terminal, where the carrier offloads the trailer and delivers it to the consignee.

Placard – A label that identifies a hazardous material shipment and the hazards present.

POD Abbreviation for – Port of Discharge, or Port of Destination.

Pool/Drop Trailers – Trailer that are staged at a facility for preloading purposes.

Point of Sale (POS) – The time and place at which a sale occurs, such as a cash register in a retail operation, or the order confirmation screen in an on-line session. Supply chain partners are interested in capturing data at the POS because it is a true record of the sale rather than being derived from other information such as inventory movement.

Port Authority – State or local government that owns, operates, or otherwise provides wharf, dock, and other terminal investments at ports.

Port of Call – Port where a ship discharges or receives traffic.

Port of Entry – Port where cargo is unloaded and enters a country.

Port of Exit – Place where cargo is loaded and leaves a country.

Private Carrier – A carrier that provides transportation service to the firm that owns or leases the vehicles and does not charge a fee.

Private Warehouse – A company-owned warehouse.

Pull Logistics System – "Just-in-Time" logistics system driven by customer demand and enabled by telecommunications and information systems rather than by manufacturing process and inventory stockpiling.

Pup – A short semitrailer used jointly with a dolly and another semitrailer to create a twin trailer.

Push Logistics System – Inventory-based logistics system characterized by regularly scheduled flows of products and high inventory levels.

Rag Top – A slang term for an open-top trailer or container with a tarpaulin cover.

Rail Division – The amount of money another carrier pays to the railroad for overland carriage.

Rail Grounding – The time that the container or trailer was discharged (grounded) from the train.

Rail Siding – A very short branch off a main railway line with only one point leading onto it. Sidings are used to allow faster trains to pass slower ones or to conduct maintenance.

Ramp – Railroad terminal where containers are received or delivered and trains loaded or discharged. Originally, trailers moved onto the rearmost flatcar via a ramp and driven into position in a technique known as "circus loading." Most modern rail facilities use lifting equipment to position containers onto the flatcars.

Ramp-to-Door – The movement where the load initiates at an origin rail ramp and terminates at a consignee's door.

Ramp-to-Ramp – A movement of equipment from an origin rail ramp to a destination rail ramp only with another party providing the local pickup or delivery service.

Reconsignment – The changing the consignee or destination on a bill of lading while shipment is still in transit. Diversion has substantially the same meaning.

Reefer – Refrigerated container or trailer.

Regional Railroad – Railroad defined as line-haul railroad operating at least 350 miles of track and/or earns revenue between $40 million and $266.7 million.

Reliability – Refers to the degree of certainty and predictability in travel times on the transportation system. Reliable transportation systems offer some assurance of attaining a given destination within a reasonable range of an expected time. An unreliable transportation system is subject to unexpected delays, increasing costs for system users.

Reverse Logistics – A specialized segment of logistics focusing on the movement and management of products and resources after the sale and after delivery to the customer. Includes product returns and repair for credit.

Receiving – The function encompassing the physical receipt of material, the inspection of the shipment for conformance with the purchase order (quantity and damage), the identification, and delivery to destination, and the preparation of receiving reports.

Ro/Ro – A shortening of the term, "Roll-On/Roll-Off." A method of ocean cargo service using a vessel with ramps, which allows wheeled vehicles to be loaded and discharged without cranes. –

Roll-on/Roll-off vessels – Ships specially designed to carry wheeled containers or trailers using interior ramps.

Route – The manner in which a shipment moves; i.e., the carriers handling it and the points at which the carriers interchange.

Seasonality – Repetitive pattern of demand from year to year (or other repeating time interval) with some periods considerably higher than others. Seasonality explains the

fluctuation in demand for various recreational products, which are used during different seasons.

Shipping Manifest – A document that lists the pieces in a shipment.

SHEX – Saturday and Holidays Excluded.

SHINC – Saturday and Holidays Included.

Shipment – The tender of one lot of cargo at one time from one shipper to one consignee on one bill of lading.

Shipper – The person or company who is usually the supplier or owner of commodities shipped. Also called Consignor.

Shippers Association – A nonprofit entity that represents the interests of a number of shippers. The main focus of shippers associations is to pool the cargo volumes of members to leverage the most favorable service contract rate levels.

Short-Line Railroad – Freight railroads which are not Class I or Regional Railroads that operate less than 350 miles of track and earn less than $40 million.

Short-Sea Shipping – Also known as coastal or coastwise shipping, describes marine shipping operations between ports along a single coast or involving a short sea crossing.

Sleeper Team – Two drivers who operated a truck equipped with a sleeper berth; while one driver sleeps in the berth to accumulate mandatory offduty time, the other driver operates the vehicle.

Sleepers – Loaded containers moving within the railroad system that are not clearly identified on any internally generated reports. When used in truck transportation denotes a tractor with a sleeper berth for the driver.

Stack Car – An articulated five-platform rail car that allows containers to be double stacked. A typical stack car holds ten 40-foot equivalent units (FEU).

Stack-train – A rail service whereby rail cars carry containers stacked two high on specially operated unit trains. Each train includes up to 35 articulated multiplatform cars. Each car is comprised of 5 well type platforms upon which containers can be stacked. No chassis accompany containers.

Standard Industrial Classification (SIC) – The standard numerical code used by the U.S. Government to classify products and services.

Standard International Trade Classification (SITC) – A standard numeric code developed by the United Nations to classify commodities used in international trade, based on a hierarchy.

STCC Abbreviation for "Standard Transportation Commodity Code."

Steamship Conference – A group of vessel operators joined together for the purpose of establishing freight rates.

Stevedore – Individual or firm that employs longshoremen and who contracts to load or unload the ship.

Stock Keeping Unit (SKU) – A category of unit with unique combination of form, fit, and function.

Stock Outs – Merchandise that is requested by a customer but is temporarily unavailable. Also referred to as (OOS).

Stopoff Charge – Charge associated with a load that has more than one dropoff point. Typically, the first stop of a multistop load is free, and then the charge applies to the subsequent stops.

Store-Door Pick-Up Delivery – A complete package of pick up or delivery services performed by a carrier from origin to final consumption point.

Stowage – A marine term referring to loading freight into ships' holds.

Strategic Highway Network (STRAHNET) – A network of highways which are important to the United States' strategic defense policy and which provide defense access, continuity, and emergency capabilities for defense purposes.

Strategic Rail Corridor Network (STRACNET) – An interconnected and continuous rail line network consisting of over 38,000 miles of track serving over 170 defense installations.

Stripping – Removing cargo from a container or trailer (same as devanning).

Stuffing – Putting cargo into a container or trailer.

Supply Chain – A logistical management system which integrates the sequence of activities from delivery of raw materials to the manufacturer through to delivery of the finished product to the customer into measurable components. "Just-in-Time" is a typical value-added example of supply chain management.

Surcharge – An additional charge levied on top of a quoted price. See Fuel Surcharge.

Switching and Terminal Railroad – Railroad that provides pick-up and delivery services to line-haul carriers.

Terminal – An assigned area in which containers are prepared for loading into a vessel, train, truck, or airplane or are stacked immediately after discharge from the vessel, train, truck, or airplane.

Terminal Charge – A charge made for a service performed in a carrier's terminal area.

TEU – Abbreviation for "Twenty-Foot Equivalent Unit."

The Term "Third-Party Billing" or "TPB," – Specific account pricing or specific billing procedures and provisions which apply when the freight charges are to be billed to and paid by the specific account shown as the third-party payor of the freight bill, and that party has no direct affiliation with either the shipper or the consignee.

Through Rate – The total rate from the point of origin to final destination.

Third-Party Logistics (3PL) Provider – A specialist in logistics who may provide a variety of transportation, warehousing, and logistics-related services to buyers or sellers. These tasks were previously performed in-house by the customer.

Third-Party Shipments – A shipment in which the person who arranges the shipment is neither the originating nor the receiving destination. The third party makes the arrangements for the shipper and receiver.

Throughput – Total amount of freight imported or exported through a seaport measured in tons or TEUs.

TL Abbreviation for "Trailer Load."

TOFC Abbreviation for "Trailer on Flat Car." – The movement of a highway trailer on a railroad flatcar. Also known as Piggyback.

Ton-Mile – A measure of output for freight transportation; reflects weight of shipment and the distance it is hauled; a multiplication of tons hauled by the distance traveled.

Tractor – Unit of highway motive power used to pull one or more trailers/containers.

Trailer – The truck unit into which freight is loaded as in tractor-trailer combination. See Container. Standard trailer sizes (van) are 53' and 48' by 8'6" wide.

Transit Time – The total time that elapses between a shipment's delivery and pickup.

Transloading – Transferring bulk shipments from the vehicle/container of one mode to that of another at a terminal interchange point.

Transship – To transfer goods from one transportation line to another or from one ship to another.

Transshipment Point – Place where cargo is transferred to another carrier.

Truckload (TL) – Quantity of freight required to fill a truck, or at a minimum, the amount required to qualify for a truckload rate.

Twenty-foot Equivalent Unit (TEU) – The 8-foot by 8-foot by 20-foot intermodal container is used as a basic measure in many statistics and is the standard measure used for containerized cargo.

Unit Load Packages – loaded on a pallet, in a crate or any other way that enables them to be handled at one time as a unit.

Unit Train – A train of a specified number of railcars, perhaps 100, which remain as a unit for a designated destination or until a change in routing is made.

Unitization – Loading one or more large items of Cargo onto A single piece of equipment, such as a pallet.

Vanning – A term for stowing cargo in a container or trailer.

Vehicle Miles of Travel (VMT) – A unit to measure vehicle travel made by a private vehicle, such as an automobile, van, pickup truck, or motorcycle.

Warehouse – Storage place for products. Principal warehouse activities include receipt of product, storage, shipment and order picking. A place for the reception, delivery, consolidation, distribution, and storage of goods/cargo.

Warehouse Entry – Document that identifies goods imported when placed in a bonded warehouse. The duty is not imposed on the products while in the warehouse but will be collected when they are withdrawn for delivery or consumption.

Warehousing – The storing of goods/cargo.

Waybill (WB) – A document prepared by a transportation line at the point of a shipment; shows the point of the origin, destination, route, consignor, consignee, description of shipment and amount charged for the transportation service. It is forwarded with the shipment or sent by mail to the agent at the transfer point or waybill destination.

Yard – A classification, storage, or switching area.

H.2 Acronyms

AAPA – American Association of Port Authorities

AASHTO – American Association of State Highway and Transportation Officials

ACE – Automated Commercial Environment

ATA – American Trucking Association

BTS – Bureau of Transportation Statistics

CBP – Customs Border Protection

CDL – Commercial Drivers License

CFS – Commodity Flow Survey

CMAQ – Congestion Mitigation Air Quality Act

CMV – Commercial motor Vehicle

CTPAT – Customs Trade Partnership Against Terrorism

CVISN – Commercial Vehicle Information Systems and Networks (CVISN), a national program administered by the Federal Motor Carrier Safety Administration designed to improve motor carrier safety and to enhance the efficiency of administrative processes for industry and government.

CVO – Commercial Vehicle Operations

DOD – Department of Defense

FAST – Free and Secure Trade

FHWA – Federal Highway Administration

FMCSA – Federal Motor Carrier Safety Administration

FPD – Freight Professional Development

FRA – Federal Railroad Administration

GIS – Geo Information Systems

GPS – Global Positioning System

HERS – Highway Economic Requirements Systems

HPMS – Highway Performance Monitoring System

ITE – Institute of Transportation Engineers

ITS – Intelligent Transportation System

MPG – Miles Per Gallon

MUTCD – Manual on Uniform Traffic Control Devices

NAFTA – North American Free Trade Agreement

NHS – Nation Highway System

NVOCC – Nonvessel Operating Common Carriers

P&D – Pick up and delivery.

POD – Proof of Delivery

POE – Port of Entry

SED – Shipper's Export Declaration

SCAC – Standard Carrier Alpha Code

SLSC/SLDC – Shipper Load, Shipper Count/Shipper Load, Driver Count

STCC – Standard Transportation Commodity Classification

TRANCAD – Transportation Computer Assisted Design

UFC – Uniform Freight Classification