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FREIGHT DATA SYNTHESIS

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April 2008

COLORADO DEPARTMENT OF TRANSPORTATION
RESEARCH BRANCH

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16. Abstract

The research in this report was designed to collect information on the freight data needed to support transportation planning in Colorado. There were three steps involved in the research for this study. First, the freight-related transportation planning efforts in the State were reviewed. The second step was to research freight planning efforts in other states to document the types of freight data that were used and needed for these studies. This step represents the core of the research effort. The third step was to develop recommendations for freight data collection for studies planned in Colorado based on the types of data that were successfully used in other states on similar studies. The primary finding of this research is that there are freight data needs in the State that would significantly improve freight transportation planning. The primary freight data need is improved origin-destination data collected through roadside truck origin-destination surveys on interstates and key freight-intensive state highways in Colorado. This type of data would be beneficial for several types of studies, including corridor studies, truck-rail diversion studies, safety studies, and economic development studies. The research in this study also indicated that there were several freight-related studies that would be beneficial for the State including a freight-focused vehicle classification count program, a truck safety analysis, and a freight-focused economic analysis. This research also identified a freight data collection program for Colorado that includes the development of rough cost estimates for each freight data collection effort that is recommended along with examples of how the freight data can be utilized.

Implementation:

This study recommends that transportation agencies in Colorado implement the following four types of freight-related data programs:

1. Roadside truck origin-destination data program;
2. Freight-focused vehicle classification data program;
3. Truck safety data analysis; and
4. Economic data analysis.

The Colorado DOT would be the responsible agency for the truck origin-destination program, the truck safety data program, and the economic data analysis. The freight-focused vehicle data collection program would best be jointly handled by CDOT to fill in large-scale truck count gaps and at the MPO/TPR level where local jurisdictions can determine the most important local freight facilities and conduct classification counts according to local needs. A truck safety data analysis would include parsing through the existing statewide accident database to determine the number, type and severity of accidents on each interstate and state highway in the State. Also, accident mitigation measures at each of the high-accident hot spots can be developed. An economic data analysis would include a review of the industries that rely on freight transportation, a description of the number and types of jobs in each industry, and a review of the logistics chains of key industries in the State and identification of the location of bottlenecks in the State that likely impact these industries.

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- Richard Sarchet (Study Manager);
- Mehdi Baziar;
- Tim Baker;
- Jason Wallis; and
- John Coil.

EXECUTIVE SUMMARY

The research in this report was designed to collect information on the freight data needed to support transportation planning in Colorado. Improved freight data are needed to enhance the accuracy of forecasting transportation needs in the State. Improved freight data also are needed to incorporate freight into transportation models. According to the Colorado Department of Transportation, urban truck vehicle miles traveled (VMT) daily increased 65 percent from 1997 to 2006 to an estimated 3.2 million VMT. This is much higher than the 44 percent increase in urban daily VMT for all vehicles. To efficiently address transportation issues such as congestion, safety, and emissions, the role of freight transportation needs to be better understood. Additionally, an efficient freight transportation system is needed to retain, attract, and grow goods-intensive companies to Colorado.

There were three steps involved in the research for this study. First, the freight-related transportation planning efforts in the State were reviewed. The second step was to research freight planning efforts in other states to document the types of freight data that were used and needed for these studies. This step represents the core of the research effort. The third step was to develop recommendations for freight data collection for studies planned in Colorado based on the types of data that were successfully used in other states on similar studies.

The primary finding of this research is 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. CDOT has purchased the Global Insight TRANSEARCH database. However, this database includes only freight flows between regions without direct correlation to the road and rail infrastructure in the State. Several assumptions and calculations are needed to estimate the impact of freight on the State's infrastructure from the TRANSEARCH data. To complement this database, this research recommends that roadside truck origin-destination data 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 this 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.

The results of this research were fairly comparable to the expectation of the research. In 2005, CDOT completed the Freight Data Assessment which also found that roadside truck origin-destination surveys were the most pressing freight data need in the State. Therefore, it is not surprising that this research effort also found this to be the most significant data need as well. Additionally, the 2005 study also found that economic data were important for the State. The two new freight data elements identified through this study were the truck safety data and the freight-focused vehicle classification program needs. This research can be used to develop a freight data collection program for Colorado. This includes the development of rough cost estimates for each freight data collection effort that is recommended along with examples of how the freight data can be utilized.

Implementation Statement

This study recommends that transportation agencies in Colorado implement the following four types of freight-related data programs:

1. Roadside truck origin-destination data program;
2. Freight-focused vehicle classification data program;
3. Truck safety data analysis; and
4. Economic data analysis.

The Colorado DOT would be the responsible agency for the truck origin-destination program, the truck safety data program, and the economic data analysis. Each of these items would be most effective if conducted on a statewide basis rather than by regions. However, the freight-focused vehicle data collection program would best be jointly handled by CDOT to fill in large-scale truck count gaps and at the MPO/TPR level where local jurisdictions can determine the most important local freight facilities and conduct classification counts according to local needs. The specific implementation strategy would begin by conducting a roadside truck origin-destination program. This was found to be the most pressing need. This program would start by developing a survey instrument based on the freight data needs of transportation planners in the region. This survey instrument would be tested at a small number of locations in the State and then based on the success of these locations, the survey can be undertaken on key interstates and state highways around the State. Ideally, these surveys would occur every 5 to 10 years to ensure that the origin-destination data are current.

The second step would be to identify gaps in the current truck count data and to develop a freight-focused vehicle classification data program to fill these gaps. At the state level, CDOT would identify gaps on the interstates and state highways based on the current count program. Counts at these locations would occur once every three years to ensure that the count data at these locations are current. For MPOs and rural TPRs, similar processes can be undertaken to determine the location of truck counts for other types of facilities. A truck safety data analysis would include parsing through the existing statewide accident database to determine the number, type and severity of accidents on each interstate and state highway in the State. Secondarily, accident mitigation measures at each of the high-accident hot spots can be developed. An economic data analysis would include a review of the industries that rely on freight

transportation along with a description of the number and types of jobs in each industry. The economic analysis also would include a review of the logistics chains of key industries in the State and identification of the location of bottlenecks in the State that likely impact these industries along with a description of the impact of these bottlenecks on the larger supply chains.

The specific implementation of each of these four data collection programs depends on available resources within the State, but it is clear that priority should be given to the roadside truck origin-destination data program. The beneficiaries of these recommended data collection programs would primarily be transportation planners in the State. This information could be used in the development of a freight transportation plan for the State. The economic data could be used to justify the need for freight transportation projects and projects on freight-intensive corridor. The data also could be used in the development of freight travel demand models, truck-rail diversion analyses, and rail relocation studies.

TABLE OF CONTENTS

LIST OF TABLES

1. INTRODUCTION

The Colorado DOT (CDOT) is in the process of investing significant resources and time towards understanding the movement of goods and freight activities within the State. In 2001, CDOT conducted the Eastern Colorado Mobility Study that included a forecast of goods movement in the eastern portion of the State. In 2005, CDOT conducted the Freight Data Assessment Study to characterize the freight data needs in the State and develop a plan to address the needs. CDOT also has purchased the TRANSEARCH freight flow database for Colorado which includes commodity, volume, and origin-destination data at the county level for the entire State. However, freight flow data have not been fully incorporated into the CDOT and MPO project-level programming and planning efforts. This research effort was designed to provide a useful synthesis of practice for using freight data in transportation planning. The synthesis was designed to answer the following questions:

- What have other MPOs and DOTs done relative to freight data that specifically aided in developing long-range transportation plans?
- What is the value and weakness of the Freight Analysis Framework for use in statewide freight planning, Regional/MPO planning or county-to-county data?
- How effectively has freight data been used in completing transportation plans in Colorado?
- What DOTs or MPOs are leaders in the use of freight data for transportation planning and what are their practices?
- What models are available for factoring freight data into transportation planning?
- What assistance is available at the Federal level?
- What is the recommended approach for CDOT and Colorado MPOs?

The approach to this study was to focus the resources on complementing the previous freight work that already has been done in the State by dividing the work into the following four tasks:

- Task 1 – Review and Update Previous Colorado Freight Planning Studies;
- Task 2 – Scan State of the Art in National, State, and Regional Freight Data and Freight Planning Efforts;
- Task 3 – Develop Recommended Data Collection and Analysis Practices for Colorado; and
- Task 4 – Write Draft and Final Research Report.

The first task was used to summarize and update the Freight Data Assessment Study and other freight-related activities conducted by CDOT and other agencies since that study was completed. The second task was the core of the study and consisted of a focused scan of DOTs and MPOs around the country to examine how freight data have been used in other regions. It also reviewed research performed at the national level that is applicable to freight planning efforts in Colorado. The third task integrates the information collected from Tasks 1 and 2 into a cohesive set of recommended actions for CDOT. This document represents the deliverable for the fourth task of the study which is to develop a study report summarizing the methodology, results, and recommendations of the research.

2. STUDY SUMMARY

As mentioned previously, the work in this study was divided into four tasks. The goal of Task 1 was to review and update the state of the practice of transportation planning in Colorado and to identify how freight planning has been incorporated into these processes. The primary work in this task was to review freight data needs as described in the Colorado DOT Freight Data Assessment Final Report which was developed in July 2005. This information was updated by interviewing key transportation planning staff in Colorado and by reviewing documents developed for recent and current studies in Colorado.

The Freight Data Assessment Final Report included a review of the CDOT organizational freight-related goals and objectives, the identification of three broad categories of freight needs, and interviews of transportation planners which included asking interviewees to rate various freight data elements in terms of relevance and quality. The five freight data elements with the highest relevance rating and low-quality rating are shown below in Table A.

Table A. Rating of Freight Data Elements by Colorado Freight Stakeholders

Freight Data Element	Relevance	Quality	Difference
Temporal Variability	3.7	1.2	2.5
Routing Information	3.7	1.3	2.4
Origin-Destination Data	4.1	1.8	2.3
Freight Value of Time	3.2	1.2	2.0
Travel-Time Data (Delay Characteristics)	4.1	2.1	2.0

Task 1 of this study also included phone interviews and e-mail queries for information from 11 Colorado transportation planners to update the information contained in the Freight Data Assessment in regards to recent, ongoing and planned freight-related transportation planning efforts. A total of 21 studies were identified during this interview process. The final step for Task 1 was to review the corridor studies that are underway at CDOT. The studies were

reviewed based on information and reports provided on the CDOT web site. Overall, this task illustrated that there is a significant amount of freight-related planning at CDOT and a significant amount of freight-related data that are available to support these activities. However, based on the specific applications of freight data to these studies, there are several freight data needs for performing freight transportation planning in the State. The full activities and findings of Task 1 were described in a technical memorandum which is provided as Appendix A to this report.

Task 2 of this study was designed to scan a broad range of national, state, and regional projects to begin to identify a set of potential freight planning and data collection practices for consideration in Colorado. The projects reviewed in this task 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.

Thirty-two projects were reviewed in total. These projects are shown by category and jurisdiction type in Table B. 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 includes 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. The reviews of each of the projects is provided in Appendix B. Appendix B is the technical memorandum for Task 2 of this study.

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

	MPO	State	National and/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	NYSDOT Trade Overview Study	
	South Suburban Mayors and Managers Association Freight Study	Washington Statewide Rail Capacity and System Needs Study	
	San Francisco Bay Area Regional Goods Movement Study		

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

	MPO	State	National and/or Multijurisdictional
Freight Data Collection and Development Programs	Southern California Association of Governments (SCAG) Goods Movement Truck Count and Survey Study	Oregon Commodity Flow Database	Federal Highway Administration 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	
	SCAG Truck Model		
	San Joaquin Valley Truck Model		
Corridor Studies	I-710 Major Corridor Study	Georgia Statewide Truck Lane Needs Study	West Coast Corridor Coalition
	I-15 Comprehensive Corridor Study		
	SR 60 Truck Lane Study		
	SCAG Multicounty Goods Action Plan Truck Lane Analysis		
Economic Issues in Freight Planning	Colton Crossing Benefits Analysis Project	Freight Rail and the Oregon Economy	
	SCAG Port and Modal Elasticity Study		
	Regional Economic Impacts of the I-5 Columbia River Crossing Chokepoints (Oregon DOT)		

The objective of Task 3 was to develop a set of data collection and analysis practices to support freight transportation planning. This was accomplished by comparing the freight-related projects underway or planned in Colorado with studies that have been done in other regions. The freight data utilized in similar projects in other regions was compared to the freight data that is available and in use in Colorado. Data not available in Colorado was considered freight data needed for the State. Recommendations were developed based on these freight data needs and based on the need to maintain frequently used freight data in the State. Additionally, a review was conducted of the freight data needs identified and implied from the interviews done as part of Task 1 of this study and the 2005 Freight Data Assessment Report. The final recommendations incorporated the needs that were identified through these techniques as well. The full activities and findings from this task are shown in Appendix C, which is the technical report for Task 3.

CONCLUSION AND RECOMMENDATIONS

Conclusion

As discussed in the Task 3 Technical Memorandum, the overwhelming conclusion from the freight data studies, surveys, and interviews is that roadside truck origin-destination surveys would be the best next step for the freight data collection program under development in Colorado. Roadside truck origin-destination surveys were found to be utilized in several studies across the country. They are considered to be more accurate and reliable in terms of providing corridor-specific information than TRANSEARCH data. The major hurdles to conducting these surveys are the identification of suitable data collection sites and gaining permission from necessary operators of these sites to conduct the surveys. If these hurdles are cleared, then this data collection type will provide cost-effective information on truck activity throughout the State. Typically, the best locations for these surveys are weigh stations and select rest areas. Therefore, the types of truck trips intercepted for surveying tend to be intercity truck trips that tend to cross the jurisdiction of multiple MPOs and rural areas. Based on this trip pattern, it makes sense for these surveys to be conducted by the state DOT rather than an MPO or other type of regional agency. In addition to the typical questions (e.g., origin, destination, commodity carried, and facility type at origin and destination), the surveys should consider querying truck drivers for information on truck parking deficiencies throughout the State.

Establishment surveys are the second most important data collection activity. These surveys provide valuable information, but are very difficult to implement successfully. The cost per completed survey is relatively high compared to roadside truck origin-destination surveys. Additionally, it is often difficult to expand establishment surveys to a “universe” of truck trips to enable full use of the data. The most effective use of establishment surveys is the collection of qualitative information on freight infrastructure deficiencies from the perspective of the private sector freight stakeholders. This can be used to develop freight improvement projects and is particularly effective in developing near-term projects that both improve freight flow and garner the support of the freight community towards long-term freight planning coordination.

Establishment surveys conducted in Colorado should also incorporate information on temporal variability in truck activity, routing information, freight value of time, and travel-time (delay) characteristics. These were mentioned as key freight data elements that were lacking in the 2005 CDOT Freight Data Assessment. Based on the typically local nature of the information collected from establishment surveys, it may make sense for MPOs to be responsible for conducting these surveys and managing the collected data. However, as discussed in Task 1, the private sector freight community often does not understand what an MPO is. Therefore, having establishment surveys cosponsored by the Colorado DOT may improve the response rate.

Economic data related to goods movement is growing in importance in the region and around the country. It is often used to justify freight projects. It also is becoming increasingly common to prioritize projects based on some level of economic comparison between projects. It would be beneficial for CDOT to assemble the free public sector information on the relationship between goods movement and the state and local economies. Based on this review of the existing and free sources, a decision can be made on the extra value gained from purchasing one of the proprietary databases such as the Regional Economic Modeling, Inc. software system or the Transportation Economic Development Impact System that tend to have more detailed information by geography and industry sector. It is recommended that this analysis be performed by CDOT because much of the benefits of freight accrue across multiple MPO jurisdictions and a CDOT-led analysis will ensure consistency in methodologies for estimating freight-related economic benefits across the State.

Safety data is similar to economic data in that it is becoming increasingly important for project- and system-level analysis. In many instances, the economic benefits of safety improvements are estimated. Therefore, these analyses can be thought of as complementary. It would be beneficial for CDOT to conduct a statewide freight-related analysis to identify the accident rates and number of accidents related to truck and rail, where these accidents tend to occur, what the impacts of the accidents are, and what potential accident reduction projects can be considered. This would involve a comprehensive analysis of the State's safety database along with

interviews of regional engineers to corroborate high-accident locations and problematic road segments in the State. Related to the safety analysis is an analysis of truck parking throughout the State. Inadequate truck parking causes safety issues as overflow trucks tend to park on medians and ramps creating road hazards. It is a recommendation of this study that as part of the interview of region engineers that CDOT also inquire about truck parking deficiencies in the State and follow-up with site studies of problematic locations.

Recommendations

This research agrees with the recommendations of the 2005 CDOT Freight Data Assessment Study. The 2005 study recommends commencing with one of the data collection techniques shown in Table C. Based on the five-year budget utilized in the Freight Data Assessment Study, CDOT should conduct 76 roadside origin-destination surveys, 200 establishment surveys, 1 economic analysis and 1 safety analysis with the specific survey inclusions mentioned earlier in this section. It should be noted that one of the recommendations of the Freight Data Assessment has been completed. This was the purchase of the TRANSEARCH commodity flow database for the state of Colorado.

Table C. CDOT Freight Data Program – High Funding Options

Year	Scenario 1 76 O-D Surveys, 200 Establishment Surveys, 2 Economic Analyses, Freight Flow Database	Scenario 2 108 O-D Surveys, 2 Economic Analyses, Freight Flow Database	Scenario 3 28 O-D Surveys, 2 Economic Analyses and Lite Model
1	Freight flow database, 25 –D surveys	Freight flow database, 36 –D surveys	14 O-D surveys
2	Economic significance of freight (local data), 100 establishment surveys	Economic significance of freight (local data)	Economic significance of freight (available data), Economic impact of projects (available)
3	25 O-D surveys	36 O-D surveys	14 O-D surveys
4	Economic impact of projects (local data), 100 establishment surveys	Economic impact of projects (available data)	Develop "lite" statewide truck model
5	26 O-D surveys	36 O-D surveys	

Source: 2005 CDOT Freight Data Assessment Study.

REPORT PUBLICATIONS LIST

Colorado Department of Transportation, Freight Data Assessment Study, 2005

Colorado Department of Transportation, Eastern Colorado Mobility Study, 2002

Appendix A - Task 1 Technical Report

Review and Update of Colorado Freight Planning Studies

The goal of Task 1 was to review and update the state of the practice of transportation planning in Colorado and to identify how freight planning has been incorporated into these processes. The primary work in this task was to review freight data needs as described in the Colorado DOT Freight Data Assessment Final Report which was developed in July 2005. This information was updated by interviewing key transportation planning staff in Colorado and by reviewing documents developed for recent and current studies in Colorado.

REVIEW OF FREIGHT DATA ASSESSMENT REPORT

CDOT Freight Data Goals and Objectives

In 2005, the Colorado Department of Transportation completed the Freight Data Assessment Study. This study covered several topics including the development of a set of recommended freight goals and objectives which seem to remain applicable to this current freight data effort. The goals and objectives are as follows:

- Track activity for the two most significant freight modes in the State: truck and rail;
- Enable statewide, corridor-focused planning;
- Track the performance of the transportation system in meeting the needs of the freight community;
- Enable decision-makers to understand the relationship between freight and the economy;
- Determine the impact of freight activity on the other users of the transportation system;
- Allow for the incorporation of freight interests in the project-selection process;
- Incorporate freight data related to rural access to the interstate and national rail infrastructure;
- Focus on multijurisdictional freight data elements that are most effectively managed at the state level; and

- Develop a fiscally constrained freight data program that considers resources available to CDOT and the long-term costs of collecting, analyzing, storing, and disseminating data throughout CDOT and partner agencies in the State.

These goals will be used to measure the effectiveness of the current freight data available in Colorado. It will also be used as a standard to describe the improvements that would be enabled based on recommendations that are generated by this current study effort.

Identified Freight Data Needs

The 2005 Colorado Freight Data Assessment Study also included interviews of over 40 freight stakeholders including Colorado DOT planning staff, Colorado MPO planning staff, economic development officials, and private sector freight interests around the State. The interviews identified three broad categories of freight data needs within the State as follows:

1. Corridor-level freight data needs;

2. Economic analysis data needs; and

3. Rail data needs.

The interviews included surveys of the relevance and quality of 18 specific freight data elements. To identify the greatest freight data needs in the state, freight data elements with high "relevance" and low "quality" were identified based on the average difference between these two characteristics by the survey respondents. This difference was calculated for each freight data element with the conclusion that the top five freight data elements needed in the state are: temporal variability, routing information, origin-destination data, freight value of time and travel time data (Table 1). These findings are consistent with the identified needs for corridor-level freight data and economic data as freight data needs for the state. Rail data was not a specific element included in the survey.

Table 1. Rating of Freight Data Elements by Colorado Freight Stakeholders

Freight Data Element	Relevance	Quality	Difference
Temporal Variability	3.7	1.2	2.5
Routing Information	3.7	1.3	2.4
Origin-Destination Data	4.1	1.8	2.3
Freight Value of Time	3.2	1.2	2.0
Travel Time Data (Delay Characteristics)	4.1	2.1	2.0

SUMMARY OF DISCUSSIONS WITH COLORADO FREIGHT STAKEHOLDERS

The information compiled in the Freight Data Assessment Study was updated by interviewing key transportation planners in Colorado. These planners included the following:

- Jason Wallis, Colorado DOT;
- Mehdi Baziar, Colorado DOT;
- Tim Baker, Colorado DOT;
- Irene Merrifield, Colorado DOT, ; and
- John Coil, Denver Regional Council of Governments.

E-mail requests for information were also sent to Colorado DOT ITS staff and representatives of the other four MPOs in the State including:

- Bruce Coltharp, Colorado DOT ITS Planning Manager;
- Ken Simms, Grand Valley Area MPO;
- Suzette Mallett, North Front Range MPO;
- Craig Caspar, Pikes Peak Area Council of Governments; and
- Bill Moore, Pueblo Area Council of Governments.

Responses were not received from all of the MPOs. Also, no response was received from the President of the Colorado Motor Carriers Association (CMCA).

Discussions with the freight stakeholders were used to identify several recent, ongoing, and upcoming freight-related projects and activities. The freight-related projects are described below along with associated freight data used and implied freight data needs. The list also includes freight planning activities and issues that were noted through the discussions:

- **CDOT Purchase of Global Insight TRANSEARCH Data –** This data include county-level freight flow tonnages for the truck and air modes with both base year and forecast data. CDOT is sharing this database with the State's MPOs. However, multiple MPO-level staff felt that this database would be much more useful if it was available on a corridor level and had better accounting for local truck trips as well. A potential freight analytical tool to bridge this gap would be a valuable resource to freight transportation planning efforts in Colorado.

- **CDOT 2035 Statewide Transportation Plan –** This plan is currently underway. The plan will include a freight technical section that uses the TRANSEARCH database as

well as FHWA's Freight Analysis Framework (FAF) to help describe freight activity in the State. The previous statewide transportation plan also included a technical report on freight. Data used in this report included freight data from the Federal Highway Administration Freight Analysis Framework database and the Census Bureau Commodity Flow Survey. The report also included economic information from the Colorado International Trade office. Additionally, general information was collected on air cargo, pipelines, intermodal rail facilities, and intermodal highway connectors in the State.

- **Public Benefits and Costs Study of Rail Relocation –** This study analyzed the costs and benefits of alternative routings for a rail line that runs through the Denver metropolitan area. Project benefit categories included: reductions in auto and truck travel time, increased safety, increased air quality, increased property values, improved quality of life, increased job opportunities, increased tax revenues, and additional profit for the railroads. This project also estimated the costs of three alternative alignment scenarios and compared them to a no-build scenario.

- **Phase II of Rail Relocation Study –** The purpose of this study is to determine what steps will have to be carried out to form a public/private partnership. This study will define and finalize the project scope and costs. Additionally, it will determine how costs should be shared based on both public and private benefits. This study also included more detail in terms of the alignment of the rail relocation, the benefits associated with the rail relocation and the costs as well. Additionally, this study will review potential funding sources for the rail relocation.

- **Statewide Rail Database –** This database includes the number of trains for each rail line in the State. This database is also linked to CDOT's roadway inventory database.

- **CDOT Classification Count Data Review –** This study is reviewing the number and location of truck counts in the State and determining whether they are adequate to serve the State's freight planning needs.

- **Colorado Strategic Plan for Improving Roadway Safety –** This is a three-year planning document that integrates safety planning efforts of all safety stakeholders into one document that serves as a tool for future planning efforts across the State. The plan is constituted of 18 focus areas of which "Large Trucks" and "Railroad Crossings" are two of the focus areas. The trucking data in this report included the number of fatalities, injury crashes and property damage only crashes that occurred in Colorado from 2001 to 2005. The same data were provided for crashes involving railroads.

- **Upcoming Front Range Travel Survey –** This survey will include both personal and commercial vehicles. On the commercial side, it will be conducted as an establishment survey where respondents will be identified based on their establishment. The study area for this survey will be from Pueblo, CO to Cheyenne, Wyoming. The commercial vehicles component will include both short-range local truck trips and long-haul truck trips as well. This is an update of a similar survey performed roughly 10 years ago.

- **Upcoming Statewide Freight Roadmap –** CDOT plans on developing a freight roadmap that covers the entire State. The goal of this study is to provide information regarding big picture freight policies and concepts such as describing current conditions, developing a freight vision and goals, collecting and synthesizing information into the roadmap, identifying institutional requirements to implement the roadmap, and development of the roadmap document itself. Check with Jason for more deail.

- **Upcoming Truck Origin-Destination Pilot and Survey –** This study will be done in two stages. First, will be the development of the survey methodology along with a pilot study which will serve as a proof of concept. The second stage will be the full implementation of the survey. The second stage has no funding earmarked at this time.

- **Western Colorado Mobility Plan –** This study was under consideration and would ideally be used to complement the Eastern Colorado Mobility Study that was done several years back. Performing this study was considered, but is unlikely at this time due to the eastern study being slightly outdated.

- **Tracking of Oil, Gas, and Ethanol Shipments –** The recent and rapid increase in the price of oil has caused significant changes in the energy supply chain including the increased use of alternative fuels. An emerging issue for the State is to be able to estimate the location and quantity of the oil, gas, and ethanol that is shipped from, to and through the State of Colorado. Freight data needs for this study could include origin-destination surveys on interstates that are likely used for these shipments. This could also be included as part of the Front Range Travel Survey by including oil, gas and ethanol as part of the establishments that are surveyed.

- **Chain-Up Station Usage –** The location and quantity of chain-up stations has been noted as deficient causing non-ideal locations to be used creating safety hazards.

- **Ports-to-Plains Rest Stop Study –** This study estimated the current number of truck parking spaces in the Ports-to-Plains corridor and it also estimated the number of truck parking spaces needed by 2030. Freight data likely used in this study were forecasts of truck VMT into 2030, perhaps specifically for long-haul truck trips, ideally for truck trips with origin-destination patterns similar to those identified through truck driver interviews. The traffic model that was developed as part of the 2004 Corridor Development and Management Plan for Ports to Plains was used for this study.

- **Truck Parking Issues at Interstate Rest Areas in Colorado –** This study was designed to identify locations at or near Colorado Interstate Rest Areas where illegal or unsafe truck parking is occurring and then identifying potential alternative truck parking locations. The main task of this study was to coordinate with CDOT Maintenance forces, the Colorado State Patrol, and members of the private trucking industry to collect parking information at interstate rest areas and document other locations where trucks are stopping illegally on the interstate system. The study also identified potential public and/or private partnering opportunities for additional safe truck

parking locations and developed recommendations for alternative approaches for addressing the truck parking issue.

- **Potential Additional Rest Area Efforts –** CDOT applied for a Federal grant under SAFETEA-LU for actual construction/improvements of two rest areas in the state. However, neither of these grants were accepted.

- **North Front Range Freight Survey –** In conjunction with economic development groups and the local chamber of commerce, the North Front Range MPO conducted a survey of the top freight companies in its jurisdiction. The purpose of the survey was to collect information on their transportation needs. The response rate for this survey was relatively low and the answers were very general.

- **North Front Range Classification Counts –** The North Front Range MPO conducted classification counts of all of the regionally significant corridors. There was also an attempt to capture truck O-D information in the travel demand model.

- **Economic Data Needs –** One CDOT staff member mentioned the need for better economic data related to freight movement and freight projects. Ideally, the benefit of freight to local economies would be readily available.

- **Rail Data Needs –** One CDOT staff member mentioned the need for better rail data in Colorado. Much of the information from the FRA is updated only once every 3 or 10 years and more annualized data are needed. Specifically, information on the timing and length of trains along with vehicle speeds at at-grade crossings would be relevant.

- **Freight Data Collection Responsibilities –** One of the MPO representatives mentioned that freight data should be one of the responsibilities of CDOT, since many of the freight companies operate on a statewide or multiregional level and it didn't make sense to have all 15 of the Transportation Planning Regions in the State talking to the same stakeholders. Additionally, CDOT is already a recognized regulating agency and is likely to receive a greater response than an MPO which freight companies generally do not understand.

REVIEW OF PROJECT LIST FROM CDOT WEB SITE

The project list on the CDOT web site was also reviewed to further examine the role of freight in the CDOT planning process. Projects which are either on an interstate or are multiregional in nature were reviewed to determine the extent that freight planning was incorporated or needed on the study. The freight data used and needed for these studies was also noted.

There were 15 projects on the list that were found to be relevant in terms of freight as shown in Table 2. However, only five of these projects incorporated freight data in to their analysis. The types of freight-related data that were used included truck counts, road geometry information, limited origin-destination information and information from a previous TRANSEARCH purchase by the CDOT. However, several other studies did not

include a significant amount of freight data in the analysis. This included some corridor studies which occurred on I-25 and I-70 which have a significant amount of freight. In these cases, the freight data that would have been the most valuable appears to be corridor-specific, origin-destination data particularly for medium and long-haul trucks. Additionally, accident data by vehicle class would have been helpful for the I-70 Safety Study. The vehicle class accident data are available as evidenced by the Statewide Report on Improving Roadway Safety, but not explicitly mentioned on the I-70 Study. The I-70 West Mountain Corridor PEIS would have benefited from analyzing speed data separately for trucks and autos to better illustrate the need for climbing lanes.

Table 2 Select Major Corridor Studies from CDOT Web Site

Major Corridor Studies	Status	Freight Data Used	Implied Freight Data Needs
North I-25 Environmental Impact Study	Final EIS due in spring 2007	None mentioned	Medium- and long-haul truck trip data
Valley Highway (I-25) EIS	Final EIS document completed and distributed	None mentioned	None indicated
I-25 Corridor – Lincoln Avenue to Castle Rock	Construction underway	None mentioned	None indicated
The New Pueblo Freeway – I-25 through Pueblo	Draft EIS to be published in fall 2008	None mentioned	Medium- and long-haul truck trip data
I-70 Truck Parking Guide	Completed report in 2005	Grade information, height and weight restrictions on I-70, number of truck parking spaces and other truck-related services at each exit on I-70	None indicated
I-70 (MP 178.00 to MP 192.00) Safety Assessment Report	Completed in April of 2007	Truck count data, road geometry with truck escape routes	Accident data by vehicle type
I-70 West Vail Pass Environmental Assessment	Scheduled for completion in 2008	None mentioned	Speed data by vehicle class
I-70B West Study	Alternatives analysis	Truck access to existing businesses	None indicated
I-70 West Mountain Corridor PEIS	Draft PEIS available for public comment in December 2004, Final PEIS scheduled for 2007	None mentioned	Truck counts, O-D data
I-70 East Corridor Environmental Impact Statement	Preparing DEIS for I-70 in East Denver. Scheduled for completion in 2007	None mentioned	None indicated
E-470/I-70 Interchange Complex Environmental Assessment	EA completed in 2006	None mentioned	None indicated
Eastern Colorado Mobility Study	Final report completed in 2002	Commodity information, regional economic information, freight forecast data	O-D information from surveys
Northwest Corridor EIS	EIS in progress	None mentioned	None indicated
Ports to Plains Corridor Study	Most recent plan completed in 2004	Truck counts, O-D information from models	O-D information from surveys

SUMMARY OF FREIGHT PLANNING REVIEW

This task has illustrated that there is a significant amount of freight data that are available to support planning activities for the state. However, as noted in the interviews from the 2005 freight data study, the recent discussions with Colorado freight stakeholders and the review of the project list on the CDOT website, there are several freight data needs which still remain. These include the collection of new freight data within Colorado and the dissemination of freight data from existing sources. Task 2 of this study will review and compare freight planning and data in Colorado with other states. This information will be used to develop a comprehensive set of recommendations in Task 3 regarding future Colorado freight data activities.

Appendix A-1 Discussion Notes

COLORADO DEPARTMENT OF TRANSPORTATION FREIGHT DATA SYNTHESIS DISCUSSION NOTES, JULY 16, 2007

IRENE MERRIFIELD, COLORADO DOT

- Irene is currently managing a truck parking study in which they developed an inventory of truck parking spaces at rest areas on the interstates in Colorado and are considering developing a similar inventory for truck stops on the interstate.

- Irene recommended that I look at the studies listed on the CDOT web site under the tab "Major Corridor Studies" and determine which of those studies are freight-related. Specific studies that should be included are: Heartland Express, Front Range RR Study.

- Irene mentioned that there was an ITS study on I-70 with information on truck activity that should be of note. CDOT has requested Federal funding to continue this effort.

- Colorado developed a Strategic Plan for Roadway Safety which has a page on truck safety which she will send to me for reference.

Irene provided the following names of additional people to talk to:

- Bruce Coltharp, CDOT ITS, (303) 512-5807;

- Ken Simms, Grand Valley Area MPO, (970) 244-1830;

- Suzette Mallett, North Front Range MPO, (970) 416-2257;

- Craig Caspar, PPACG, (719) 471-7000; and

- Bill Moore, Pueblo COG, (719) 553-2943.

COLORADO DEPARTMENT OF TRANSPORTATION FREIGHT DATA SYNTHESIS FINAL DISCUSSION NOTES, JULY 13, 2007

JASON WALLIS, COLORADO DOT

- Jason has been with CDOT for one and a half years and can comment on freight planning activities during that time period.
- Jason developed a rail database for the State.
- Jason also sits on the 2035 Long-Range Plan Technical Committee and serves as a liaison for freight issues and planning.
- Tammy Lang, Information Management Branch Manager, is working on a rail relocation study to relocate rail lines from the Front Range to a point to the east:
  - The project is currently at the stage of high-level discussions with the operating railroads;
  - The goal is for this study to be a public-private venture;
  - This is Phase II of the study. The first phase was an economic feasibility (benefit/cost) study; and
  - Jason recommends that I speak to Tammy for more information on this project.
- Jason is also working on a project studying CDOT count data. He is polling truck counts and attempting to determine if there is sufficient data being collected to meet the Department's planning and operational needs. This study will also consider alternatives for the method and amount of vehicle classification data being collected by CDOT.
- There are two upcoming studies at CDOT that are related to freight data:
  1. **Colorado Statewide Freight Roadmap –** No information about details of this roadmap are currently available, but this project is likely to begin in early 2008; and
  2. **Pilot Truck Origin-Destination Survey –** This will be done in two phases. The first phase is a proof of concept to develop the methodology for the survey. The second phase will implement the methodology.
- DRCOG is interested in freight data, particularly origin-destination data. They have an ongoing freight study that Dike should inquire about as part of this interview process.
- The CDOT 2035 Statewide Transportation Plan is currently underway. This plan includes a freight section that will include a very general description of statewide freight movements. Some truck counts will be used. However, more and better data are desired for the 2040 Plan.

- There is a truck parking/rest area study underway. This study involves updating the list of rest areas around the State and documenting the number of truck parking spots at each rest area along the interstates. Lack of truck parking is seen as an issue statewide.

- Jason is also interested in the economic impacts of freight activity. While this has not been a strong interest organizationally, Jason would like to be able to say what the financial benefits are of freight for a local community. The current Long Range Transportation Plan has some minimal information on economic impacts.

- Jason mentioned that there is a need for significantly more rail data. Currently, CDOT retrieves information from the Federal Railroad Administration, but these data are updated every 3 or every 10 years depending on the data item. More local rail data is needed such as information on rail-highway grade crossings (number of trains and vehicles, speeds of trains). Also, more information on truck-rail diversion is needed.

COLORADO DEPARTMENT OF TRANSPORTATION FREIGHT DATA SYNTHESIS FINAL DISCUSSION NOTES, JULY 13, 2007

MEHDI BAZIAR, COLORADO DOT

- CDOT purchased Global Insight TRANSEARCH data recently. This database includes county-level information on freight flows for both a recent base year and a forecast year. The modes included in the database include truck and possibly air. There are no rail data included. CDOT is sharing this data with MPOs in Colorado. I believe there is limited rail data in TRANSEARCH

- The TRANSEARCH data are being used to update the CDOT Statewide Transportation Plan with a summary of the data included in the Technical Appendix of the document. This appendix is scheduled to be finalized by the end of July.

- As part of the Corridor Funding Management Program, the Ports-to-Plains study was conducted. This study included a significant amount of freight (primarily truck) data in the analytical section. There are no additional projects currently slated to come out of this program.

- DRCOG is leading an effort to perform a Front Range Travel Survey. The survey area runs from Pueblo, Colorado to Cheyenne, Wyoming. This is still in the early stages of development, but collecting information on trucks will be part of this study.

- Phase II of the rail relocation study is underway. Discussions have begun with BNSF and UP and Tammy Lang regarding this project.

Potential Upcoming Freight Data/Projects

- CDOT hopes to do a truck O-D survey later this year.

- An emerging freight data issue is the tracking of oil, gas, and ethanol shipments. Many of these production facilities are relatively new and not included in existing freight databases. Specifically, truck volume data from these facilities is important. CDOT staff is currently working on collecting this information.

- CDOT may at some point perform a Western Colorado Mobility Study, similar in methodology as the Eastern Colorado Mobility Study that was performed several years ago.

- As part of SAFETEA-LU, CDOT submitted a rest area improvement application to, but CDOT has not yet heard back from the Federal government whether or not this was approved.

- There is also an issue of providing "chain-up stations" for trucks to provide them with space to put chains on their tires when needed under snow conditions.

COLORADO DEPARTMENT OF TRANSPORTATION FREIGHT DATA SYNTHESIS FINAL DISCUSSION NOTES, JULY 16, 2007

TIM BAKER, COLORADO DOT

- Tim was able to confirm the ongoing and planned freight-related projects that were mentioned in my discussions with Jason and Mehdi including (new information received in discussion with Tim is also described):
  - CDOT's purchase of Global Insight TRANSEARCH data based on the recommendations of the Freight Data Assessment Study;
  - TRANSEARCH data are being used to update the CDOT Statewide Transportation Plan;
  - Ports-to-Plains study virtually complete. However, the Ports-to-Plains Coalition continues to meet on a regular basis;
  - DRCOG is leading an effort to perform a Front Range Travel Survey to update the Travel behavior Index that they developed 10 years ago. This survey needs to be integrated with the upcoming CDOT truck O-D survey;
  - Phase II of the rail relocation study;
  - Upcoming CDOT truck O-D survey;
  - Upcoming statewide freight strategic plan – more strategic than analytical;
  - Rail database being developed for the State. Matching FRA rail lines with CDOT road inventory to identify all grade crossings;
  - CDOT classification count data review;
  - Truck parking/rest area study underway – currently led by Irene Merrifield. Contact her for more information; and
  - There are no major corridor studies underway at this time.

Additional items mentioned during discussion:

- Western Colorado Mobility Study would be a mismatch with the Eastern Colorado Mobility Study, since the eastern study was completed over five years ago; and
- There is a statewide AVO study that may include trucks, but is unlikely to include much valuable information.

Other people/organizations to talk to or consider mentioned by Tim:

- Irene Merrifield – to discuss freight planning in general and the truck parking/rest area study in particular;

- Freight Coordinating Committee – meets once a month. CDOT staff only; and Public Utilities staff
- Freight Advisory Council – meets three times a year, mostly private sector;
- Tammy Lang – rail relocation study;
- John Coil – DRCOG activities and identify other MPOs (e.g., PPACOG) that may be interested in freight data; and
- Greg Fulton, Colorado Motor Trucking Association – get their general perspective.

Appendix B - Task 2

Scan of National, State, and Regional Freight Data and Freight Planning Efforts

TABLE OF CONTENTS - APPENDIX B

LIST OF TABLES - APPENDIX B

LIST OF FIGURES - APPENDIX B

1.0 Introduction

This report presents the results of Task 2 of the Colorado Freight Data Synthesis Study. This task is designed to scan 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 this task were divided into five categories:

Multimodal freight studies and plans;

Freight data collection and development programs;

Freight models;

Corridor studies; and

Economic issues in freight planning.

In total, 32 projects were reviewed as shown in Table 1.1. 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 includes 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.

In Task 3, the consultant team will work with the Steering Committee for this study to develop a set of recommendations based on combining the experiences of other state DOTs and MPOs described in this report with the freight data planning activities that were described in Task 1 through stakeholder interviews and a review of recent projects in the State.

Table 1.1 Studies Included in Scan of Freight Data and Freight Planning Efforts

	MPO	State	National and/or Multijurisdictional
Multimodal Freight Studies and Plans	DVRPC Freight Forward Improvement Program	Virginia Freight Plan	AAR National Rail Freight Infrastructure Capacity and Investment Study
	FAST Corridor Program	New Mexico Freight Plan	
	Binghamton MTS Regional Freight Study	Florida Freight Network and Statewide Freight Plan	
	Greater Vancouver Goods Movement Study	NYSDOT Trade Overview Study	
	South Suburban Mayors and Managers Association Freight Study	Washington Statewide Rail Capacity and System Needs Study	
	SF Bay Area Regional Goods Movement Study		
Freight Data Collection and Development Programs	SCAG 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, ODOT)	ITMS (California)	
		California Statewide Truck Survey	
Freight Models	Portland Metro Truck Model	Oregon Statewide Freight Model	
	SCAG Truck Model		
	SJ Valley Truck Model		
Corridor Studies	I-710 Major Corridor Study (MTA)	Georgia Statewide Truck Lane Needs Study	West Coast Corridor Coalition
	I-15 Comprehensive Corridor Study (SANBAG)		
	SR 60 Truck Lane Study (SCAG)		
	SCAG Multicounty Goods Action Plan Truck Lane Analysis		
Economic Issues in Freight Planning	RCTC Colton Crossing Benefits Analysis Project	Freight Rail and the Oregon Economy	
	SCAG Port and Modal Elasticity Study		
	Regional Economic Impacts of the I-5 Columbia River Crossing Chokepoints (ODOT)		

2.0 Multimodal Freight Studies and Plans

2.1 DVRPC Freight Forward Improvement Program

The Freight Forward Improvement Program was created by the Delaware Valley Regional Planning Commission (DVRPC) as an innovative freight planning program aimed at the implementation of low-cost capital, operations, and maintenance projects for short-term improvements in freight capacity and efficiency in the Philadelphia – Camden – Trenton region. The program is based on proactive discussions and feedback from the freight community, including carriers (trucking companies, railroads, etc.), shippers, receivers, and other stakeholders (including the general public), and serving as a clearinghouse for suggestions on small freight projects which can be quickly investigated and potentially implemented over shorter timeframes by the responsible public-sector transportation agencies. The program is innovative in that it is a diversion from the traditional long-term MPO freight planning process, and is rooted under the recognition that short-term capacity and operational improvements as well as maintenance projects can realize immediate benefits to the region in terms of increased efficiency of goods movement while also improving safety and reliability of the freight transportation system.

The success of the program can be attributed to the following key factors:

1. The program aims at short-term improvements to the freight transportation system, which is consistent with the needs of the local freight community (shippers/receivers, carriers, freight forwarders, etc.). These businesses typically have shorter time horizons for their business plans, which often conflict with the traditional long-term public-sector transportation planning processes.
2. The program gathers recommendations for freight transportation system improvement and maintenance projects in the region directly from the stakeholders and users most familiar with the existing problems in the system (such as capacity constraints/bottlenecks, safety problems such as grade crossings, etc.), thus ensuring that the project development and implementation process addresses the most critical needs in the region.
3. Strong institutional relationships established by the DVRPC with the freight stakeholder community, such as the New Jersey and Pennsylvania Motor Trucking Associations.

The program is designed to have applications to meet the operational needs of trucks, trains, ships, and aircrafts. Some examples of candidate projects that could be implemented as part of the program include the following:

- Installation of increased protection at highway/railroad grade crossings;
- Increased turning radii for trucks;
- Traffic signals; and
- Truck parking, etc.

Solicitations for potential improvement and maintenance projects are received through a special form, furnishing project-specific information related to location, specific transportation need, or problem at the location, and the proposed remedy and its benefits. While the DVRPC program has been a success, such short-scale programs can have some potential limitations. In programs like these which are different from the traditional MPO long-range transportation planning process, it is important to ensure that sufficient funds are available for the successful implementation of the selected projects. There might be cases wherein the project costs might be too low for inclusion of the project into the MPO's Transportation Improvement Program (TIP), while the costs might exceed the local agencies' maintenance and operations budgets, in which case, there is the risk of antagonizing the private sector and/or losing the credibility of the public sector with the private freight community, due to the inability to meet the needs of the stakeholders.

Relevance for Colorado DOT and Colorado MPOs

This is a good example of a study that can be used to implement quick, short-term solutions of interest to the freight community. Implementing a program such as this also builds tremendous credibility between the public sector planning agencies and the private sector, thereby fostering support and engagement for long-range planning efforts as well.

Data/Information Needed to Implement Program

Information would need to be collected from the private sector freight stakeholders regarding which projects are of most interest to them. This can be done through mass surveys, individual interviews, or freight stakeholder roundtable events. It would also be helpful for CDOT and/or the MPOs to have a method of quantifying the benefits of these small projects to allow for prioritization and filtering of studies. Additionally, these types of programs are most successful when there is a predefined amount of money dedicated to these types of projects prior to engaging the private sector, so that they understand that the projects are funded and will not be held up in the traditional long-range transportation planning process.

2.2 FAST CORRIDOR PROGRAM

The Freight Action Strategy for the Everett-Seattle-Tacoma Corridor (FAST Corridor) is a public-private partnership (PPP) program between 26 local cities, counties, the seaports, Federal, state and regional/metropolitan transportation agencies, trucking companies, and the railroads, with the objective of solving key freight mobility problems in the Puget Sound region in Washington through coordinated solutions. Some of the key agencies and stakeholders partnering in the FAST Corridor program are presented in Table 2.1.

Table 2.1 FAST Corridor Partner Agencies and Private Stakeholders

Public (by Jurisdiction) and Private Sector Groups	Agency
Federal	FHWA (U.S. DOT)
State	Washington State Department of Transportation (WSDOT)
	Freight Mobility Strategic Investment Board (FMSIB)
	Transportation Improvement Board
Region	Puget Sound Regional Council (PSRC)
Ports	Port of Everett
	Port of Seattle
	Port of Tacoma
Cities	Seattle
	Tacoma
	Everett, and other cities in the Puget Sound Area
Counties	King
	Pierce
	Snohomish
Private Stakeholders	Railroads (BNSF and Union Pacific)
	Washington Trucking Association (WTA)

Source: http://www.psrc.org/fastcorridor/partners.htm.

The FAST Corridor program was initiated in 1998 with the following freight mobility visions and goals in the region:

- Improving the functionality, capacity and connectivity of the mainline rail system;
- Elimination of chokepoints/bottlenecks at the intersection of railroad and arterial networks;

- Provision of safe railroad crossings, and reliable emergency access for local communities; and
- Establishment of reliable and efficient truck linkages between the ports, intermodal rail yards, and regional warehouses/distribution centers.

Looking at the visions and goals of the FAST Corridor program, the importance of the program for the Puget Sound region and the State of Washington as a whole, cannot be overemphasized. Maritime trade supports a whopping 30,000 direct, indirect, and induced jobs in Washington State alone, making it the most trade-dependent State in the nation. Also, the Ports of Seattle and Tacoma, together, account for the third-largest container port complex in the country, and are experiencing robust growth in cargo volumes, which is invariably straining the capacity of the regional transportation system. Consequently, the efficient inland distribution of international goods through the State is key to ensuring the vitality of the state and regional economy, and to preventing the loss of investment and market (and associated jobs) to other regions/markets due to inadequate capacity or system inefficiency.

A total of 25 related but independent high-priority grade separation projects in the Everett – Seattle – Tacoma corridor were selected in the FAST Corridor program for their expected impacts on freight mobility improvements in the region. The projects were evaluated and prioritized based on five evaluation criteria, which include General Mobility; Freight Mobility; Safety; Communities/ Environment; and Cost-Effectiveness. The evaluation methodology also included a comprehensive analysis of truck traffic data, applications of rail traffic simulation models, safety data and emissions data.

The FAST Corridor projects have been implemented in two phases – Phase I and II. Phase I included 15 projects selected in the 1998 prioritization process, 10 of which have been completed. The Phase II was added to the program owing to the tremendous success of the Phase I program in leveraging partnership funds for the implementation of critical projects. The Phase II prioritization process selected 10 projects in 2002, and some of these have already begun construction. The completion of all FAST Corridor projects will lead to grade separations of most major arterials crossing rail mainlines to the Ports, thus providing significant benefits in terms of rail and highway capacity and reliability enhancements, as well operational, and other (safety, environmental, etc.) benefits.

In the close to 10 years since FAST was established, $568 million of public and private funding has been leveraged for strategic freight mobility improvements. The remaining 15 projects have an estimated budget of an additional $300 million (as of April 2006). The funding participation for the FAST Corridor program from the program stakeholders was planned through the signing of a Memorandum of Understanding between stakeholders, which outlined the following funding participation goals:

- Contribution of 40 percent of the program costs by the Federal Government – in TEA 21 and other targeted efforts;
- Contribution of 40 percent of the program costs by the State of Washington, through the Washington State DOT, the Freight Mobility Strategic Investment Board and the Transportation Investment Board;
- Contribution of 7 percent of the program costs by the Ports of Seattle and Tacoma, collectively;
- Contribution of 3 percent of the program costs collectively by the railroads – Union Pacific (UP) and Burlington Northern Santa Fe (BNSF); and
- Contribution of the remaining 10 percent of project costs by each project's parent agency.

It is to be noted that actual participant funding shares vary by project, based on specific project benefits.

The most notable benefit of the FAST program relates to the multiparty collaboration in project selection and financing, for freight mobility enhancement in the region. The program has allowed funds to be redirected to projects which are ready to begin construction, and has promoted a strategic and integrated approach to project selection leading to more efficient and effective use of available funds. Also notable are the significant freight mobility benefits realized from the FAST Corridor program in the region through improved port access and elimination of major arterial – railroad crossings through grade separation. Other significant benefits attributable to the projects implemented through the program are briefly discussed below:

4. Mitigation of conflicts between urban center growth and freight growth;
5. Increased truck mobility due to improved capacity and travel time reliability along major arterials;
6. Increased operational speeds for the railroads and safety improvements due to separated grade crossings; and
7. Increased freight capacity at the Ports due to enhanced landside truck and rail mobility.

Relevance for Colorado DOT and Colorado MPOs

This project is an illustration of the benefits of interagency coordination in regards to dealing with freight projects. Freight solutions tend to be even more multijurisdictional than passenger issues, thereby heightening the importance of multijurisdictional coordination. Interagency coordination is important in Colorado as it is in other states. Therefore, the lessons learned in this study can be referenced when considering interagency coordination in Colorado.

Data/Information Needed to Implement Program

To implement a program similar to the FAST Corridor Program, transportation planning agencies in Colorado would need to work closely with the private sector to develop a set of freight projects that is mutually beneficial to both parties. This is a complex task since the private sector has a shorter planning horizon than the public sector and they are often difficult to coordinate with in terms of performing transportation planning. Additionally, many private sector companies do not understand the public sector planning process and are unclear how to interject into the process efficiently. There will be a significant education and outreach effort which must occur in Colorado prior to partnership with the private sector.

2.3 BINGHAMTON METROPOLITAN TRANSPORTATION STUDY REGIONAL FREIGHT STUDY

The first task of this study was to establish a benchmark of existing freight demand, capacity, and operating characteristics. This study developed a regional freight profile using data from Global Insight TRANSEARCH data. The data were used to show the modal and industrial composition of the region; its freight traffic volume by various measures (such as tons, value, units, ton-miles, and truck vehicle-miles traveled (VMT)); and its trading patterns – including those that pass through the area. The concentration of freight volume and its flows along highway and rail networks were depicted using modeling techniques provided by the study team to NYSDOT. The industrial components of traffic were linked by commodity classification codes to a data set of business establishments and utilized to define targets for field interviews.

Field interviews were used to complete the descriptive profile and collect interactive and strategic information. The interviews were used to collect data on local freight traffic that is not covered in the national and state databases and also to obtain an understanding of service requirements and system performance. Stakeholders were relied upon to uncover a range of local issues, from facility access to major and minor bottlenecks, truck parking and staging, signaling, and signage. A number of these were amenable to relatively low-cost solutions, which BMTS could address in a quick-start program.

Another task in this study was to describe the existing economy of the Binghamton area and the relationship between Binghamton's freight transportation system and its economy, and to analyze transportation's impact on future economic growth. The characteristics of the Binghamton regional economy were described using Global Insight's Business Demographic Model databases. Key economic and demographic trends affecting the Greater Binghamton, New York State, and Northeast regional economies were described using Global Insight's Regional Service models.

Relevance for Colorado DOT and Colorado MPOs

This study is an example of a traditional MPO-level freight transportation plan. However, this study has a particular emphasis on describing the relationship between freight and the economy. This is very often a feature of freight plans in small and medium-sized areas. This can be used as a guide in developing MPO-level freight plans in small and medium-sized areas in Colorado. The focus on economic issues is often critical to explaining and justifying freight studies in smaller regions.

Data/Information Needed to Implement Program

The freight flow information used in the Binghamton Freight Plan already exists in Colorado through the TRANSEARCH database. Much of the economic data utilized in this freight study are available at no charge from the Economic Census. However, some economic data is suppressed due to concerns about privacy of the private sector. Therefore, economic data may need to be supplemented using one of the proprietary sources such as Woods & Poole for employment data and REMI for economic impact data.

2.4 GREATER VANCOUVER GOODS MOVEMENT STUDY

This study divided its work into the following five primary tasks. These tasks come together in the framework shown below.

- **Task 1 – Data Assessment** will determine within the first month of the project what data are available, and will compile these data for use in other tasks. It also will provide an initial assessment of data gaps that will need to be filled in Phase II.
- **Task 2 – Economic and Industry Sector Scan** will define the key economic drivers of goods movement demand, and will determine how the current goods movement system is serving the needs of its customers. Understanding of key industry logistics and supply chain patterns and trends will be included in this assessment, as will a description of the economic significance of goods movement for the region.
- **Task 3 – Modal Profiles and Traffic Patterns** will describe each of the modal systems, their infrastructure issues, and traffic levels. This will be the core analysis of transportation issues and concerns that need to be addressed by strategic investments and other program alternatives.
- **Task 4 – Regulatory Issues and Governance Scan** will address key issues and concerns related to the interactions between industry and the government, and will look at the changing role of public sector entities in the freight system.

- **Task 5 – Final Report and Phase II Workplan** will compile the results of the study into a final report that profiles the regional freight system and recommends directions for future policy. The Phase II Workplan will be detailed and will describe the data gaps to be filled, the tools to be developed/ upgraded, and the strategies that will be evaluated.

The objective of the data assessment task was to compile and conduct an assessment of the available data. The goal was to use the data in the subsequent tasks to conduct the scans, and the assessment will allow us to determine what data will be needed to be collected in Phase II to build tools and conduct analysis. The data assessment will organize the available data and data needs of the following types:

- Economic and industry logistics data;
- Modal infrastructure data; and
- Traffic and system performance data.

In conducting the assessment, a review was conducted of all of the major sources that are readily available through Federal, Provincial, regional/local, and industry/ private sources. Specific data sources included:

- *Shipping in Canada* (Statistics Canada);
- International Trade Data – Strategies (Industry Canada);
- *Rail in Canada* (Statistics Canada);
- Economic Impact Analysis of the Major Commercial Transportation System (Greater Vancouver Gateway Council);
- *Trucking in Canada* (Statistics Canada);
- IMTC Cross Border Travel Study (2001);
- For-Hire Trucking Survey (Statistics Canada);
- Strategic Freight Transportation Analysis database for Washington State (Washington State University);
- Annual Motor Carriers of Freight Survey (Statistics Canada);
- IMTC Cross Border Rail Study;
- National Roadside Survey;
- IMTC Binational Transportation Model Development;
- Lower Mainland Truck Freight Study (truck travel diaries, gate intercept surveys at key freight facilities);
- Lower Mainland Rail Infrastructure Study (Greater Vancouver Gateway Council);
- BC Freight Transportation Study (Transport Canada);

- BC Ports Strategy (Ministry of Transportation); and
- BC Ministry of Transportation Vehicle Classification Counts.

A useful way of assessing the data was to define the questions that need to be answered and the types of data needed to answer the questions, and then to identify the types of data sources that address these questions. Then the quality of existing data was rated and priorities for future data collection can easily be developed.

Relevance for Colorado DOT and Colorado MPOs

Much of the data and information available in Vancouver is port-related and not directly related to Denver. However, this recent study has expended significant resources to differentiate intraregional traffic from interregional traffic and through traffic. This is of particular importance in Vancouver due to the ongoing debate regarding the extent to which the port traffic is local to the Vancouver area or domestic. This is important in other regions, in addition to Colorado, because the relative proportion of internal traffic relative to through traffic impacts the urgency ascribed to freight issues and the types of solutions that are proposed.

Data/Information Needed to Implement Program

The information collected in the Colorado Freight Data Assessment and Task 1 of this study can be utilized to define the types of questions that need to be answered and the quality of existing data to answer these questions. However, there is a long list of freight-related studies in the Vancouver region which provide a more comprehensive set of data than what is currently available in Colorado. Data needs that would be needed to develop a similar database include: a trucking survey, a roadside survey of autos, detailed information on rail and port activity, and a comprehensive truck count program.

2.5 SOUTH SUBURBAN MAYORS AND MANAGERS ASSOCIATION (SSMMA) FREIGHT STUDY

The South Suburban Mayors and Managers Association is an organization consisting of representatives of municipalities in the southern portion of the Chicago metropolitan area. They commissioned a freight study to understand the impacts of freight flows in their region. The technical approach for this study consisted of four major tasks described below:

- **Task 1 –** Perform an inventory of the Southland's existing and proposed freight infrastructure; identify existing freight purchasers and users; and profile existing freight patterns;

- **Task 2 –** Conduct two Stakeholder workshops to gain an understanding of the Southland's perceived freight infrastructure needs and deficiencies and help to build an enduring Public-Private Partnership Forum;
- **Task 3 –** Evaluate existing and perceived assets, needs and opportunities; and
- **Task 4 –** Develop a phased implementation plan for capital and operational improvements, based on policies and strategies that achieve economic benefit goals while minimizing transportation impacts and related costs.

The objective of the first task was to perform an inventory of the Southland's existing and proposed freight infrastructure, identify existing freight purchasers and users, and profile existing and future freight patterns. For existing facilities, the consultant team assembled information on the highway system, including network geographic information systems (GIS) files, vehicle counts and truck percentages from the Illinois Department of Transportation (DOT) highway performance monitoring system (HPMS) data, and other available information from the Federal Highway Administration (FHWA), Illinois DOT, CMAP (formerly CATS), and county records. The team also obtained current and forecast truck flows and volume/capacity ratios from Illinois DOT, CMAP, or other local sources. The next step was to assess available data on truck flows in the Southland. As part of a recent freight planning study for the City of Chicago, Cambridge Systematics updated the 1980s era truck trip table used in the CATS regional travel demand model with new data derived from county-to-county freight volumes and truck counts on highways and arterials. While focused on the central portion of the metropolitan area, this data may be helpful in developing a profile of truck movements in the region.

The consultant team also obtained rail system information, including roadway-railroad grade crossings, rail yards, and facilities from the Federal Railroad Administration (FRA) rail network and grade crossing data, the Bureau of Transportation Statistics (BTS) intermodal facility database, Illinois DOT, and private railroads. The next step was to obtain information on the proposed Abraham Lincoln National Airport from the Illinois DOT based on the South Suburban Airport Master Plan. Finally, information was obtained on intermodal connectors from FHWA data sources, along with any information from the Illinois DOT, the CREATE study, the Metropolis 2020 Freight Plan, and other local sources.

For planned facilities, the consultant team obtained highway improvements from the transportation improvement plans (TIP) and long-range plans of the Illinois DOT, Illinois State Toll Highway Authority (ISTHA), and CMAP, through the SSMMA Transportation Committee, as well as Cook and Will Counties. Additionally, information on rail improvements was collected from the Illinois DOT and area railroads. The Illinois DOT provided information on improvements to air cargo facilities and intermodal connectors.

In collecting existing information on demographics and land use patterns in the Southland area, particular attention was paid to clusters of freight activity. The primary users of the freight transportation system were identified using the InfoUSA database. Population density and employment data was collected from the U.S. Census and local sources for county and subcounty levels. Land use, land development, zoning, and freight facilities (current and year 1995) was collected from CMAP, the State of Illinois, Cook and Will Counties, and other sources as available. InfoUSA data was used to identify types and locations of freight generating businesses. InfoUSA is a commercial data product by Dunn and Bradstreet that provides address locations for businesses by type, broken out by number of employees, output, and other measures. This tool was helpful for identifying likely freight-generating businesses – particularly manufacturing, agriculture, wholesale, transportation, warehouse/distribution, and retail. The data covered establishments in the Southland study area.

To develop a profile of current and future freight patterns, data was obtained by mode of transportation and major commodity grouping utilizing the FHWA Office of Freight Management Freight Analysis Framework Version 2 (FAF2). Other public data sources, such as the Illinois DOT, CMAP, local universities, CREATE, and Metropolis 2020 Freight Plan; and private industry data, including railroads and trucking companies was also incorporated.

Relevance for Colorado DOT and Colorado MPOs

This study is on the opposite end of the spectrum relative to the Binghamton Freight Plan. Rather than focusing on the relationship of freight to the economy, this study focuses on freight's impact on congestion and freight's impacts on the transportation infrastructure. This represents a separate path for the Colorado DOT and MPOs and Colorado to consider in conducting freight plans and studies.

Data/Information Needed to Implement Program

To implement a study similar to the SSMMA Freight Study, extensive information on current and future operating conditions are needed. This would include a large vehicle classification counts, freight facility information (including location, size, and number of trucks in and out of the facility), information on bottlenecks in the study area and a means of forecasting both freight and passenger vehicle activity in to the future. To implement this study statewide, a statewide model with a separate truck component would be needed. Alternatively, a coarse analysis technique that relied on historical growth rates to forecast future growth could be implemented. This would require extensive historical information on both truck and auto counts throughout the State. To implement this study on a metropolitan level, a travel demand model is also preferable to enable the identification of bottlenecks in the urban area. Additionally, information on the operational and physical condition of the infrastructure would be needed. Operational data can be estimated from travel demand models and infrastruc-

ture information is typically available from state DOTs and included in the HPMS database.

2.6 REGIONAL GOODS MOVEMENT STUDY FOR THE SAN FRANCISCO BAY AREA

The Regional Goods Movement Study for the San Francisco (SF) Bay Area was undertaken by the Metropolitan Transportation Commission (MTC), the regional MPO for the SF Bay Area, with the goals of understanding key economic issues in the region impacting goods movement, logistics and supply chains of key industries in the region, current and future trends in demand for goods movement, and existing and future conditions of the freight transportation system, in order to develop priorities for the allocation of funds for key transportation projects to enhance goods movement efficiency, and allow for the development of a framework for the MTC for Federal advocacy as well as regional goods movement planning efforts. Funds for conducting the study were also contributed by other public sector agencies, including the Port of Oakland, the Bay Area Air Quality Management District, Caltrans, the Economic Development Alliance for Business, and the Bay Area Council. The study was conducted in two phases – Phase I looked at the goods movement demand and supply characteristics, the economic significance of goods movement activities, and the interactions between land use and goods movement, while Phase II summarized key goods movement issues in the region and identified goods movement policies and projects for the long-range transportation planning process. The results from the study made key contributions to the development of the Transportation 2030 Plan for the SF Bay Area, making goods movement issues to be incorporated specifically into the plan for the first time.

The key freight data sources used in the study, and their applications, are briefly discussed below.

- Trade statistics data from the U.S. Department of Commerce were used to analyze the economic activity of the regions major gateways (airports and seaports) and determine their share of the total bay area economic output. The trade data were also used to analyze the major industry sectors/ commodity groups involved in international trade using the regions international gateways.
- The Caltrans ITMS data provided the commodity flow statistics to estimate the major types of commodities involved in domestic trade in the region, and the magnitude of the trade in terms of tonnages. The data also provided the share of the total trade moving on different modes by value and weight. The domestic trade data from ITMS were analyzed separately for internal flows (flows within the region) and interregional flows (flows between the region and external regions).

- The IMPLAN Economic Impact Modeling System was used to analyze the expenditures of goods producing industries in the region on transportation services by mode. These statistics are useful in analyzing which are the major industry sectors relying on transportation, and what share of total business costs of these industries are spent on transportation services, which is a key data input for determining the economic impacts of transportation system performance improvements. IMPLAN also provided data to estimate economic output of key industry sectors in the region (in terms of value of goods and services produced).
- The importance of the goods-related industries to the bay area economy was analyzed using employment and economic output data from the Association of Bay Area Governments (ABAG). This analysis was performed by estimating the shares of total employment and economic output for each of the nine counties in the region related to goods-related sectors.
- The study used the survey data from the Caltrans Heavy Duty Truck Survey conducted along major freeways in the region (I-880, I-580, U.S. 101, I-80, and I-680) to understand origin-destination (O-D) distribution patterns of trucks on these facilities, the major commodities moving along these corridors, and the major types of facilities used by trucks on these facilities. This information is useful in identifying what drives truck traffic demand on these corridors, and which are the major industry sectors that might be impacted by congestion on these corridors.
- The study used Weigh-in-Motion (WIM) data to understand time-of-day distribution patterns of truck and auto traffic along key corridors (I-880, I-80, U.S. 101, etc.) to understand how any peak-period interactions between auto and truck traffic, and their impacts on congestion.
- Data and maps from the Railroad Atlas of North America, the National Transportation Atlas Database from the Bureau of Transportation Statistics (BTS) and Caltrans were used to analyze rail network characteristics in the region, and line ownership and trackage rights by railroad.
- Rail traffic, in terms of train counts, were analyzed using data obtained directly from the railroads (UP and BNSF) in terms of number of trains along major rail corridors (such as Oakland-Stockton and Oakland-Roseville) for intermodal, Carload, and Unit trains.
- The Carload Waybill Sample from the STB was used to analyze inbound and outbound rail carload and intermodal freight flows in terms of tons for major commodity groups.

Relevance for Colorado DOT and Colorado MPOs

This MPO-level freight plan is a good example of a comprehensive MPO-level freight plan. It incorporated an analysis of the relationship of freight to the regional operations, the regional infrastructure, and the regional economy. This

has been captured neatly in the framework developed for the study (Figure 2.1). This can be used as a reference for MPOs in Colorado that are considering conducting a freight plan for their jurisdiction.

Data/Information Needed to Implement Program

This study assembled transportation and economic data from a multitude of sources to develop a comprehensive picture of goods movement in the region. It drew from previous studies such as a statewide roadside truck survey, statewide TRANSEARCH freight flow data. The study also benefited from pre-existing economic and employment data provided by the regional economic development organization, ABAG. To implement a similar study, truck survey and economic data would be needed in Colorado. Specific data needs to implement this program would be economic data, rail traffic data, WIM data, roadside truck survey data, and inter-regional trade data.

Figure 2.1 Freight Transportation System Data and Trends

2.7 VIRGINIA DEPARTMENT OF TRANSPORTATION FREIGHT PLAN – PHASE I

The Virginia DOT recently completed Phase I of its statewide freight plan. The scope of work for this project was to:

- Compile an inventory of the existing freight network by its key components: highway, rail, air, ports, intermodal facilities and connectors, and distribution centers;
- Identify current and future needs on the system;
- Examine the macro-sale economic impact of freight movement;
- Provide recommendations for state planning and programming policies; and
- Include an extensive program of coordination among public sector agencies, including regional planning bodies, and outreach to the public and private stakeholders.

The basic framework of the study included a task titled "Data Collection, Analysis, and Tools." The study compiled existing data from the Virginia DOT (including a planned TRANSEARCH data purchase from Global Insight) and other Virginia modal agencies, along with other available Federal, regional, and local data into a geospatial freight database. The data was analyzed using proprietary software. The result was a comprehensive overview of freight transportation and its underlying macro-level economic factors, drivers, and impacts. Key sources of data included important modal and cross-modal planning studies that address freight movement including the VTrans 2025, the Virginia DOT's 2025 Highway Needs Assessment, the 2003 Virginia Air Transportation System Plan Update, the DRPT Virginia Statewide Rail Plan, I-81 diversion and tolling studies, Heartland Corridor planning studies, and various highway corridor planning studies. The study will obtain relevant public-source data from Federal sources including:

- Bureau of the Census Commodity Flow Survey results;
- The original and recently updated Freight Analysis Framework (FAF) data;
- The U.S. Army Corps of Engineers Waterborne Databank and Port Facilities inventory;
- The FRA's rail network and the Surface Transportation Board (STB) Public Use Carload Waybill Sample (the full Waybill Sample is available, but subject to use restrictions);
- The Bureau of Transportation Statistics (BTS) Intermodal Facility database; and
- Bureau of the Census economic and demographic data.

Another task of the study is to develop a macro-level understanding of the importance of freight to Virginia's economy through: 1) an analysis of the breadth and size of Virginia's freight-related industries and their importance to the Virginia economy; 2) an overview of the Virginia's economic structure and the roles played by freight in supporting its key industries and businesses; and 3) a review of national and international economic and freight logistics trends and their potential ramifications on Virginia's freight-related facilities and

industries. Local and national economic data sources were used to quantify the current level of economic activity in Virginia that is directly related to freight movement. The level of economic activity for Virginia's "goods movement cluster" will be estimated using county-level employment and wage data from a variety of sources, including the U.S. Department of Labor's Bureau of Labor Statistics, the U.S. Department of Commerce's Bureau of Economic Analysis, the U.S. Census Bureau (this will include an analysis of freight-related revenues, payroll, and productivity levels based on data from the Economic Census for Transportation), and the Virginia Employment Commission. These data will be provided for segments of the goods movement industry including: trucking, air transportation, railroads, warehousing and distribution, couriers, and other freight-related services.

Relevance for Colorado DOT and Colorado MPOs

This study is an example of a traditional statewide freight plan. It examines both the impact of freight on the State's infrastructure and the relationship between freight and the economy in the State. This can be used as a reference if Colorado were to consider a statewide freight plan in terms of the breadth of information that can be assembled across economic categories, freight flow categories, infrastructure types, and regulatory/legislative considerations.

Data/Information Needed to Implement Program

This study demonstrates the wealth of information available at the state level to perform state freight plans. This study combines TRANSEARCH data with publicly available data and state-owned employment data to tie goods movement to the economy and the State's infrastructure. The data needed in Colorado to implement this plan would be the detailed FRA rail network. All of the other data are publicly available and can be obtained by CDOT.

2.8 NEW MEXICO FREIGHT PLAN

The objective of this study is to define the significance of goods movement to the New Mexico economy. This phase will identify existing and emerging industries that are significantly impacting the State's freight transportation system and/or are the focus of statewide or regional economic development activities; describe how industry logistics patterns impact the freight transportation system; and describe the key economic, trade, and supply chain trends that are influencing freight demand and freight movements in the State.

This first subtask in this study was to develop a data collection strategy and obtain necessary data. For this study a framework was developed similar to the one developed for the Colorado Freight Data Assessment Study to identify and prioritize freight data needs for the State. Additionally, data sources at the Burlington Northern and Santa Fe Railway (BNSF) and Union Pacific railroads and major national and regional motor carriers were used to obtain necessary

data in other statewide freight studies in the western states. Specific sources of data mentioned included:

- New Mexico Multimodal System Study;
- Woods & Poole Economic Data;
- FHWA Freight Analysis Framework Data;
- Carload Waybill Sample;
- Bureau of Transportation Statistics (BTS) Commodity Flow Survey;
- Highway Performance Monitoring System;
- U.S. Census County Business Patterns;
- BTS Transborder Surface Freight Data;
- InfoUSA Business Establishment data;
- BTS Transportation Satellite Accounts;
- the State's ES 202 employment by establishment database (if available);
- County Business Patterns (a publicly available product of the U.S. Census); and
- Data and information available from the New Mexico Economic Development Department.

The importance of transportation to these key industries was described using impact studies, statewide and national input-output models, and Transportation Satellite Accounts. Contacts at major railroads and other freight facility operators were also interviewed to better understand how the supply chain and logistics decisions made by these stakeholders are affecting the transportation system and operations in New Mexico. The logistics processes of major and emerging industries were then mapped. This approach will allow for the identification of major highway and rail links in the statewide and regional networks that are most heavily used by different industries. This has proven to be a very effective technique for demonstrating the business impacts of transportation system deficiencies on specific industries, and it also is useful for prioritizing infrastructure investments to promote economic development.

Relevance for Colorado DOT and Colorado MPOs

This study is an example of a state freight plan that is oriented towards developing a statewide understanding of the relationship between freight and the economy. A unique element of this study is the incorporation of logistics chains. The logistics chains are used to describe all of the goods movement steps involved in supplying the industry with inputs. It also describes the process of moving goods to customers of the key industries. Supply chains tend to involve multiple modes, several geographies, and have varying degree of urgency asso-

ciated with different goods which is often different than the average value of time data that is often used to monetarily quantify the significance of goods movement.

Data/Information Needed to Implement Program

The economic data to conduct a study similar to the New Mexico Freight Plan already exists in the State of Colorado. However, information on the logistics chains for key industries does not exist. These would need to be collected separately. The first step in the process would be to identify key industries in the State. This can be done based on economic output of an industry, employment levels in each industry, and growth forecasts of each industry. Much of this data is already available at the state level. The next step would be to interview several of the companies within each industry and inquire about the goods that they purchase and their sourcing methods for these goods. Sourcing methods would include asking about information such as:

- How much of each commodity do you purchase?
- Do you manage the transportation process for delivering the goods to your location?
- What locations do these goods originate from?
- What mode is used to ship the goods to you?
- What specific routes are taken to ship the goods?
- What bottlenecks exist for each of the routes? Which bottlenecks impact your overall production, distribution schedule and what is the nature of the impact?
- How often do you have the goods shipped to your facility?
- What options do you have to source the goods and why did you select the current option?
- How do you foresee the sourcing of these goods changing over time?

Similar questions would be asked in regards to the shipment of goods from the facility to the end customer. The end result would be the generation of multiple supply chains that identify the critical flows for each company. As the supply chains of multiple companies within industries and across industries are overlaid with each other, a picture can be developed regarding the critical infrastructure and critical bottlenecks for key industries in the State.

2.9 FLORIDA FREIGHT NETWORK AND STATEWIDE FREIGHT PLAN

The objective of this task was to design, develop, and execute an approach for designating a statewide Freight Network and Modal Linkages System (Freight

Network). This network included the Florida Statewide Strategic Intermodal System (SIS), the Emerging SIS, regional, and local system elements and will address all modes of transportation. This designated system was the foundation for the Florida Statewide Freight Plan, utilizing, and building upon, previous efforts. The Freight Network designation process was modeled after the process used to designate the SIS and was driven by policy objectives and supported by data. Designation criteria were based on national and industry standards, and reflective of partner input. The GIS-based data analysis and mapping system developed as part of the SIS was expanded as necessary to facilitate the Freight Network designation process. Figure 2.2 provides an example of the type of data available through the SIS, presenting truck volumes throughout Florida.

The objective of this study was to develop a comprehensive Statewide Freight and Goods Mobility Plan that integrated all available resources and projects. This included consideration and integration with the SIS, the trade corridors program, and the existing modal plans, as well as the identification and prioritization of additional investments to fully develop and improve the Freight Network and Modal Linkages System.

Documentation of the existing freight system reflected the results of the freight network designation process. Data on key system attributes and performance measures was compiled into a GIS database that builds upon the existing SIS and Florida Intermodal Highway System (FIHS) databases. Enhancements considered for this study included the addition of a rail network and mode choice model to the Freight Model; expansion of the Macroeconomic Model to address marine, aviation, and intermodal investments; augmentation of the decision support system modules to include freight and economics; and addition of freight network and modal linkages details to the SIS and FIHS databases.

Figure 2.2 Truck Highway Volumes in Florida, AADTT

Relevance for Colorado DOT and Colorado MPOs

The unique aspect of this study is the focus on identifying the statewide transportation system that is critical for the movement of goods. The Florida DOT had already identified the network that is critical for passenger travel in the State. This information is important in Florida, because projects on the critical transportation network, termed the Strategic Intermodal System (SIS), have priority in terms of funding and implementation. This is relevant to Colorado because it provides an option in terms of performing freight and general transportation planning. Using the Florida technique, the first step would be to identify your critical freight corridors in the state. Then, all planning focuses on those specific corridors, while no planning occurs at the statewide level for the other facilities.

Data/Information Needed to Implement Program

Data to identify the critical freight infrastructure system in Colorado exists. This could be constructed based on truck counts throughout the State. However, a statewide model would be very helpful to refine the analysis by estimating volumes in between count locations and identifying the distribution of short-haul and long-haul trucks throughout the State. A DOT could conceivably prioritize one type of truck flow above another.

2.10 NYSDOT TRADE OVERVIEW STUDY

This study included a task to describe the current New York State (NYS) and regional economies and identify the demographic and economic trends that will shape the economies in the future. Understanding the statewide and regional economies and the trends affecting them provides insight into how the transportation system serves existing and emerging industries and contributes to economic vitality and competitiveness. A summary and interpretation of demographic and economic forecast data was developed through 2030. Particular emphasis was placed on pinpointing the growth industries, both on a statewide and a regional basis that will shape NYS' future economic growth. The economic profiles provided a demographic and economic context to guide strategic decision-making, allowing the State to make transportation decisions that enhance statewide and regional economic competitiveness.

An analytic interpretation of historic and forecast demographic and economic data was developed for NYS and its subregions. The key factors that will influence future economic growth, including growth in working-age population, rate of population increase, income growth, and educational attainment, were identified and described. National, state, and county-level trends (historic and projected) for each factor were also analyzed.

The characteristics of the NYS economy (e.g., employment, wages, output levels, investments, sales, etc.) were detailed by industry at the two-digit level of the North American Industry Classification System (NAICS). Historic and forecast changes in the economic structure of NYS and its regions were analyzed to identify existing economic strengths and emerging industry clusters. The transportation needs (e.g., infrastructure requirements, services and service levels, cost-sensitivity, etc.) of these industries were also outlined. Close attention was given to the regional, state, national, and global trends affecting New York's target growth industries, which have already been identified by Empire State Development.

The primary data sources for this analysis were Global Insight's Regional Service models and the Global Insight's Business Demographic Model databases. These provide historical and forecast information on the demographic and economic indicators for NYS, covering population, workforce, and industry sector output and employment. Global Insight information was supplemented with data from other sources such as the New York Department of Labor (detailed industry employment and wage data) and information from The State University of New York at Albany's ongoing efforts to describe the development of transportation-intensive clusters along corridors.

This study also included a task to describe current and future freight demand in NYS trade corridors, including freight demand at major freight generators such as ports, airports, intermodal terminals, and economic centers within a 500-mile radius of NYS. The central requirement of this task was to organize TRANSEARCH freight traffic flows by NYS trade corridors including creating a

profile of freight flows for the current period and a 20-year forecast horizon. Corridor volumes were compared to the approximate capacity of the trade corridors to identify current stress points. These were correlated with system bottlenecks known from NYSDOT analysis or from FHWA work on highway freight bottlenecks to produce a preliminary picture of capacity constraints. The profiles and information on capacity constraints set the stage for the analysis of corridor markets, bottlenecks, investment requirements, policy options, and transportation strategies. An analysis of New York's share of economic growth was conducted which looked at current and anticipated volume increases at major traffic generators. Growth rates were examined by production and distribution markets, at modal and intermodal facilities inside NYS, and at facilities in the surrounding region. Growth and the composition of growth on NYS' facilities and at its economic centers were compared to that of rival facilities and centers in other states.

Another task in this study was to define the geographic extent of NYS' effective market area for freight movement (i.e., the NYS "freightshed") and the major trade corridors connecting NYS to key freight centers within and beyond this area. A wide range of market pairs were examined for their impact on the NYS trade corridors including trade between NYS and other states and provinces, trade between New England and the rest of the country, and trade between Mexico and the Canadian Maritime Provinces. Each of these market pairs was found to have significant impacts on the NYS trade corridors. The consultant team used Global Insight's international and domestic trade databases to search out and describe the effective freight trade area, the dominant trade flow patterns (as desire lines or trade interchange tables), and trade partners (e.g., ports, states, regions, world trade blocks, etc.). The findings showed how trade moves into, through and out of NYS from the Northeast region and from United States and global trade blocs.

This study also included a task to describe supply chain trends impacting freight movement along NYS trade corridors. This task began by identifying and describing logistic and global trends likely to have a direct impact on freight movements, considering, for example, just in time delivery/reduced inventory; key industry supply chains, including international trends; the impact of larger container ships on landside operations and access; security issues; extended terminal gate hours; night receiving hours; emerging technologies, such as product-level radiofrequency identification tags; the internationalization of trade; etc. To look at changing logistics strategies and supply chains, interviews were conducted with NYS shippers, receivers, and carriers about their logistics strategies and supply chain operations. Additionally, information was extracted from national research on logistics trends for this task.

Relevance for Colorado DOT and Colorado MPOs

Similar to the New Mexico Freight Study, the NYSDOT Trade Study was an attempt to understand the relationship between freight and the economy. Unlike

the New Mexico study, it relies heavily on data sources from Global Insight (one of the consultant team members) rather than free publicly available information from existing sources. Another difference between this study and the New Mexico study is that a much higher-level approach was taken in regards to examining the role of supply chains. The NYSDOT Trade Study examines global logistics trends and determines how they will impact goods flowing through the State. This is of particular importance in New York due to the impact of goods using the Port of New York/New Jersey for entry and exit to the U.S.

Data/Information Needed to Implement Program

Substitutes for much of the economic information in this study can be found in free, publicly available sources. Therefore, this type of study can be conducted in Colorado if data sources were assembled in the State from sources such as the U.S. Economic Census and the statewide employment database.

2.11 WASHINGTON STATEWIDE RAIL CAPACITY AND SYSTEM NEEDS STUDY

The Washington Statewide Rail Capacity and System Needs Study was undertaken by the Washington State Department of Transportation (WSDOT) in 2006 based on the direction of the Washington State Legislature to conduct a statewide rail study looking at the critical needs of the rail system in the State in the future, determining the role of the public sector (the State in particular) in the rail planning and policy-making process, and developing rail policies to govern the State's participation in the rail system. The study focused on both the passenger and freight rail system in the State – however, the discussion in this section is limited to the freight rail component of the study. The main components of the study included an analysis of the State's rail system (network, terminals, yards etc.), identification of major rail system users in the State, current and projected rail capacity issues/constraints and their impacts on rail users and the State's economy, and a discussion of rail policy and planning issues in the State (current rail policies and investments, and identification of future role of the State in rail planning through policy recommendations). The following sections describe the key types of analyses conducted in the study and the types of freight data sources used in conducting them.

- Global Insight's TRANSEARCH database provided the commodity flow data to estimate base year (2004), and future (2015 and 2025) rail tonnage flows in the State for major commodity groups, classified in the Standard Transportation Commodity Code system.
- The study involved interviews of key industry sectors dependent on the rail system to assess their growth in demand, and their perspectives on key rail system issues in the State (such as rail rates, rail capacity issues, rail equipment availability, etc.

- Information from each of the major seaports in the State (Ports of Seattle, Tacoma, and Vancouver) were used to assess the economic impacts of port activity in the region, and the international cargo demand moving through the seaports, and their shares on the intermodal rail system.
- Rail system capacity constraints and key rail investment projects in the State were identified through discussions with the railroads.

Relevance for Colorado DOT and Colorado MPOs

This study provides a methodology for understanding rail flows in the State. A key feature of the study is to interview representatives from the key industry sectors in the State to be able to describe their experience using the rail system. This is a critical, but often overlooked, dimension to understanding the nature of truck-rail diversion options for a state. The interviews provide unbiased information on the ability of the rail system to handle current flows and provide insights into the potential of rail to handle more of its existing commodity mix and new commodities as well. It also provides operational characteristics that are important for the end user of the rail system.

Data/Information Needed to Implement Program

The information needed to conduct a similar study in Colorado would primarily be interviews from the users of the rail system. Additionally, information on current and forecast rail bottlenecks would need to be determined based on TRANSEARCH data and discussions with the railroads. Finally, estimates on the rail investment projects and their associated costs would be needed.

2.12 AAR NATIONAL RAIL FREIGHT CAPACITY STUDY

The objective of this study was to identify the necessary infrastructure expansion, replacement, and rehabilitation investments in the continental U.S. rail network that will allow freight railroads to meet rail freight demand projections through the year 2035. This study addressed four major rail freight infrastructure elements:

- Line capacity along primary Class I railroad corridors;
- Capacity at Class I railroads' terminals, ports, service facilities, and gateways;
- Line capacity and upgrades on Class I railroad secondary mainlines and branch lines; and
- Shortline and regional railroad upgrades to accommodate 286,000-pound freight cars.

The general approach was to divide the continental U.S. Class I railroad network into primary corridors; establish the volume of trains in 2005 and 2035; compare those volumes to current capacity; determine the additional capacity needed to accommodate 2035 volumes; identify the types of improvements warranted; and

estimate the costs of these improvements. A similar approach was used to estimate infrastructure capacity and investment for the Class I railroads' terminals, gateways, and service facilities serving the primary corridors. Estimates of the capacity and investment for secondary mainlines, branch lines, and regional and shortline railroads will be developed from prior industry studies of the shortline system. The key sources of data were:

- The Federal Railroad Administration's (FRA) rail network database to construct a primary corridor network and identify key characteristics of the network that determine capacity;
- The 2005 Rail Waybill Sample to estimate 2005 train movements;
- The Freight Analysis Framework2.2 (FAF2.2) to establish rail traffic growth by service type (e.g., intermodal, manifest, and bulk), from 2005 to 2035; and
- Primary data from the railroads and the AAR to determine the trains per day capacity for various types of rail corridors and the cost of upgrading a corridor from one capacity level to another.

Relevance for Colorado DOT and Colorado MPOs

Developing a comprehensive understanding of rail movement in Colorado is important given the heavy presence of rail in the State. However, the analysis of rail requires a national approach since rail trips are typically very long (usually more than 500 miles) and often crisscross several states. Additionally, each of the major railroads in the U.S. have rail networks that span half of the country and they make their operating decisions based on the movement of goods in their half of the country. Therefore, a national study of freight rail capacity would be of tremendous use for Colorado in understanding rail flows through the State.

Data/Information Needed to Implement Program

It would be difficult for CDOT to implement a similar study within the State of Colorado due to logistical challenges with obtaining information from the railroads. However, information from the AAR study should be incorporated into Colorado's freight rail database for future study and use.

3.0 Freight Data Collection and Development Programs

Significant efforts are currently being and have been undertaken on the collection of freight data and development of freight data sources, at the Federal, state, and MPO/local levels, for freight planning applications. The importance of freight data for planning applications is underscored by the provisions in SAFETEA-LU for enhancement of freight data collection practices and data development programs to support planning at the national, state, and local levels, which also outlines the key types of freight data elements that are critical for planning, as well as the need for a comprehensive and consistent freight data framework for analysis and dissemination of freight information within the freight community. Freight data collection and development programs differ across agencies and jurisdictions in their geographic coverage, type of data collected (for example, MPOs and local agencies primarily focus on truck freight data since trucking accounts for the majority of freight activity in urban areas, while larger areas also typically look at other modes like rail), and the type of planning applications (for example, data collection for freight model development programs will be different from data for regulatory/institutional analysis at the Federal level, such as driver hours of service, rates, etc.). Also, the methods of freight data collection vary depending on the type of freight data being collected (for example, roadside intercept surveys of trucks to collected O-D information, while video recording of vehicles for collected vehicle traffic flow information).

3.1 SCAG Goods Movement Truck Count and Survey Study

The Goods Movement Truck Count Study was initiated by the Southern California Association of Governments (SCAG) in 2001 to meet the truck freight data needs in the region for the MPO's freight transportation planning process. The study was initiated with the realization that existing truck traffic data in the region was limited, in areas such as geographic coverage (number of facilities), time-of-day traffic patterns, truck volumes by truck class, truck traffic distribution patterns, etc., all of which are critical to the planning process. Some of the primary goals of the study were to develop a comprehensive truck count database for the region, provide data for the refinement of the SCAG Heavy-Duty Truck (HDT) model, improve the knowledge of truck traffic volumes and distribution patterns associated with intermodal terminals and regional gateways, and develop a framework for an ongoing truck monitoring program in the region, among others.

The study involved collection of truck traffic and activity data in the region through classification counts and external intercept surveys, notable aspects of which are briefly discussed below. Twenty-four-hour truck classification counts were conducted in the study at 150 locations in the region in the fall of 2001. Trucks were classified based on the number of axles (2, 3, 4, and 5 or more axles) to analyze truck traffic volumes by type of truck. Collecting hourly truck counts also allowed for the analysis of truck traffic volumes by time of day, to understand peak-period characteristics of truck traffic for different highway corridors and freight access routes. The study made the following recommendations with respect to the collection and use of truck classification counts for planning purposes in the region:

- Developing an ongoing truck classification count program for the region, collecting hourly truck traffic volume data along key facilities, and for different truck classes, for reliable and updated truck volume information in the region;
- Using data from the classification counts to verify the accuracy of the time-of-day factors being used in the SCAG HDT model; and
- Using the truck classification count data to validate the SCAG HDT model at key freight corridors, and also analyze the performance of the model for arterials.

Over 3,300 24-hour intercept surveys were conducted at 10 locations in the study area, involving surveys of a sample of drivers of intercepted trucks. These surveys were accompanied by classification counts in order to expand the data to the total trucks passing through the location in the survey time period. The surveys collected information from drivers on the Gross Vehicle Weight (GVW) rating of the truck, the payload (weight of cargo), last and next stop of the truck trip, and the total stops made by the truck during the day. The study made the following recommendations with respect to the collection and use of truck classification counts for planning purposes in the region:

- Test the effectiveness of the commodity flow technique used in the SCAG external HDT model for the estimation of external truck trips, using data on commodity flows and their O-D patterns collected from the surveys;
- Validate the commodity tonnage to truck trip conversion process in the SCAG external HDT model using the payload data collected from the surveys; and
- Validate through truck traffic and empty truck trip estimation processes in the SCAG model using the through and empty truck trip data collected from the surveys.

Relevance for Colorado DOT and Colorado MPOs

This study demonstrated the importance of collecting vehicle classification information specifically for freight planning purposes. This is important because

most states collect information primarily to meet HPMS requirements, and secondarily to identify high passenger vehicle count locations for planning purposes. Few DOTs or MPOs select count locations specifically for the purposes of freight monitoring or planning. However, designing such a program ensures that relevant information is available for future freight planning efforts.

Data/Information Needed to Implement Program

A vehicle classification count program focused on counting at critical freight locations would be needed to implement this study. Similarly, a roadside truck survey program would need to be implemented.

3.2 PORTLAND FREIGHT DATA COLLECTION PROGRAM

The Portland Freight Data Collection Project (undertaken in two phases – Phases I and II), was designed with the objective of conducting a comprehensive freight data needs analysis, and subsequently, collecting critical freight data for the Portland metropolitan region. This discussion pertains to the Phase II of the project, which involved the data collection and compilation process to meet the freight data needs in the region (identified in Phase I). The Phase II project was initiated in 2005 with funds provided by a host of public sector agencies, including the Oregon Department of Transportation (ODOT), the Port of Portland, the Washington State Department of Transportation (WSDOT), and Portland Metro (MPO for the Portland region). ODOT was the contracting entity for the project, while the Port of Portland was the lead agency for project management.

The following three types of freight data were collected in the project, for the Portland metropolitan region:

1. **Vehicle Classification Counts –** In terms of hourly counts by direction and vehicle type (using the FHWA 13-group vehicle classification system) were conducted at 108 locations in the study area using video data collection methods (cameras), in the spring of 2006. Of the 108 locations, 52 locations had 24-hour data collection, while the rest involved 72-hour count data collection. The locations selected for the study area included high truck volume highway corridors, and arterials and local routes providing access to key freight facilities in the region (marine terminals, warehouses, intermodal terminals, etc.). Some potential applications of the collected counts for the region include:
    a. Validation of the Portland Metro truck model by truck class;
    b. Calibration of the input truck trip matrix for the Portland Metro truck model using the Origin-Destination Matrix Estimation (ODME) technique; and
    c. Analysis of time-of-day truck traffic patterns for key freight corridors and access routes, and comparison of auto and truck traffic volumes by time of day, to understand peak-hour interactions between auto and truck traffic.

2. **Roadside Intercept Surveys –** Conducted at a total of nine external gateway locations in the study area. These locations included all the major highways that served as external gateways to the region (carrying truck trips between the study area, and external regions). Another key factor affecting the choice of the exact highway segments for the surveys was the availability of areas conducive to conducting intercept surveys (such as rest areas, weigh stations, and California Highway Patrol truck inspection locations). These surveys collected key truck activity characteristics from truck drivers including truck type, type of cargo, cargo weight, truck O-D locations, type of facility at origin and destination, and highways used by the truck during the truck trip. These surveys were accompanied by truck counts for the expansion of survey data. Some potential applications of the roadside survey data for regional planning purposes include:

    d. Validation of payload factors for the conversion of tons to truck trips in the Portland Metro truck model;

    e. Validation of O-D distribution patterns of external gateway truck trips in the truck model; and

    f. Validation of empty and through truck trip factors in the truck model.

3. **Establishment Surveys –** The study involved conducting phone interviews of companies owning major freight facilities in the region (such as warehouses, manufacturing facilities, etc.) to understand the trucking activity characteristics associated with these important freight facilities. The establishment surveys gathered data on facility type, hours of operation, number of employees, number of loading/unloading bays, types of products handled, volume of inbound/outbound shipments, average payload weight, empty truck trip fractions, daily and seasonal time distributions, and primary highway access routes used by trucks entering and leaving the facility. Some potential applications of the establishment survey data for regional planning purposes include:

    g. Identifying key access routes used by truck trips associated with major freight facilities in the region, which is important to ensure highway capacity along these routes for efficient goods movement through these facilities in the future; and

    h. Identifying truck trip generation rates (as a function of employment) for major freight facilities, to serve as inputs in the modeling process to estimate truck trips produced from and attracted to major freight facilities.

Relevance for Colorado DOT and Colorado MPOs

This study is similar to the SCAG count and survey program, but it also incorporates an establishment survey. While success with establishment surveys has been mixed, it does provide qualitative information on both freight trip characteristics and freight bottlenecks in the system. The biggest drawback with

conducting freight establishment surveys is determining the "universe" of truck trips or facilities to use to expand the collected data.

Data/Information Needed to Implement Program

A freight-focused truck count program, roadside truck survey, and establishment survey would be needed to implement this program. To implement the establishment survey, a comprehensive list of freight facilities and a universe of freight facilities or truck trips would be needed.

3.3 OREGON COMMODITY FLOW DATABASE

The Oregon commodity flow database development work was undertaken by ODOT to create a database of base year (1997) and forecast (2030) commodity flows for the entire State. The base year was chosen to be 1997 to allow for the comparability of data with the commodity flows estimated separately for the Portland metropolitan area. To ensure consistency between the statewide commodity flow estimates and the estimates for the Portland region, the methodology used in the development of the Portland area commodity flows was applied for the development of the statewide database. The statewide estimates, however, were enhanced using newly available data sources to address issues with estimating flows of specific commodities. The types of data used in the development of the statewide commodity flow database, and some key methodological issues, are described briefly below.

Several data sources were used in the estimation of the baseline commodity flow estimates. The Global Insight TRANSEARCH database served as the initial data source for the commodity flows. The flows in TRANSEARCH were enhanced, particularly for specific commodity groups such as agricultural commodities, nonmetallic minerals, petroleum products, and waste products, using the 1997 Commodity Flow Survey (CFS) database developed by the U.S. Census Bureau, and statewide data for Oregon from the 1998 Freight Analysis Framework (FAF) from the FHWA. Additionally, data from TRANSEARCH was enhanced for the rail, marine, and pipeline modes using mode-specific commodity flow data – Carload Waybill Sample from the Surface Transportation Board (STB) for rail, Waterborne Commerce data from the U.S. Army Corps of Engineers for marine, and the Energy Information Administrations (EIAs) pipeline data for the pipeline mode. The database of commodity flows from the above data sources is in terms of tonnage. The 1997 Commodity Flow Survey data was used to estimate average value per ton factors by commodity group, which were used to convert the tonnage estimates to values, to provide the capability in the database to perform economic analyses for key industry sectors. Some other key features of the database are briefly outlined below:

- The database is based on the Standard Transportation Commodity Classification (STCC) codes; and
- The geographic coverage of the database includes the State of Oregon, metropolitan areas in the State, and Area Commissions on Transportation (ACT) areas. Additionally, the database also includes Hood River County (neither an ACT nor a metropolitan area), and Columbia and Yamhill counties (which overlap multiple ACT areas).

Relevance for Colorado DOT and Colorado MPOs

This study is of particular importance because it demonstrates how to verify and augment the TRANSEARCH freight flow database by using economic output data and other goods movement data available from other sources. It may be worthwhile for the Colorado DOT to compare its TRANSEARCH data to freight flow data from other sources such as the BTS Commodity Flow Survey and economic data provided by the Economic Census to determine what the strengths and weaknesses of the database are. Additionally, it may be reasonable to augment some of the data fields based on information from outside sources.

Data/Information Needed to Implement Program

The data to verify and augment the TRANSEARCH data exist in several sources, but it would be useful for the Colorado DOT to assemble economic output data from publicly available sources, particularly for the nonmanufactured commodities. Additionally, 24-hour roadside truck surveys would be useful to determine the veracity of TRANSEARCH long-haul truck flows.

3.4 CALIFORNIA HEAVY DUTY TRUCK TRAVEL SURVEY

The California Heavy Duty Truck Travel Survey was undertaken by Caltrans in 2001 to understand statewide trucking activity characteristics through roadside intercept surveys at selected sites in the State of a representative sample of trucks. The primary goals of the survey were to successfully collect truck survey data at a statewide level, and ensure the collected data can be used for analyses pertaining to the identification of relationships between economic activity and truck travel patterns, and estimation of major commodity movements by (and industries reliant on) the truck mode in the State.

Roadside intercept surveys were conducted at a total of 33 sites providing a good geographic representation of various regions around the State, and involved surveys of 8,287 truck drivers. The surveys at each site were accompanied by 24-hour video taping counts for survey data expansion. The key components in the survey process included site selection, sampling design, survey instrument design, data collection, and reporting of survey data. The site selection process involved identification of a set of sites in the State for conducting the surveys, which included Rest Areas, California Highway Patrol (CHP) Commercial

Vehicle Enforcement Facilities, and Agricultural Inspection Stations. The sampling design process arrived at the appropriate sample size for the surveys based on site capacity, number of surveyors, and expected traffic volume by time of day. The survey instrument was designed based on the key types of truck trip data to be collected from the surveys, which included the following:

- Type of truck (GVW, number of axles, etc.);
- Truck shipment characteristics (primary commodity, percent full, trip length, etc.);
- Last Stop and Next Stop Characteristics (location, type of facility, type of activity –loading/unloading, etc.);
- Daily truck activity characteristics (total number of stops per day, total distance traveled per day, etc.); and
- The data collected from the surveys were used to prepare summary statistics of trucking activity characteristics in the State, which included percent of truck fleet by truck type (single trailer, single unit, etc.), truck body (van, flatbed, container, etc.), and number of axles, percent by GVW, major origin and destination facilities (warehouses, intermodal terminals, marine terminals, etc.) of truck movements, trip length frequency distributions of statewide truck trips, etc.

Relevance for Colorado DOT and Colorado MPOs

The Caltrans truck survey data have been used on multiple studies in California including: the freight plan for the San Francisco Bay Area, multiple goods movement studies in the Central Valley in California, and truck model development in Southern California. This study illustrates how a simple data collection effort can benefit freight planning for several years.

Data/Information Needed to Implement Program

A similarly styled roadside truck O-D survey would be needed to implement this study.

3.5 FHWA FREIGHT ANALYSIS FRAMEWORK (FAF) AND FAF2

In order to better understand freight transportation demand, assess implications for the surface transportation system, and develop policy and program initiatives to improve freight efficiency, FHWA embarked on the Freight Analysis Framework (FAF) program. The Freight Analysis Framework (FAF) estimates commodity flows at a national level, and flows through international gateways (NAFTA), as well as related freight transportation activity (such as truck traffic on the highway network) using data integrated from various freight data

sources. The original version of FAF (FAF1) included data for 1998 and forecasts for 2010 and 2020. In 2006, the FHWA published the second generation of the FAF (FAF2), which improved on the original version with respect to the following areas:

- More recent base year data (2002) and forecasts ranging from 2010 to 2035 with data available for intermediate five-year intervals;
- Geographic regions covering substate areas;
- International freight flows to Canada, Mexico, Latin and South America, Asia, Europe, the Middle East, and the rest of the world through more than 75 international gateways in the country;
- Seven modal classifications (truck, rail, water, air, pipeline, intermodal, others) instead of the traditional four provided by FAF1 (truck, rail, air, water); and
- Commodity data using the two-digit Standard Classification of Transported Goods (SCTG) scheme in order to match the 2002 Commodity Flow Survey (CFS).

The second version of FAF has two components – FAF2.1 released in January 2006, and the more recent FAF2.2 released in November 2006. The discussion in this section pertains to FAF2.2 which improves on FAF2.1 in terms of having more accurate base year (2002) commodity flow data. FAF2.2 includes a comprehensive commodity flow database providing commodity flows between states, substate regions and international gateways (for 2002 and forecasts from 2010 to 2035 with five-year intervals), and a network database that translates commodity flows into equivalent truck traffic flows on the highway network.

The FAF2.2 commodity flow database for the base year (2002) is built entirely from publicly available data sources. Some of the key data sources used in the development include the following:

- 2002 Commodity Flow Survey (CFS) from the U.S. Census Bureau and the Bureau of Transportation Statistics (BTS);
- Foreign Waterborne Cargo data from the U.S. Army Corps of Engineers;
- Carload Waybill Sample from the Surface Transportation Board (STB); and
- Transborder Surface Freight Database from BTS.

The entire list of data sources used in the development of the FAF2 commodity flow database are documented in various papers available at http://ops.fhwa.dot.gov/freight/freight_analysis/faf/. The following sections briefly discuss the key attributes of the commodity flow database, covering the types of commodities, the geographic regions, the modes, and shipment volume (tonnage, etc.) information.

The FAF2.2 commodity flow database provides coverage of commodity flows over the entire U.S. national geography. The domestic version of the database,

which relates to commodity flows within U.S. regions, provides flows between states, and substate regions. The domestic regions in the U.S. in the database are categorized into the following areas:

- Metropolitan Statistical Areas (MSAs);
- Consolidated Statistical Areas (CSAs); and
- States or balances of States.

There are a total of 114 domestic regions in the database, having a combination of MSAs, CSAs, and States/balances of States. The two regions in Colorado covered in the database include the Denver-Aurora-Boulder CSA and the region covering the rest of Colorado ("Remainder of Colorado"). The database includes 7 foreign trade regions comprising of Canada, Mexico, Latin and South America, Asia, Europe, Middle East, and Rest of the World. The international gateway locations for off-shore and NAFTA movements can also be inferred from the database. The international gateways are denoted either by one of the domestic regions where the port of entry or exit is located (for example, flows moving through the San Pedro Bay ports in Southern California would be denoted by the Los Angeles CSA, since these ports are located in that region), or by 17 additional international gateway locations included in the database.

The FAF2 commodity flow database uses the Standard Classification of Transported Goods (SCTG) commodity classification system, which is based on building blocks derived from the Harmonized Commodity Description and Code System (HS) or the Standard Classification of Goods (SCG) system in Canada. The use of the SCTG system in the FAF2 database ensures consistency in the classification of goods for analysis over the entire North American geographic area. Specifically, the database only has goods classified at the two-digit SCTG level, without further level of detail. The two-digit SCTG classification level has 43 exhaustive and mutually exclusive commodity groups.

The FAF2 commodity flow database provides commodity flows for the following modes of shipment:

- Truck: The truck mode in the database includes both private and for-hire trucks; however, the database does not split the trucking mode into these subcategories;
- Rail: This mode includes rail carload shipments;
- Water: Includes Shallow Draft (river and canal shipments), Deep Draft (oceangoing shipments), and Great Lakes shipments;
- Air: Includes shipments by air, or a combination of truck and air (includes air freight and air express shipments);
- Truck-Rail Intermodal: Includes intermodal shipments by a combination of truck and rail (could be associated with international or domestic intermodal);

- Other Multiple Modes: Includes mail/parcel/courier shipments (typically less than 100 pounds), and all other intermodal shipments (truck-water, water-rail, etc.);
- Pipeline and Unknown: Includes pipeline shipments and all other shipments for which the mode is unknown.

The FAF2 database provides shipment volume information in terms of weight and value of shipments. Weight is represented in terms of thousands of short tons (where one short ton is equivalent to 2,000 pounds). Value of shipments in represented as the net selling value free-on-board (f.o.b.) plant, exclusive of freight charges and excise taxes, in terms of millions of U.S. dollars.

This section presents some examples of the types of applications where the FAF2 commodity flow database can be used for freight planning, with some examples of real-world applications. These include the following:

Freight Demand Model Applications

Owing to its transparency in the data development process using publicly available data sources, robust methodologies for data integration from different data sources, sound freight forecasting procedures based on considerations of economic and trade activity trends and projections, as well as comprehensive geographic, commodity and modal coverage, the FAF2 commodity flow database can provide inputs for the development of robust commodity-based freight demand models. Since FAF2 is intended to serve as a national freight flow database, it does not provide data at disaggregate levels of geographic detail (for example, county, or subcounty) which are typically needed for local and regional freight demand models. However, FAF2 can serve the important purpose of providing control totals of commodity flows for the validation of more disaggregate local/regional commodity flow databases used for model development. Another important application of FAF2 is in the validation of commodity flow forecasts or growth factors needed to estimate forecasts. In many cases, local/regional commodity flow databases use growth rates that are not representative of expected growth in the region, or owing to lack of data/information, might apply the same growth rates across shipments of different industry/commodity groups, or across different O-D pairs. Since the growth trends typically vary by the type of industry and also by O-D pairs, and FAF2 growth rates account for these variations, these growth rates can be used for the validation of growth rates in local/regional commodity flow databases for the accurate estimation of commodity flow forecasts for the modeling process. Since freight models are intended to have the capability to forecast flows for longer time horizons (typically 2030), the FAF2 forecasts up to 2035 can serve as vital inputs in the modeling process.

The FAF2 database was used in the development of the San Joaquin Valley Truck Model, as well as in the development of the SCAG External Heavy-Duty Truck Model, for the validation of base year flows and forecasts in the California

Intermodal Transportation Management System (ITMS) commodity flow database that provided the commodity flow data inputs for these models.

Value-to-Ton Conversion Factors

Since the FAF2 database provides both value and weight of shipments between O-D pairs by commodity type and mode, it can be used to develop value-to-ton conversion factors for individual commodity groups. In many cases, especially those dealing with trade flow or input-output data/analyses, data might be available only in terms of value of commodities/shipments, without any tonnage information. In such cases, value-to-ton conversion factors by industry type can serve the useful purpose of determining the equivalent trade flows in terms of tons, which can then be used to determine modal flows (for example, truck trips by applying payload factors to the tonnage flows). Also, value-to-ton conversion factors can be used in economic impact analyses, wherein tonnage data might need to be converted to equivalent dollar values to estimate the impact of flows on the economy.

FAF2 value-to-ton conversion factors were used in the SCAG external HDT modeling process to convert value-based data from the IMPLAN input-output model to equivalent tonnage-based I/O matrices, for the use of the I/O matrices in the disaggregation of commodity flows from counties to TAZs in the modeling process.

Market Analysis

The FAF2 commodity flow database can be used to perform market analyses to determine existing and future trends in growth in freight demand along key corridors, or international gateways. Some key types of market analysis questions that can be answered using the data from the FAF2 database include the following:

- What are the key commodities and industry groups that rely on a particular freight corridor?
- What are the major O-D pairs associated with the freight moving along a particular freight corridor?
- What share of the total market demand along a particular freight corridor is reliant on the truck mode vis-à-vis the rail mode, and what are the expected trends in the future?
- What is the magnitude of freight traffic (in terms of value and weight) by commodity type moving through an international gateway (such as a seaport), and what are the expected trends in the future? Also, what are the landside modal and O-D distributions of freight moving through the international gateway (this can be useful in identifying the major inland access routes and corridors that serve the international gateways)?

4.0 Freight Models

The increasing focus of freight in the transportation planning process has spurred the development of freight demand models, particularly at the state and MPO levels. Also, significant work is currently being done by the Federal government to enhance the state of the art and the state of the practice in freight modeling at the national, state, and local levels, notably the Freight Model Improvement Program (FMIP) managed by the FHWA's Office of Freight Management and Operations. Freight models are critical to freight planning, particularly because they provide the capability to predict future freight flows in a region as a function of key trends in parameters influencing freight flows. Examples of these parameters include trends in economic activity in a region, industry supply chains and logistics patterns (for example, just in time logistics and their impacts of freight flows), increased international trade flows, service trucking and local pick-up and delivery activities in an urban area, etc. Another important application of freight models for planning pertains to the analysis of impacts of specific investments in the freight transportation system on freight demand, and system performance in the future. This analysis is critical to the prioritized selection and implementation of the most critical investments in the freight transportation system for optimal system performance and freight flow efficiency in the future.

Freight demand models have been typically based on methods initially developed for passenger travel demand forecasting, notably the four-step modeling approach. Commodity-based freight models are the most common forms of four-step freight models involving commodity flow generation (productions and attractions), commodity flow distribution, modal split, and traffic assignment. However, freight models typically differ based on the level of geographic detail, particularly with regard to the modes considered in the model. For example, urban area freight models are typically truck models, since trucks account for majority of the freight movements in an urban area. Commodity-based truck models have only three steps in the modeling approach due to the obviation of the need for modal split. There have also been applications of vehicle-based truck models, which in lieu of considering commodity flows, directly consider truck trips. However, due to the inherent complexities in freight movements, and the differences in players and parameters impacting freight and passenger demand, there have been applications of more advanced freight modeling approaches considering such factors as industry supply chains and logistics practices, truck trip chains, and second leg truck traffic movements (associated with local pick-up/delivery, retail distribution, etc.), which entail different data inputs and modeling requirements/capabilities compared to traditional freight modeling approaches.

This section presents a discussion of some key examples of freight modeling undertakings at the state and MPO levels, focusing specifically on the types of freight data used in their development. Some examples of the types of freight data that are typically used as inputs in modeling freight demand include the following:

- Truck counts on the highway network;
- Commodity O-D data;
- Socioeconomic data (types of industries, industry employment, population, etc.);
- Input-Output data;
- Payload factors;
- Freight infrastructure (infrastructure network information such as number of lanes, speeds, travel times, etc.);
- Industry supply chains and logistics (logistics nodes, truck trip chaining, etc.);
- Empty and through truck trips; and
- Urban area trucking activity (service trucking, local pick-up and delivery, retail distribution, mail/parcel, etc.).

4.1 PORTLAND METRO TRUCK MODEL

The Portland Metro truck model is also referred to as the Tactical Model System. The Tactical Model System, together with the Strategic Model Database, forms the core elements of the truck freight forecasting model for the Portland metropolitan area. The Strategic Model Database (SMD), which provides commodity flow data inputs to the tactical model, contains aggregate present and future freight flows for different commodity and mode combinations. This database serves as a useful tool providing freight flow inputs required for strategic decision-making concerning the development and operation of Portland's seagoing and river marine terminal infrastructure, major air, rail and trucking terminals, as well as its modal transportation networks of freight corridors and access routes, to ensure transportation efficiency, reliability, cost-effectiveness, and economic competitiveness in the region, in the future. Portland's Strategic Model Database was originally developed from a number of data sources including:

- The Global Insight TRANSEARCH database;
- For air freight, forecasts by commodity and route, based on FAA air freight traffic data and related freight data provided by the Portland airport;
- For seaborne trade, forecasts by commodity and route, based on international trade data showing shipments by customs district;

- Regional macroeconomic forecasts;
- PIERS data from the Journal of Commerce showing sea trade movements; and
- Forecasts prepared by the Port of Portland.

The Tactical Model, as it currently stands, is largely empirical and less behavioral, implying that it has many fixed percentages for data inputs at various stages of the modeling process. However, with better understanding of the regional freight system dynamics, and industry shipper behavior, the model is expected to incorporate more behavioral components in its various steps of the modeling process. The study area of the Tactical Model is comprised of Columbia, Clackamas, part of Marion, Multnomah, Washington, and Yamhill counties in Oregon, and Clark County in Washington. The model comprises of 2,029 internal TAZs, and 17 external TAZs.

One of the key data inputs into the model is the commodity flow data in the SMD, as described earlier. The outputs from the SMD include a set of summary commodity flow tables at an aggregate geographic level that are used as control totals for the generation of commodity flows between TAZs in the subsequent modeling steps. The primary data inputs from the Strategic Model Database can be categorized into commodity flows into, out of, and within the Portland region. The SMD also provides *through* commodity movements in the region, as long as there is a change of mode involved, for example, goods coming into the Port, and moving inland by truck. Since all goods movements that move through the region by the same mode (primarily truck, and some rail) are not captured in the SMD, the Tactical Model needs to account for through truck movements using sources other than the SMD. As discussed earlier, the SMD includes 17 commodity classifications, which also are used in the model.

Commodity flow data in the SMD used in the Tactical model are allocated to either internal zones, highway gateway locations/external zones, or terminal gateway locations, based on the type and direction of commodity flows. Origin locations in the model to which commodity flows need to be allocated include internal zones (with origins of internal-internal and internal-external flows), highway gateway locations or external zones (with origins of external-internal and through commodity movements), and terminal locations like port facilities, air cargo facilities, and rail terminals, where international or external domestic shipments are offloaded, and generate associated truck trip origins. Similarly, destination locations in the model include internal zones (for destinations of external-internal and internal-internal flows), highway gateway or external zones (for destinations of internal-external and through movements), and terminal locations where international exports or external domestic shipments leaving the region are loaded, which generate associated truck trip destinations.

The following sections describe the type of data inputs used by the Tactical model for the commodity flow allocation processes:

- **Internal Zones –** As described earlier, origins or internal-internal and internal-external flows, and destinations of internal-internal and external-internal flows, are allocated to TAZs in the Tactical Model system. This is accomplished by disaggregating flows to zones based on zonal employment shares for specific industry groups associated with each commodity category. For this purpose, the Tactical Model uses base year employment at the two-digit SIC industry level provided by Metro. For future employment forecasts, however, employment data inputs to the model are available only for two employment categories, retail and nonretail. Base year distribution of industry employment across detailed industry groups are applied to the future year total employment by zone to arrive at employment forecasts by zone for detailed industry groups.
- **Highway Gateways/External Zones –** The Tactical Model allocates commodity flow origins entering the region, and destinations leaving the region by truck to highway gateways/external zones. The internal-external and external-internal commodity flows from the SMD by external region (North, South, and Other) are allocated to highway gateways based on a fixed allocation to major roadway facilities as external stations in the Metro travel forecasting network, based on the distribution of current (from observed classification counts) or forecast (based on truck count trends or statewide model results) truck trips on each of the facilities. The same distributions are used for the allocation of all commodity groups, unless there are certain specific restrictions for the use of a gateway by a particular commodity group, or if there is specific commodity flow information available at each highway gateway location (for example, from surveys).
- **Terminals –** Allocation to terminal locations is performed by the Tactical Model for all modal segments having their primary mode other than trucking. However, the procedure for the allocation of truck shipments associated with these market segments to specific terminals will depend on the primary mode. For example, all truck shipments associated with the air cargo modal segment are allocated to only one terminal location, which is the Portland International Airport (PDX). Where more than one point of entry or exit may exist, the model uses inputs from the Port of Portland or other sources to identify shipment patterns and the use of each terminal location by individual commodity types. This step also allocates drayage truck trips to terminals for sea and rail, and sea and barge modal segments, where the associated terminal facilities are at separate locations (thereby leading to a truck drayage move).

An important data input for the Tactical model is the annual to average weekday conversion factor to convert annual commodity flows in the SMD to average weekday flows. Consequently, an average conversion factor from annual to average weekday of 1/264 is used for the estimation of weekday truck trips, based on information published in the report *Vehicle Volume Distributions by Classification* (Hallenbeck et al., Washington State Transportation Center, draft,

June 1997). Payload factors are used by the Tactical Model to convert commodity flows derived from the previous step to equivalent heavy duty truck trips. ODOT roadside surveys provide the data for the development of payload factors for use in this step of the Tactical Model.

Relevance for Colorado DOT and Colorado MPOs

The Portland Metro truck model represents one of the early examples of a truck travel demand model developed primarily from TRANSEARCH freight flow data.

Data/Information Needed to Implement Program

The primary data needed to implement this truck model is TRANSEARCH data, a network and zone structure typical for passenger travel demand models, employment at the zone level of detail, survey data to generate payload factors.

4.2 SCAG HDT MODEL

The new version of the SCAG HDT model is an update to the old version based on new truck travel surveys and commodity flow data. The entire SCAG HDT model consists of two components – an external model which models external trucks trips which have at least one trip end outside the six-county SCAG region, and an internal model which models truck trips within the SCAG region. The external truck trip model is based on a commodity flow database and forecasts developed by DRI/McGraw Hill and Reebie Associates (now Global Insight).

The new updated SCAG HDT model uses commodity flow data from the California Intermodal Transportation Management System (ITMS) database developed by Caltrans. This commodity flow data has an original base year of 1996, which were based on 1993 county-level commodity flow data developed for the SCAG Interregional Goods Movement Study and the original Caltrans ITMS. In addition to a base year of 1996, ITMS also contains commodity flow forecasts for 2006, 2016, and 2026 based on the FHWA Freight Analysis Framework and Caltrans employment forecasts by industry at the county level. Since the base year of the SCAG HDT model is 2003, the model uses 2003 commodity flow data inputs from ITMS. The national Commodity Flow Survey for 2002 and the data available for the Southern California metropolitan area was used to conduct a limited validation of the 2003 base year estimate developed from ITMS, to ensure accurate data inputs for the HDT model. This provided an important update to a key data input to the external model of the "new" SCAG truck model. The commodity flows in the ITMS are in terms of flows between counties within California, and states outside California, for Standard Transportation Commodity Code (STCC) commodity categories, in tons and by trucking submodes (truckload, LTL, and private trucks).

A key data input for the SCAG external HDT model is the employment data by industry at the TAZ level, which was used to disaggregate ITMS commodity

flows from the county level to TAZs for the modeling process. County-level commodity flows in the SCAG truck model were disaggregated to TAZs using zone-level employment data. For outbound truck moves, commodity flows were allocated to TAZs in the origin county based on the employment share of the producing industry in each TAZ. For inbound flows of manufactured goods and farm products by truckload and private truck modes, economic input/output models were used to determine the portion of each commodity that moves to a manufacturing facility and the portion that moves directly to a warehouse for eventual distribution to a retail facility. For commodities carried by less-than-truckload carriers, these flows were disaggregated from county to TAZ level based on the exact locations of LTL facilities in the SCAG region using a list of LTL terminals.

Another key data input for the SCAG external truck model is payload factors for converting commodity flows into truck trips. These payload factors were derived using data from a combination of O-D surveys (2002 SCAG Truck Count Study) and data from the Census Bureau's 2002 VIUS. First, the tons were allocated to the three truck classes in the model (light-heavy duty trucks, medium-heavy duty trucks, and heavy-heavy duty trucks) using the data from VIUS. Next, the tons in each of the truck classes were converted to truck trips using the payload data from the intercept surveys and VIUS. Some other key data inputs to the external SCAG HDT model, with their applications include the following:

- Weigh-in-motion (WIM) data were used to convert annual truck trips to average weekday truck trips in the model. This disaggregation process converted the annual truck tons in the commodity flow database into a daily zone-level truck trip table for the SCAG region.
- IMPLAN input-output data was used for the disaggregation of inbound county-level commodity flows to TAZs.
- Inbound and outbound warehouse shipment data for the SCAG region was used to determine the share of secondary shipments (shipments originating from warehouses) that are associated with different commodity types. This information was critical for the conversion of secondary commodity flow tonnages to equivalent number of secondary truck trips in the region.

The internal truck model is another important component of the SCAG HDT model, which models internal truck trips within the SCAG region. The internal model is a three-step freight model, involving trip generation, trip distribution, and traffic assignment steps. An important data input for the internal model is truck trip generation rates by different industry/land use sectors for the estimation of total truck trips produced and attracted in the region. The trip rates for internal truck trips are estimated using data on daily truck activity collected from a shipper-receiver survey and zone-level employment data. The land use/employment categories for the trip rates include agriculture/mining/construction, transportation/communication, wholesale trade, retail trade, finance/insurance/real estate/services, government, and households. The sam-

ples for the shipper-receiver survey were drawn by industry group from the American Business Directories' Southern California Business Directory, a listing of 725,000 businesses, their addresses, telephone numbers, seven-digit Standard Industrial Classification Code, and sales and employment figures. The sampling frame did not include households or government facilities. The survey of shippers and receivers divided trips into two major categories: trips that delivered something to a facility (including services) and trips that picked-up something from a facility. Respondents estimated the number of truck trips per day associated with their facility (pick-up and deliveries) and noted whether shipments were truckload or partial-truckload deliveries. For several of the categories, insufficient survey data were available to estimate trip rates, so rates were borrowed from other metropolitan area models (Phoenix and San Francisco). Special generator models were used to add truck trips to the table from the major sea ports, intermodal transfer facilities, and airports.

An import input for the trip distribution step of the internal model is the data derived from trip diary surveys. The traffic assignment was done by first allocating the truck trips to the four time periods in the SCAG passenger model using truck count data collected by weigh-in-motion equipment at California's weigh stations. A multiclass assignment was then performed using both the passenger car and truck trip tables.

Relevance for Colorado DOT and Colorado MPOs

The SCAG HDT model represents the state of the practice in what is termed hybrid truck travel demand models. It is an appropriate model to consider for MPO-level truck modeling purposes.

Data/Information Needed to Implement Program

The primary data needed for this model include a county-level freight flow database, zone-level employment data, payload factors, and data capable of estimating internal truck trips.

4.3 SAN JOAQUIN VALLEY TRUCK MODEL

This discussion pertains to the version of the San Joaquin Valley Truck Model developed as part of the Phase II San Joaquin Valley Goods Movement Study. The model is currently being updated as part of the Phase III study. The Phase II model is an integrated truck freight demand model for the eight-county San Joaquin Valley region in Central California, bounded approximately by the Sacramento metropolitan area to the north, the San Francisco Bay Area and California coast to the west, the Sierra Nevada to the east, and the Los Angeles metropolitan area to the south. The purpose of developing a truck model for the region was to provide an analytical tool and framework for evaluating the impacts of transportation system changes and improvements on truck-related goods movement in the region.

The San Joaquin Valley truck model was developed using the California Department of Transportation (Caltrans) road network. The truck model reported truck volumes in two truck classes: medium heavy-duty trucks and heavy heavy-duty trucks. These truck classes are defined based on gross vehicle weight rating and are consistent with the California Air Resources Board truck definitions. The model utilizes a truck trip table that was generated from two separate truck trip tables. The first of the truck trip tables was developed using the Caltrans Intermodal Transportation Management System (ITMS) commodity flow data. These truck trip tables were developed entirely from commodity flow data. The second truck trip table was developed from local socioeconomic data.

The Phase II model has the following modeling components:

- **ITMS Trip Generation –** This component estimates the total number of loaded (commodity-related) truck trip productions and consumptions in the model study area;
- **Non-ITMS Trip Generation –** This component estimates the total noncommodity-related (such as empties, service trucks, etc.) truck trip productions and consumptions in the study area, using truck trip generation rates as a function of employment;
- **Trip Distribution –** This component distributes the truck trip productions and attractions using a gravity model between model zones; and
- **Trip Assignment –** This component performs a multiclass assignment by integrating trucks with autos in the assignment process.

The key data inputs to the Phase II model, and their applications, are briefly discussed below:

- **ITMS Commodity Flow Data –** The ITMS commodity flow data for California, in terms of base and future year commodity flow tonnages by trucking submodes (truckload, Less-than-truckload, and private trucking) by major commodity groups is used in the model for the estimation of loaded (commodity-related) truck trip productions and consumptions.
- **Vehicle Inventory and Use Survey (VIUS) Data –** The Vehicle Inventory and Use Survey (VIUS) is a database of truck fleet characteristics in the U.S. (truck types in terms of axle groups and GVWs, truck lengths, cargo weights, etc.), developed by the U.S. Census Bureau. The VIUS data for 1997 were used in the model to estimate payload factors for the model to convert ITMS commodity flow tonnages to equivalent truck trips.
- **Employment Data –** Zonal employment data from Dun & Bradstreet was used to disaggregate county-level ITMS truck trips to zip codes and TAZs, in the model.
- **Quick Response Freight Manual (QRFM) –** The Quick Response Freight Manual (QRFM) from the Federal Highway Administration provided truck

trip production rates for the estimation of noncommodity-related truck trip productions in the model study area.

- **Bureau of Economic Analysis (BEA) Input Output (I/O) Accounts –** The BEA I/O accounts were used to estimate truck trip consumption rates for the estimation of noncommodity-based truck trip consumptions in the model study area.
- **Institute of Traffic Engineers (ITE) Passenger Car Equivalency (PCE) Factors –** The ITE PCE data were used in the trip assignment model to perform a multiclass assignment combining trucks with autos. In order to integrate trucks with autos, they were converted to equivalent number of cars by applying PCE factors derived from ITE guidelines.
- **Caltrans Truck Counts –** Truck counts from Caltrans by truck type (number of axles) were used to validate the model by Screenline. In order to convert the Caltrans truck counts (based on number of axles) to counts in terms of model truck classes (medium and heavy trucks), the VIUS database was used to derive axle-to-weight conversion factors, which were used to arrive at counts by weight class in the model, for the validation.

Relevance for Colorado DOT and Colorado MPOs

Similar to the SCAG HDT model, the San Joaquin Valley truck model represents the state of the practice in what is termed hybrid truck travel demand models. It is an appropriate model to consider for MPO-level truck modeling purposes. It should be noted that the FASTruck Model is developed using a similar hybrid truck model methodology.

Data/Information Needed to Implement Program

Similar to the SCAG HDT model, the primary data needed for this model include a county-level freight flow database, zone-level employment data, payload factors, and data capable of estimating internal truck trips.

4.4 OREGON STATEWIDE FREIGHT MODEL

The first version of the Oregon Statewide Model was developed through the establishment of the Transportation and Land Use Model Integration Program (TLUMIP) by the State of Oregon in 1996. In 1999, ODOT initiated the work on updating this model, leading to the development of the second generation integrated statewide model, which is discussed in this section. This model simultaneously models economic activity, land use, transportation supply, and travel demand, thus belonging to the class of models also referred to as "economic activity models." The main purpose of developing an integrated land use/ transportation model for Oregon was for applications in the simultaneous analysis of land use and transportation decisions, by making periodic long-term

economic activity, demographic, and freight flow forecasts at the statewide and substate levels.

The model consists of seven modules (Regional Economics and Demographics, Production Allocations and Interactions, Household Allocations, Land Development, Commercial Movements, Household Travel, and Transport Supply) which are integrated together. These modules share data and run iteratively using feedback loops, since change to one of the modules can potentially impact the inputs and the subsequent outputs of other modules. This framework is evidently different from the traditional four-step demand models, in which data flows only in one direction, and there is no occurrence of feedback and iteration.

The key data inputs to the modeling framework of the Oregon freight model are briefly discussed below:

- **Land Use and Socioeconomic Data –** These include input/output accounts, imports and exports by industry sector, demand function parameters, and location utility function parameters, for the land use and economic activity interactions component of the model (for example, modeling the impacts of economic trends on land use choices in the region)
- **Transport Demand and Supply Data –** These include transportation network data (links, nodes, capacities, lengths etc.), trip characteristics (modes, traffic volumes, travel times, value of time, etc.), mode split parameters (elasticity, and scaling factors), and speed flow curve parameters. The model uses these data to analyze how constraints in the system affect mode and route choices, in order to determine micro-level demand characteristics on the transportation system.

Relevance for Colorado DOT and Colorado MPOs

The Oregon Statewide truck model is innovative in that it estimates truck traffic not from employment or economic output data, but from land use data. This methodology provides transportation and land use planners the capability to forecast the impact of land use changes on both truck and auto and traffic throughout the State. While a powerful tool, the implementation of this model has proven challenging. Developing a similar tool in Colorado would require significant resources.

Data/Information Needed to Implement Program

In addition to the data needed to develop a traditional hybrid model, detailed land use and socioeconomic data would be needed at the zone level.

5.0 Freight Corridor Studies

Freight corridor studies provide key inputs for corridor-level freight planning activities. Highway corridor studies have traditionally been the most common types of freight corridor studies. However, with the realization of increasing importance of freight rail capacity requirements for efficient freight movement and as an alternative to building additional highway infrastructure, there have been some notable efforts in conducting rail freight corridor studies as well. The data compiled and analyzed as part of freight corridor studies provide key inputs for various freight planning activities, some of which are briefly outlined below:

- Highway freight corridor studies, for example, analyze truck commodity flows along a corridor, and their O-D and routing patterns, which provide key inputs for truck model development.
- Truck traffic analyzes in corridor studies, in conjunction with auto traffic flows, can be used to understand interactions between truck and auto traffic flows, especially during peak periods, analyze their impacts on peak-period congestion and safety, and assess the effectiveness of programs that shift truck traffic to off-peak periods on improving traffic mobility and safety along the corridor.
- Understanding the types of commodities and industries shipping goods along a rail or highway corridor can be critical to determining the detrimental impacts on the economy associated with bottlenecks in the rail and highway freight system. Also, information on the stakeholders dependent on the corridor can be useful in identifying public-private partnerships for financing capacity and/or operational improvements along the corridor.
- Highway freight corridor studies can be used to assess the feasibility of implementation of truck-only lanes on high-volume truck corridors, by providing inputs to analyze financing options (such as truck toll lanes), existing and future magnitude of truck traffic flows, types of commodities and industries using the corridor (which will provide inputs to determine truck value of time), etc.

This section begins with a description of individual corridor studies in Southern California, along with a description of the overarching corridor program in the region. It is followed by a description of a multistate corridor coalition. The relevance of these studies for Colorado and the data needs to implement the studies are described at the end of this section rather than at the end of each individual project.

5.1 I-710 MAJOR CORRIDOR STUDY

The I-710 Major Corridor Study was initiated in January 2001 to analyze mobility problems, traffic congestion, traffic safety, and environmental issues (diesel emissions) along the I-710 travel corridor, with the objective of developing longer-term transportation solutions to address these problems as well as quality of life concerns experienced by communities along the I-710 Corridor. The study was conducted through the cooperative and collaborative efforts of several agencies, organizations, and localities within the jurisdiction of the I-710 Corridor Study Area as well as through the active participation of a number of community groups, interested citizens, and project stakeholders. They key public sector agencies involved in conducting the study included the Los Angeles Metropolitan Transportation Authority (LAMTA) along with Caltrans, SCAG and the Gateway Cities Council of Governments. The primary goals of the study included identifying solutions that focused on achieving improved safety and public health along the corridor, improved mobility, and sustenance of regional, state, and national economies relying on the corridor.

A key initial component of the study was an in-depth analysis of existing and future sociodemographic, safety, environmental, and transportation system (traffic, congestion, etc.) conditions along the corridor to understand the factors impacting travel patterns, and travel conditions contributing to mobility, safety, and environmental (emissions) issues. The analysis involved 1) looking at existing and future year population and employment density, and land uses along the corridor to identify regions accounting for high concentrations of passenger and truck trips, 2) use of the SCAG model to analyze existing and future year truck traffic patterns along the corridor, specifically looking at port truck traffic forecasts, and trends in truck traffic shares of total traffic along the corridor, 3) analysis of accident data collected and reported by Caltrans (such as the Traffic Accident Surveillance and Analysis System – TASAS data files) to identify high accident rate sections along the corridor, and 4) Air quality and public health issues along the corridor using data collected and studies conducted (such as the Multiple Air Toxics Exposure Study – MATES) by the South Coast Air Quality Management District (SCAQMD) to identify regions with high public health (such as cancer) risk from emissions.

The outcome from the study was the recommendation of a hybrid alternative for implementation along the corridor that combines appropriate elements from the five alternatives analyzed for potential application along the corridor. A key element in this process was involvement of community stakeholders and the general public, in the decision-making process. Some of the key projects included under the hybrid alternative for implementation include the following:

- Exclusive truck facility on the I-710 corridor to improve truck travel time reliability through more streamlined truck movements, as well as safety benefits from the separation of trucks from autos;

- General purpose traffic improvements on the I-710 corridor, including additional travel lanes to increase system capacity; and
- Truck-related interchange improvements to reduce truck traffic conflicts, and providing for access and egress for trucks using the truck only lanes

5.2 I-15 COMPREHENSIVE CORRIDOR STUDY

The I-15 Comprehensive Corridor Study was undertaken in 2005 to address current and future travel needs along the I-15 corridor, between the State Route 60 (SR 60) Freeway interchange in Mira Loma and the Mojave River crossing in Victorville. The study was jointly sponsored by the Southern California Association of Governments (SCAG), the San Bernardino Associated Governments (SANBAG), and the California Department of Transportation (Caltrans). The primary objectives of the study included identifying long-term planning solutions along the corridor for 1) improving levels-of-service (LOS) along the corridor through provision of sufficient capacity and operational strategies, to meet demand, 2) improving the efficiency and reliability of goods movement along the corridor, 3) enhancing access to transit services, and 4) improving safety by reducing the frequency, and severity of traffic collisions along the corridor.

The study evaluated the feasibility of transportation improvements along the corridor to meet the study objectives by analyzing five alternatives/strategies, which included Strategy A (No Build), Strategy B (Transportation Demand Management/Transportation System Management), Strategy C (High-Occupancy Vehicle – HOV lanes), Strategy D (Full Corridor Dedicated Truck Lanes), and Strategy E (Reversible Managed Lanes). Following are some key freight data and model applications in this study for the analysis of alternatives and development of project recommendations for future implementation:

- Existing and future socioeconomic conditions (population and employment) along the corridor were analyzed using data available from SCAG developed for the 2004 Regional Transportation Plan. This analysis looked at 2000 and 2030 population and employment data along the corridor to identify key socioeconomic trends impacting traffic characteristics along the corridor.
- The study used the 2000 SCAG Heavy Duty Truck Model (which was also used for the 2004 SCAG RTP) for the estimation of traffic forecasts and level of service (LOS) conditions under each of the five alternatives described earlier. The analysis was conducted for the a.m. peak, p.m. peak, and average daily time periods. Some key parameters analyzed using the model outputs included traffic volumes by type (trucks, single-occupancy vehicles, and high-occupancy vehicles), percent truck traffic by time period, volume-capacity ratios (V/C), and travel times.
- Existing traffic conditions along the corridor pertaining to average daily auto and truck traffic volumes, weekday versus weekend variations in traffic

volumes, distribution of volumes by time of day (peak versus off-peak periods), and peak-period directional distributions of traffic volumes were analyzed in the study using data from Caltrans traffic count database, data from previous studies and reports conducted along the corridor, as well as data collected from a comprehensive survey of daily users of the corridor conducted as part of the study.

The key outcome of the study was the development of specific project recommendations for the I-15 corridor based on the comprehensive analysis of the five alternatives, as well as the public outreach efforts through surveys of corridor users. The key projects recommended for future implementation along the corridor included Strategy B (Transportation Demand Management/Transportation System Management) projects (such as additional ramp metering), dedicated truck lanes, and reversible managed lanes along the corridor.

5.3 SR 60 TRUCK LANE FEASIBILITY STUDY

The 1998 SCAG Regional Transportation Plan identified dedicated truck lanes as a key strategy in the SCAG region to achieving goods movement efficiency and reliability, improving overall transportation mobility, as well as realizing air quality and traffic safety benefits in the region. Additionally, the RTP identified the SR 60 corridor as a high-priority corridor with the need for dedicated truck lanes. As a consequence, the SCAG Truck Lanes Task Force initiated the SR 60 Truck Lane Feasibility Study in 2001 to assess the feasibility of implementing truck lanes along this corridor, focusing on such factors as design alternatives, financial impacts, highway operations, safety and environmental issues, as well as overall regional benefits. The study area for the corridor included the segment from I-710 to the I-15 interchange.

The study analyzed physical, operational, and safety characteristics along the corridor to assess key issues that could be potentially addressed through dedicated truck lanes. Physical characteristics included the physical layout and design features of the corridor, operational characteristics pertained to the existing traffic characteristics along the corridor, particularly associated with goods movement activities, and safety characteristics related to accidents particularly those associated with heavy duty trucks. Some key data sources used in the corridor analysis included the following:

- Analysis of physical characteristics such as lane widths, lengths of segments, cross-sectional details, surrounding land uses, etc., using engineering data available with SCAG.
- Operational characteristics that were analyzed included, average daily traffic (ADT) volumes, peak-hour traffic volumes, average daily truck traffic (ADTT) volumes, traffic mix, and truck origin and destination patterns. Average daily traffic volumes and peak-hour volumes, and average daily truck traffic volumes were obtained from data compiled by Caltrans. Additionally, these

volumes were validated using observed truck count data collected by the San Gabriel Valley Council of Governments (SGVCOG) as part of the San Gabriel Valley Goods Movement Study, and counts collected by SCAG as part of this study at 5 key locations along the SR 60 corridor. The Caltrans ITMS commodity flow database was also used to understand O-D patterns of truck movements that would potentially use the SR 60 corridor.

- Safety characteristics were analyzed in terms of the historical trends in number of accidents along the corridor, with focus on total number of truck accidents, and number of truck accidents by type (including property damage only, injury, and fatality). Detailed accident data for Los Angeles County were obtained from the California Highway Patrol's (CHPs) Statewide Integrated Traffic Records System (SWITRS), while the Incident Reporting System (IRS) maintained by Caltrans was used for additional accident statistics pertaining to San Bernardino and Riverside Counties.

The study was a first step in the analysis of various factors impacting the feasibility of truck lanes along the SR 60 corridor. The study concluded that truck lanes are a potentially viable concept for the corridor in terms of providing additional capacity to handle expected growth in truck traffic volumes, and providing safety and environmental benefits, however, recognizing that more comprehensive multimodal analysis is required considering financing options (such as truck user charges), as well as multijurisdictional coordination in the future planning efforts towards the development of truck only facilities along the corridor.

5.4 SOUTHERN CALIFORNIA DEDICATED TRUCK LANE STRATEGY FOR THE MULTICOUNTY GOODS MOVEMENT ACTION PLAN (MCGMAP)

The Multicounty Goods Movement Action Plan (MCGMAP) for Southern California specifically analyzed the dedicated truck lane strategy for Southern California for the efficient movement of trucks in the region. Dedicated truck lane strategies were analyzed in the MCGMAP focusing on the following key performance criteria:

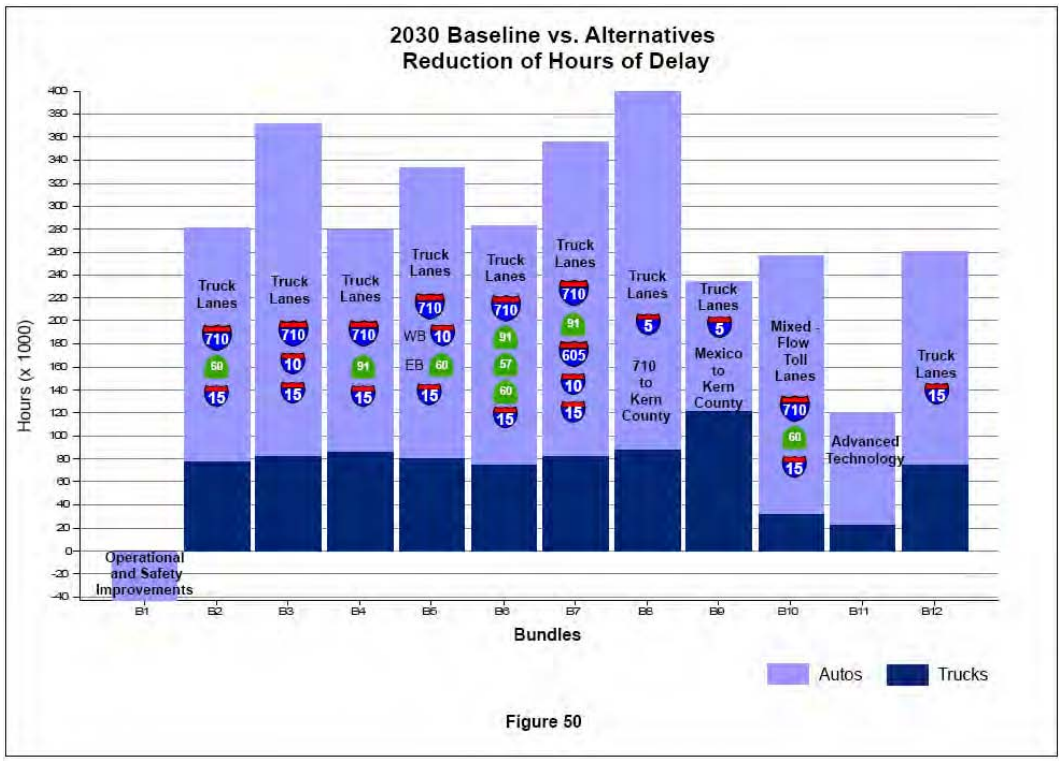
- Recurrent delay;
- Pavement deterioration;
- Safety;
- Emissions; and
- Reliability.

The following sections describe the analyses conducted under each of the performance criteria evaluation, and the data/models used for these analyses.

Recurrent Delay

The MCGMAP used the SCAG heavy duty truck (HDT) model to analyze the performance of various dedicated truck lane alternatives in the region in terms of the reduction in the hours of recurrent delay. Based on this analysis, each of the truck lane alternatives was observed to offer significant benefits in terms of reduction in delay, as shown in Figure 5.1.

Figure 5.1 Delay Reduction from Truck Lane Alternatives



Source: Multicounty Goods Movement Action Plan (MCGMAP).

The MCGMAP analyzed the impacts that dedicated truck lanes would have on pavement design and maintenance. It was observed that truck lanes essentially have the following two areas of impact on pavement condition:

- Due to the implementation of truck lanes, there would be a significant reduction in the amount of trucks traveling on the mainline freeways. This consequently would significantly reduce the amount of pavement damage on the mainline freeways as well as their needed maintenance requirements.
- Dedicated truck lanes would result in the intensive truck use of the lanes on the new facilities, thereby requiring more expensive design and maintenance.

Based on the lane mileage of the mainline freeways relative to the dedicated truck lane system, it was deduced that the net result would likely be a significant reduction in the total maintenance costs for the overall freeway network.

The operation of dedicated truck lanes would significantly reduce the number of trucks operating on the mainline freeway system, resulting in a significant reduction in the interactions between autos and trucks on the freeways. Safety has also been considered in other truck lane studies in the country, most notably the Georgia Statewide Truck Lanes Needs Identification Study, which looked at the number of accidents on interstates at different truck percentage levels. Even though the analysis indicated that the accident rate remained constant at different truck percentage levels, the number of fatalities were between 200 percent and 300 percent higher for trucks relative to autos. On state roads in Georgia, trucks were 9 percent of the total volume, but were involved in 26 percent of fatal crashes while on interstate, trucks were 14 percent of the total volume and were involved in 38 percent of the total fatal crashes. These trends were observed to support the notion that truck-auto accidents are more severe than auto-auto accidents. Since majority of the fatalities in truck-involved accidents involve automobile drivers and/or passengers, it is reasonable to assume that separating trucks and autos in Southern California through the development of truck lanes would lead to a reduction in the number of truck-related fatalities.

Table 5.1 Truck-Related Accidents on State Roads

Category	State Roads
Average Truck Percentage	9%
Total Crashes Involving Trucks	9%
Injury Crashes	9%
Fatal Crashes	26%

Source: GDOT Statewide Truck Lane Needs Identification Study.

Table 5.2 Truck-Related Accidents on Interstate Facilities

Category	Interstate Facilities
Average Truck Percentage	14%
Total Crashes Involving Trucks	16%
Injury Crashes	16%
Fatal Crashes	38%

Source: GDOT Statewide Truck Lane Needs Identification Study.

Dedicated truck lanes would also increase reliability in the freeway system. Previous studies using data from the FHWA Mobility Monitoring System have found that the reliability of a roadway is inversely correlated with the amount of delay of the roadway. Therefore, decreasing the amount of delay for trucks by using the truck lanes will also increase their reliability.

The amount of reliability that can be gained through use of the truck lanes was estimated in a study undertaken by the Southern California Association of Governments (SCAG) titled "Making the Value Case for Private Investment in Goods Movement Infrastructure." This study looked at the average savings in buffer times resulting from truck lane projects in Southern California. For the a.m. peak period, the amount of delay reduction and the amount of buffer time for select origin destination pairs are shown in Table 5.3.

Table 5.3 Average Buffer Time Savings from Truck Lane Strategies between Ports and Warehouse Districts

Begin Location	End Location	Average Delay Reduction (Minutes)	Average Buffer Time Saved (Minutes)	Total Minutes Saved
Warehouse District	Downtown	26	59	85
Downtown	Warehouse District	30	68	97
Warehouse District	Ontario	62	130	192
Ontario	Warehouse District	88	210	298
Warehouse District	Victorville	96	189	285
Victorville	Warehouse District	128	276	405

Source: Southern California Association of Governments (SCAG), "Making the Value Case for Private Investments in Goods Movement Infrastructure," PowerPoint Presentation.

5.5 WEST COAST CORRIDOR COALITION (WCCC) WEST COAST TRADE SYSTEMS ANALYSIS

This study, which is currently ongoing, was initiated by the West Coast Corridor Coalition (WCCC), a coalition represented by a diverse group of representatives from state DOTs (Alaska, Washington, Oregon, and California), regional planning organizations, ports, shippers, railroads, trucking companies, terminal operators, and labor organizations, making the case for goods movement strategies and investments in the west coast multimodal transportation system to handle projected transportation demand. The study is designed to understand key trends and issues affecting the West Coast trade and transportation system, and to provide a foundation and a framework to allow the Coalition and its members to work with national transportation policy-makers, the private sector freight stakeholders, and local partners to begin addressing specific systemwide issues and chokepoints crossing cross jurisdictional boundaries.

The study has two primary components: 1) freight demand, and 2) freight system characteristics. The freight demand component involves the analysis of existing and forecast international (marine, air cargo and NAFTA) and domestic (mega-region interregional) freight demand in the study area, while the freight systems characteristics component involves the analysis of existing and future freight transportation system conditions in the study area focusing particularly on the key capacity constraints and bottlenecks in the west coast multimodal freight transportation system. The key freight data sources being used to perform these analyses are described briefly below:

- The study team is using the Freight Analysis Framework (FAF2) commodity flow database to analyze existing and future year freight demand in the study area, which involves estimating international maritime shipments to and from the region's seaports**,** inland movements of international seaport shipments, border crossing flows between the U.S., Canada and Mexico (NAFTA flows), as well as domestic interregional freight flows within the study area.
- Data sources for analyzing freight system capacity constraints and bottlenecks include existing studies and reports, the FAF2 highway network database, as well as the private sector (through direct discussions with the railroads and the ports to identify rail and marine system constraints, respectively).

5.6 RELEVANCE FOR COLORADO DOT AND COLORADO MPOS

Corridor studies have been a key feature of previous Colorado DOT transportation planning efforts. The studies described in this section provide several examples of how to conduct corridor studies on freight-intensive corridors. Additionally, these projects describe many of the recent developments that are now applicable to corridor studies including the understanding of safety impacts, reliability impacts, studying truck-only lanes, and toll studies.

5.7 DATA/INFORMATION NEEDED TO IMPLEMENT PROGRAM

Because the Colorado DOT has conducted several corridor studies throughout the State much of the information needed on corridor counts, congestion, and origin-destination pairs already exists. There are a few additional data items that would provide even greater detail for studies for corridors that carry a high proportion of freight in Colorado. To conduct safety analysis on freight-intensive corridors, it is beneficial to develop separate crash reduction factors for autos and trucks. This will enable a more accurate estimate of the safety impacts of increased traffic and changes in the road network. Additionally, the work

conducted for the Georgia DOT Statewide Truck Lane Needs Identification Study indicates that the fatality rates of truck-involved crashes are significantly higher than auto-only accidents. It would be beneficial to determine if there is a similar pattern in Colorado.

Another issue to consider for corridor studies is reliability. Reliability is particularly important for the freight sector where on-time performance often has a direct financial consequence. There has been several first-generation reliability models developed that can be applied to corridor studies. The capturing of real-time operational data on Colorado freeways is a good first step towards understanding the level of reliability in the road network and developing local data to input into local corridor studies rather than relying on reliability data in other regions. Truck-only lanes are under consideration in many jurisdictions. To fully understand the potential benefits of this alternative, hourly vehicle classification data are needed on the corridor of concern. It is additionally beneficial to have roadside O-D survey data to verify the accuracy of the truck components of travel demand models that cover the corridor. Toll studies have also been considered on many roadways around the country. For truck-intensive corridors, it is beneficial to collect value of time data that is as specific to the corridor of concern as possible.

6.0 Economic Issues in Freight Planning

There have been numerous studies conducted at the Federal, state, and local/ MPO level to analyze and corroborate the vital integrated relationship and linkage between freight transportation and the economy. This relationship is important for the following reasons:

- An understanding of the impacts of the economy on the type, magnitude and distribution of freight flows is important to predict freight flows in the future based on expected trends in the economy;
- Information on which industries rely and by how much (for example, in terms of how much of their business costs are spent on freight transportation services) on specific components of the freight transportation system is important in order to assess which sections of the economy are adversely affected by deterioration in the performance of the freight transportation system; and
- The ability to analyze the economic impacts of specific freight projects (for example, in terms of the number of new jobs created or amount of economic output generated) is critical for planning the future development of freight projects. For example, this information is essential for determining the share of investment on a project between the public and private sectors under a public-private partnership (PPP). This information can be also useful for project prioritization processes, for the development of future projects that have the most significant economic impacts relative to the amount of investment required for project development and implementation.

This section describes four studies that combine freight with economics. The relevance of these studies for Colorado and the data needs to implement these studies is described at the end of the section.

6.1 RIVERSIDE COUNTY TRANSPORTATION COMMISSION (RCTC) COLTON CROSSING BENEFITS ANALYSIS PROJECT

A notable example of an important freight project involving considerations of economic and environmental impact issues in the freight planning process is the Colton Crossing Benefits Analysis project being undertaken currently by the RCTC. The Colton Crossing is an at-grade crossing of two railroad mainline networks located in the City of Colton, south of I-10 between Rancho Avenue

and Mount Vernon Avenue in San Bernardino County. The proposed solution to relieving the rail bottleneck at the Colton Crossing is the construction of an elevated structure on the UP double track that would parallel I-10 and cross over the BNSF double track, resulting in the grade separation of the crossing. From the perspective of the public sector, there is a need to relieve the rail bottleneck at the crossing in order to mitigate the economic, safety and environmental impacts of the bottleneck to the region, while the rail mainlines at the crossing are owned by the railroads, and the railroads are interested in increasing their net profits through system efficiency and capacity enhancements from relieving the bottleneck. In projects like this, it is therefore critical to quantify the economic and environmental benefits from the grade separation of the crossing, in order to determine the share of contribution from the public sector in providing funding for project implementation, relative to the contributions from the railroads.

The primary economic impacts considered from the implementation of the project include the creation of jobs in the region due to the increased demand being handled on the rail system due to rail capacity enhancement. Most of the increased demand that would be handled on the rail system as a result of the project would be related to international cargo moving through the San Pedro Bay ports, a significant share of which use the rail system to reach markets outside the region (for example, the Midwest). This increased demand being handled on the rail system was determined to result in increased jobs in the region associated with marine terminal activities, railroad jobs, trucking jobs, as well as jobs related to other important logistics activities associated with international cargo handling such as transloading. Also, the analysis included the estimation of private sector (railroad) economic benefits from improved efficiency of train operations (reduction/elimination of delays) as a result of the project.

The following types of data were used in the analysis of economic (job) impacts associated with the project:

- **Industry Expenditures for International Cargo Movements through the San Pedro Bay Ports –** Expenditures for various cargo handling and goods movement activities for cargo movements through the seaports by type of industry were used to estimate the direct job impacts associated with international maritime trade. These expenditures were associated with marine terminal, railroad, trucking, warehousing, transloading, insurance, and other key business sectors associated with cargo movements through the seaports. The expenditure data was derived from data gathered by the Port of Long Beach for their economic impact analysis projects.
- **IMPLAN Input-Output Model –** Used to convert the industry expenditures into direct job impacts by type of industry, as well as to estimate the indirect and induced job impacts associated with the direct jobs.
- **Average Wages by Industry Sector –** Used to convert the total jobs (direct, indirect, and induced) resulting from the project into equivalent public sector economic benefits. The average wage estimates by industry sector were

derived from data available from the California Employment Development Department (EDD).

- **Railroad Operating Costs per Hour of Delay –** Used to estimate private sector (railroad) economic benefits from the project. These benefits included the operating cost savings for the railroads as a result of the project due to the increased efficiency of operations from the elimination of train delays. The operating cost data for the railroads was derived from the Colton Crossing Feasibility Analysis Study conducted in 1999 by the California Department of Transportation (Caltrans), since more recent data could not be collected from the railroads.
- **Data describing the Relationship between Increase in Commuter Rail System Capacity and Reduction in Auto VMT –** Used to estimate the total magnitude of auto VMT reduction from the increase in commuter rail capacity from the project. This data, coupled with the data on value of pollution reduction per unit VMT reduction, was used to monetize the total environmental benefits from the diversion of automobiles to commuter trains. This data was derived from the data available from Metrolink, the agency operating the commuter trains in the region.

6.2 SCAG PORT AND MODAL ELASTICITY STUDY

The SCAG Port and Modal Elasticity Study was conducted by the Southern California Association of Governments in 2005 to understand the economics of port-related goods movement in Southern California, and the impacts of user fees on containerized imports through the San Pedro Bay Ports on the diversion of imports to other Ports in the U.S. (leading to a loss of market share for the Southern California ports). The study was undertaken as an initial step in understanding what the optimal user fees could be in the region as means to garner funds for transportation improvements, without significantly impacting cargo volumes through the ports that support the local economy in terms of jobs, as well as generating economic output.

The study used an economic optimization model of waterborne containerized imports from Asia. Some key data sources used in this study for the analysis of the impacts of business economics (supply chain costs) resulting from issues such as user fees, and their impacts on freight demand in the region, are discussed below:

- The study used west coast trade flow data in terms of 20-Foot Equivalent Units (TEUs) from the Port Import Export Reporting System (PIERS) database to determine the commodity distribution of containerized cargo moving through the west coast ports. Additional, value of containerized cargo data was derived from the World Trade Atlas (WTA) to estimate average value per TEU factors by commodity group for the economic analysis.

- Data on inventory handling and transportation costs for different ports of entry, inland transportation modes, and destination locations for imports, were tabulated based on a survey of the major importers identified from the PIERS data, for use in the economic optimization model.

For various ranges of user fees, the study used the above data as inputs in an optimization model, to analyze how total supply chain costs are impacted by user fees, and how, in turn, these fees impact the local choice and inland distribution patterns of containerized imports from Asia to the U.S. The outcome of the study was the development of elasticity curves depicting the variation of port containerized import demand as a function of user fees.

6.3 REGIONAL ECONOMIC IMPACTS OF THE I-5 COLUMBIA RIVER CROSSING CHOKEPOINTS

The "Regional Economic Impacts of the I-5 Columbia River Crossing Chokepoints" study was undertaken in 2003 by the Oregon Department of Transportation (ODOT) to understand how congestion along the I-5 highway and rail crossing across the Columbia River between Portland, Oregon and Vancouver, Washington impacts the local and regional economy in the Portland-Vancouver metropolitan area, as well as the Pacific Northwest as a whole. The study also looked at the impacts of congestion on the economies specifically on some key industry sectors in the region such as lumber and wood products manufacturing, farming industries, and warehousing and distribution industries. Some key data sources and their applications in the study are described below:

- Data from the ODOT 2001 Transportation Volume Tables were used to estimate existing traffic conditions along the I-5 bridge across the Columbia river, in terms of total average daily traffic (ADT), and average daily truck traffic (ADTT) volumes.
- Interviews were conducted with key freight stakeholders and public sector officials in the region to get their perspectives on key congestion issues in the region, and how they are impacting economies of key business sectors.
- The Portland Metro travel demand model was used to analyze forecast traffic volumes and system conditions along the I-5 Columbia River crossing in terms of future year (2020) total and truck traffic volumes, travel times along the crossing, as well as the comparisons of the duration of peak periods between the base (2000) and future (2020).
- The study analyzed the economic impacts of congestion along the I-5 Columbia River crossing by looking at model outputs on vehicle and truck hours of delay, and translating them to increased transportation costs for businesses using data from the 2002 Urban Mobility Study conducted by the Texas Transportation Institute.

The key outcome of the study was a set of recommendations for highway, rail and transit projects along the I-5 crossing along with their anticipated local and regional economic benefits.

6.4 FREIGHT RAIL AND THE OREGON ECONOMY

The "Freight Rail and the Oregon Economy" study was undertaken in 2003/2004 by the Port of Portland and the Oregon Department of Transportation (ODOT) to identify the dependence of the Oregon economy on the freight rail system, and address the need to ensure the viability and competitiveness of the freight rail system to meet future transportation demand in the State. The key objectives of the study were to estimate rail freight demand in the State, map out the State's rail infrastructure, determine the role of freight rail in supporting the economy of Oregon, the Portland metropolitan region, and the Port of Portland's marine terminals, identify corridor-level rail capacity issues and their impacts on industries, and to assess the role of the public sector in freight rail planning in the State.

Some of the key data sources and their applications in the study are discussed below:

- Global Insight's TRANSEARCH database, the Freight Analysis Framework (FAF) database from the FHWA, and the 1997 Commodity Flow Survey (CFS) data from the U.S. Census Bureau were used to estimate current and future freight rail demand in the State, as well as analyze the share of total freight demand, in terms of value (dollars), weight (tons), and weight-distance (ton-miles), supported by the rail mode relative to trucking, marine, and air modes.
- Historical trends in rail network mileage in the State were analyzed using data from the Oregon State Railroad Annual Reports.
- Data from ODOT, and the Association of American Railroads (AAR) were used to determine rail infrastructure characteristics (track miles, owned/ leased mileage versus mileage on trackage rights, etc.) in the State.
- The Carload Waybill Sample from the Surface Transportation Board (STB) was used to determine expenditures of major industry groups (separately for the State as a whole, and for the Portland metropolitan area) on originating freight using the rail system.
- The I-5 Transportation and Trade Partnership – I-5 Rail Capacity Study conducted in 2003 along with other studies in the region, and discussions with public and private sector stakeholders, were used to identify key rail capacity constraints in the region, and their impacts on business costs.

The key outcomes of the study were the identification of major industries in the State, and the Portland metropolitan region, and international gateway industries (Port of Portland marine terminals) that rely on the freight rail system, the

critical rail capacity issues in the region and how they potentially impact the economy of the industries relying on the rail system, and the role of the public sector in freight rail planning in the State (for example, leveraging funding resources such as grants for intermodal terminal development, establishing multijurisdictional corridor planning program, and encouraging private sector investment in freight rail through tax incentives).

6.5 RELEVANCE FOR COLORADO DOT AND COLORADO MPOS

These studies demonstrate the wide range of economic applications for freight-related studies. Monetizing the economic impacts is often a key component of justifying the need for a project. This also augments the traditional travel time benefits and provides a useful criteria for performing project prioritization amongst a wide range of projects competing for limited funding resources in the State. If the Colorado DOT were to pursue a program to understand the relationship between economic activity and goods movement, these studies would provide a guide on ways to organize the information in order to highlight key corridors, key industries, and the relative economic impact of goods and service sector transportation needs.

6.6 DATA/INFORMATION NEEDED TO IMPLEMENT PROGRAM

There are several data needs to implement the studies described in this section. For the grade separation project, it is important to know current and forecasted rail volumes on the rail lines. It is also important to know the commodity distribution of these volumes, so that the economic relevance of the goods can be estimated. Input-output models are also important to allow for the conversion of dollars into jobs by specific industries. Wage information by industry is important to determine the relative importance of these jobs.

It is also important to quantify the impacts of modal diversion. To implement a methodology similar to the one used in the Port Modal and Elasticity Study, it is important to have information on the supply chain for each mode and to understand how user fees are passed through to the supply chain, who will absorb the user fee, and what their reaction to the fee will be. This type of information is best captured through shipper interviews and stated-preference surveys.

For each of these projects, it is also important to understand costs involved in projects. This is important for estimating the cost to construct, operate, and maintain new infrastructure. It is also important to understand the operating costs of each of the freight modes to understand how travel time savings can be translated into an economic benefit.

Appendix C - Task 3 Final Report

Recommendations on Data Collection and Analysis Practices for Colorado

INTRODUCTION

The objective of this task is to develop a set of data collection and analysis practices to support freight transportation planning. These practices also will aid the integration of freight planning into general transportation planning at state and MPO levels in Colorado. This will be accomplished by comparing the freight-related projects underway or planned in Colorado with studies that have been done in other regions. The freight data utilized in similar projects in other regions will be compared to the freight data that is available and in use in Colorado. Data not available in Colorado will be considered freight data needs for the State. Recommendations will be developed based on these freight data needs and based on the need to maintain frequently used freight data in the State.

Additionally, a review will be conducted of the freight data needs identified and implied from the interviews done as part of Task 1 of this study and the 2005 Freight Data Assessment Report. The recommendations will incorporate the needs that were identified through these techniques as well.

SUMMARIZING FREIGHT DATA USED IN STUDIES OUTSIDE COLORADO

The scan of freight projects conducted in Task 2 revealed some important patterns in terms of the types of data that are often used in other studies that are not available in Colorado. Table 1 summarizes the results of the scan in terms of three key features:

1. The similarity between each project and current or planned studies in Colorado;
2. For similar projects, the new freight data needed to implement the study; and
3. For similar projects, the data collection method needed to collect the new data.

The most prominent pattern between the scanned studies in other regions and the new freight data needs in Colorado is the need for corridor-specific, truck origin-destination data. This type of data was considered to be essential for corridor studies on freight-intensive corridors. It also was a common feature for several types of other projects,

including state-level freight plans, MPO-level freight plans, truck-rail diversion studies, and freight data development projects. The primary method for obtaining this corridor-specific, origin-destination data was to collect roadside truck origin-destination studies. Other methods included extraction and manipulation of data from TRANSEARCH databases. This has been met with mixed success as often times the data from the TRANSEARCH database do not match with what is seen through roadside surveys. Additionally, TRANSEARCH data does not have time-of-day characteristics, which is particularly important for corridor studies that exhibit some levels of congestion. Agencies in the Portland metropolitan area pooled funds to develop a comprehensive freight data collection program. One method used to collect origin-destination data in a subregion in the Portland metropolitan area was to conduct a truck-following study. This method was found to be particularly useful to determine the number of through trucks relative to inbound and outbound trucks that were using the road system in a predominantly residential community.

The second most commonly used freight data not available in Colorado was economic data. This is becoming increasingly important as transportation agencies are beginning to demonstrate the link between the transportation system and the economy in their region. Economic data and analyses also are increasingly being used to assist in selecting between alternatives on a wide range of studies. This is most notable on long-haul corridor studies. There are three sources used to identify economic data for various studies. The first method is to assemble data from the U.S. Census Bureau of Economics. The Census data include employment and output for several different industry and commodity types. The primary benefit of this database is that it is free and readily available through the Census Bureau web site. The downside to this data is that at lower geographic levels, some of the data are suppressed due to confidentiality concerns. This has the potential to create holes in economic databases which require additional work to fill. The second method used to compile economic data is to use information from other government and trade association sources. An example of this is agriculture data (which is one of the weaker components of the TRANSEARCH database) can be found by using information available from state agriculture departments. Additionally, employment data (including medium-term forecasts) are often available from state employment agencies. The third source of economic data is proprietary databases that include information on output and employment by industry sector.

Other types of data used in other regions that are not generally available in Colorado include freight-focused vehicle classification data, information from the private railroads, shipper surveys, and safety data. Freight-focused vehicle classification data were found to be particularly important in terms of understanding truck usage for corridor studies, calibrating and validating truck components of travel demand models, and understanding the location of truck-intensive activity for regional and state freight plans. Information from private railroads was valuable in conducting rail relocation studies, truck-rail diversion analyses, and railroad grade separation studies. Shipper surveys were found to include valuable information for several types of studies such as identifying small quick-fix freight projects that can be included in short-term project programming activities, determining potential for truck-rail diversion, developing information on truck trip

distribution rates for a region, and identifying potential truck routes and restrictions in a local area. There was mixed success in terms of implementing these surveys in different jurisdictions. A typical response rate for these surveys is 20 percent. A key factor in the success of these surveys is the preexistence of a relationship between either the transportation agency and the potential survey respondents or a relationship between the surveyor and the potential survey respondents.

Safety data was not noted as being critical for one of the corridor studies reviewed in the project scan. However, it is becoming an increasingly important topic for both state DOTs and MPOs. The most recent Federal transportation legislation has increased the requirements for transportation agencies to track and report safety data. Additionally, safety improvements are a key component of calculating the benefits of roadway improvements. Analysis of statewide safety databases is one method of determining truck-involved accident rates along corridors. It is particularly important to identify separate accident rates for truck-involved accidents because truck-involved accidents have much more severe impacts than nontruck-involved accidents in terms of damage and injury.

Table 1. Key Freight Data Needs Based on Freight Studies in Other Regions

Study	Similar to Freight Study in Colorado	New Data/Information Needed to Implement Study in Colorado	Method Needed to Collect New Data
DVRPC Freight Forward Improvement Program	No	Type and location of quick-fix freight problems	Survey of freight stakeholders
FAST Corridor Program	No	Type and location of quick-fix freight problems	Survey of freight stakeholders
Binghamton MTS Regional Freight Study	Yes	County-level economic data by industry sector	Aggregate Census data or purchase employment database
Greater Vancouver Goods Movement Study	No		
South Suburban Mayors and Managers Association Freight Study	No		
SF Bay Area Regional Goods Movement Study	Yes	County-level economic data by industry sector, O-D info from truck survey	Aggregate Census data or purchase employment database, roadside truck O-D survey
Virginia Freight Plan	Yes	County-level economic data by industry sector	Aggregate Census data or purchase employment database

Table 1. Key Freight Data Needs Based on Freight Studies in Other Regions (continued)

Study	Similar to Freight Study in Colorado	New Data/Information Needed to Implement Study in Colorado	Method Needed to Collect New Data
New Mexico Freight Plan	No	County-level economic data by industry sector	Aggregate Census data or purchase employment database
Florida Freight Network and Statewide Freight Plan	No		
NYSDOT Trade Overview Study	No		
Washington Statewide Rail Capacity and System Needs Study	Yes	Information on how rail is used by shippers	Shipper interviews
AAR National Rail Freight Infrastructure Capacity and Investment Study	Yes	Detailed information on rail flows	Cooperation with railroads
SCAG Goods Movement Truck Count and Survey Study	Yes	Count data targeted towards gathering freight information and validating models, truck origin-destination information	Freight-focused Count program, roadside truck origin-destination surveys
Portland Freight Data Collection Program	Yes	Count data targeted towards gathering freight information and validating models, truck origin-destination information, information on how shippers receive and distribute goods	Freight-focused Count program, roadside truck origin-destination surveys, establishment survey, truck-following study
Oregon Commodity Flow Database	Yes	Economic output data by industry, input-output data by industry and employment by industry	Aggregate Census data or purchase employment database
California Statewide Truck Survey	Yes	Origin-destination information by truck type and commodity	Truck roadside origin-destination survey
FHWA Freight Analysis Framework2	Yes	County-level, freight flow data by mode for base and forecast years	Data available from FHWA web site
Portland Metro Truck Model	Yes	None	N/A
SCAG Truck Model	Yes	Truck trip rates for local truck trips	FHWA Quick Response Freight Manual Update or local survey
San Joaquin Valley Truck Model	Yes	Truck trip rates for local truck trips	FHWA Quick Response Freight Manual Update or local survey

Table 1. Key Freight Data Needs Based on Freight Studies in Other Regions (continued)

Study	Similar to Freight Study in Colorado	New Data/Information Needed to Implement Study in Colorado	Method Needed to Collect New Data
Oregon Statewide Freight Model	No		
I-710 Major Corridor Study (MTA)	Yes	Accident data at corridor level	Summary of state safety data by corridor
I-15 Comprehensive Corridor Study (SANBAG)	Yes	Data from daily users of corridor	Survey of corridor's daily users
SR-60 Truck Lane Study (SCAG)	No		
SCAG Multi-County Goods Action Plan Truck Lane Analysis	No		
West Coast Corridor Coalition	No		
RCTC Colton Crossing Benefits Analysis Project	Yes	Current and forecasted rail volumes, commodity distribution of rail volumes by rail line, input-output data, wage and employment information by sector	Working with railroads, use of Census data, purchase of economic database
SCAG Port and Modal Elasticity Study	No		
Regional Economic Impacts of the I-5 River Crossing Choke Points	No		
Freight Rail and the Oregon Economy	No		

COMPARISON WITH FREIGHT DATA NEEDS IDENTIFIED THROUGH CURRENT AND ONGOING STUDIES IN COLORADO

To develop a set of recommendations for the study, the results of the scan of freight-related projects in other regions was compared to the information collected through the discussions with transportation planners in Colorado and the review of corridor studies conducted in Task 1 of this study. These discussions revealed that there are several studies

underway that are directly and indirectly related to freight transportation. However, these studies can be grouped into five categories as described below:

1. Freight Data Development Studies and Programs – TRANSEARCH data purchase, Statewide Rail Database, CDOT Classification Count Data Review, North Front Range Classification Counts, Upcoming Truck Origin-Destination Pilot and Survey, Upcoming Front Range Travel Survey;

2. Rail Studies – Public Benefits and Costs Study of Rail Relocation, Phase II of Rail Relocation Study;

3. Truck Rest Stop and Parking Studies – Ports-to-Plains Rest Stop Study, Truck Parking Issues at Interstate Rest Areas in Colorado, Additional Rest Area Study;

4. Multimodal Freight Transportation Plans – Upcoming Statewide Freight Roadmap; Tracking of Oil, Gas and Ethanol Shipments; and

5. General Transportation Plans – CDOT 2035 Statewide Transportation Plan, Colorado Strategic Plan for Improving Roadway Safety, Western Colorado Mobility Plan, North Front Range Survey, Chain-Up Station Usage.

There are patterns of freight data needs indicated within each of these five categories. The completed Freight Data Development Studies and Programs have collected multimodal freight flow TRANSEARCH data and reviewed truck count and rail volume data across the State. There are three freight data development needs that have not yet been addressed in previous studies. The first is the collection of roadside truck origin-destination survey data. From the scan of studies in other regions, this type of data was found to be valuable for several types of efforts, including corridor studies, development of truck components of travel demand models, and multimodal transportation plans. The upcoming Truck Origin-Destination Pilot and Survey is an important step towards filling this data gap in Colorado. The second type of freight data need implied from this category of freight studies was establishment surveys. Establishment surveys can be used to understand the trip characteristics of truck operators in metropolitan areas. This is particularly useful for understanding interregional truck trips, because other methods of collecting truck origin-destination data tend to be more accurate for capturing intraregional truck trips. The upcoming Truck Origin-Destination Pilot and Survey also will be a good method to update the limited freight establishment survey that was collected over 10 years ago in the North Front Range Travel Behavior Inventory. The third type of freight data not included in the current program is a freight-focused vehicle classification program. In other regions, vehicle classification data were collected at specific freight-intensive locations to better understand goods movement and to assist with the calibration and validation of travel demand models.

The Colorado rail studies indicate that the transportation agencies in Colorado would benefit from continued focus on maintaining strong working relationships with the railroads in the State. However, Colorado also would benefit from accessing information

assembled through national rail studies such as the AAR National Rail Infrastructure and Assessment Study described in Task 2. The railroads often provide more detailed information to Federal agencies compared to state agencies. Colorado also may consider creating multistate alliances focused on rail. Multistate alliances are particularly relevant for studying rail, because most rail trips (in addition to rail issues and concerns) are multimodal in nature.

While none of the projects reviewed in the project scan focused on truck parking, this issue is gaining in importance across the country. Some ongoing studies shed some light on the type of data and analysis that are helpful in understanding truck parking deficiencies. Truck count data across the interstate system is critical. The FHWA has developed formulas that generate estimates of truck parking needs based on truck counts. These estimates can be made to be more accurate by providing information on the distribution of truck trip lengths at various locations. These truck trip lengths can be estimated from information collected from truck origin-destination surveys or from truck components of travel demand models. These estimates can be complemented by firsthand accounts of truck parking across the states. Typically district or regional engineers are familiar with locations where trucks typically park in unsafe and/or illegal locations. Once these locations are identified, firsthand data collection at nearby truck stops will pinpoint the locations of truck parking deficiencies across the State. This reinforces the need for truck origin-destination surveys and freight-focused vehicle classification count data. It also identifies additional sources of information (local engineers) that are important in this effort.

The most common freight flow information used for multimodal freight plans and freight components of general transportation plans is TRANSEARCH data. CDOT has recently purchased this database and, therefore, has sufficient data to perform general multimodal plans. However, several multimodal plans in other regions also have benefited from summarizing information from truck origin-destination surveys, freight-focused truck counts, and establishment surveys. To understand the impact of congestion on goods movement and to understand the impact of goods movement on congestion truck components of travel demand models are typically utilized. A simpler (but less accurate method) of understanding this relationship is through a comprehensive classification count program at the region's most congested locations. Travel demand models and truck counts also are useful in understanding the relationship between truck activity and vehicular safety for regions and states. Establishment surveys are essential to understand the short-term needs of the freight private sector community. These needs often constitute the "quick hits" that were used in some of the regional freight plans such as the Freight Forward Program in Philadelphia and the FAST Program in Seattle.

COMPARISON WITH FREIGHT DATA NEEDS IDENTIFIED THROUGH REVIEW OF CDOT CORRIDOR STUDIES

A review of the corridor studies underway in Colorado was conducted as part of Task 1 of this study. This review consistently identified information on medium- and long-haul truck trips and origin-destination data as two of the key freight data needs for these corridor studies. Both of these freight data needs could be satisfied through a comprehensive truck origin-destination survey program. Other freight data needs implied from these studies included truck counts, truck accident data and truck speed data. Based on the review of corridor studies, these would be considered to be secondary freight data needs.

Table 2. Freight Data Needs from Review of Corridor Studies

Major Corridor Studies	Implied Freight Data Needs
North I-25 Environmental Impact Study	Medium- and long-haul truck trip data
Valley Highway (I-25) EIS	None indicated
I-25 Corridor – Lincoln Avenue to Castle Rock	None indicated
The New Pueblo Freeway – I-25 through Pueblo	Medium- and long-haul truck trip data
I-70 Truck Parking Guide	None indicated
I-70 (MP 178.00 to MP 192.00) Safety Assessment Report	Accident data by vehicle type
I-70 West Vail Pass Environmental Assessment	Speed data by vehicle class
I-70B West Study	None indicated
I-70 West Mountain Corridor PEIS	Truck counts, O-D data
I-70 East Corridor Environmental Impact Statement	None indicated
E-470/I-70 Interchange Complex Environmental Assessment	None indicated
Eastern Colorado Mobility Study	O-D information from surveys
Northwest Corridor EIS	None indicated
Ports to Plains Corridor Study	O-D information from surveys

COMPARISON WITH FREIGHT DATA NEEDS IDENTIFIED FROM CDOT FREIGHT DATA ASSESSMENT STUDY

The 2005 CDOT Freight Data Assessment Study identified freight data needs through a survey of transportation planners at both the state and MPO levels. Approximately 30 freight data elements were rated based on the relevance of the element and the quality of

the element in the existing database. A review of this survey indicated that there were five data elements for which there was a substantial difference between the relevance and quality of the freight data element. These five elements are shown below in Table 3. The top three freight data elements are temporal variability, routing information, and origin-destination data. All three of these data elements can be captured through roadside truck origin-destination surveys. Establishment surveys could be used to collect information on all five of these freight data elements, but can provide improved data relative to roadside truck origin-destination surveys for three specific elements: routing information, freight value of time and travel-time delay characteristics. This generally matches with the information from the scan of projects in other regions as the two most valuable data collection activities for a transportation agency to undertake relative to freight data.

Table 3. Rating of Freight Data Elements by Colorado Freight Stakeholders

Freight Data Element	Relevance	Quality	Difference
Temporal Variability	3.7	1.2	2.5
Routing Information	3.7	1.3	2.4
Origin-Destination Data	4.1	1.8	2.3
Freight Value of Time	3.2	1.2	2.0
Travel-Time Data (Delay Characteristics)	4.1	2.1	2.0

The 2005 CDOT Freight Data Assessment Study also recommended an implementation option to move forward with a freight data collection program. Specifically, it recommended that CDOT pursue a five-year, $750,000 freight data collection program that included 76 roadside origin-destination surveys, 200 establishment surveys, two economic analyses and the purchase of the TRANSEARCH commodity flow database. This information is generally supported based on the scan of projects in other regions. As mentioned earlier, roadside origin-destination surveys were found to be valuable in several studies. Additionally, establishment surveys also contain valuable information for conducting freight studies. An additional detail learned from the scan of projects in other regions is that establishment surveys are most useful in understanding local freight flows, while roadside surveys are most useful in understanding long-haul freight flows. This has implications for which agency should conduct the surveys and which agency should maintain the database for the surveys. The scan of studies in other regions also identified truck and rail safety to be important along with economic analysis. This analysis may be added to the two economic analyses recommended in the Freight Data Assessment or the safety analysis could replace one of the economic analyses that is done.

SYNTHESIS OF COLORADO FREIGHT DATA NEEDS

The overwhelming conclusion from the freight data studies, surveys, and interviews is that roadside truck origin-destination surveys would be the best next step for the freight data collection program under development in Colorado. Roadside truck origin-destination survey was found to be utilized in several studies across the country. It is considered to be more accurate and reliable in terms of providing corridor-specific information than TRANSEARCH data. The major hurdle to conducting these surveys is the identification of suitable data collection sites and gaining permission from necessary operators of these sites to conduct the survey. If these hurdles are cleared, then this data collection type will provide cost-effective information on truck activity throughout the State. Typically, the best locations for these types of surveys are weigh stations and select rest areas. Therefore, the types of truck trips intercepted for surveying tend to be intercity truck trips that tend to cross the jurisdiction of multiple MPOs and rural areas. Based on this trip pattern, it is most logical that these surveys are conducted by the state DOT rather than an MPO or other type of regional agency. In addition to the typical questions asked for this survey (e.g., origin, destination, commodity carried, and facility type at origin and destination), the survey also should consider querying truck drivers for information on truck parking deficiencies throughout the State.

The second most important data collection activity to be conducted is establishment surveys. These surveys provide valuable information, but are very difficult to implement successfully. The cost per completed survey is relatively high compared to roadside truck origin-destination surveys. Additionally, it is often difficult to expand establishment surveys to a "universe" of truck trips to enable full use of the data. The most effective use of establishment surveys is the collection of qualitative information on freight infrastructure deficiencies from the perspective of the private sector freight stakeholders. This can be used to develop freight improvement projects and is particularly effective in developing near-term projects that both improve freight flow and garner the support of the freight community towards long-term freight planning coordination. Establishment surveys conducted in Colorado also should incorporate information on temporal variability in truck activity, routing information, freight value of time, and travel-time (delay) characteristics, because these were mentioned as key lacking freight data elements in the CDOT Freight Data Assessment. Based on the typically local nature of the information collected from these types of surveys, it may make sense for MPOs to be the responsible agency for conducting these surveys and managing the data that are collected from these surveys. However, as discussed in Task 1, the private sector freight community often does not understand what an MPO is. Therefore, having establishment surveys cosponsored by the Colorado DOT may improve the response rate for these surveys.

Economic data related to goods movement is growing in importance in the region and around the country. It is often used to justify freight projects. It also is becoming increasingly common to prioritize projects based on some level of economic comparison between projects. It would be beneficial for CDOT to assemble the free public sector information on the relationship between goods movement and the state and local economies. Based on this review of the existing and free sources, a decision can be made

on the extra value gained from purchasing one of the proprietary databases that tend to have more detailed information by geography and industry sector. It is recommended that this analysis be performed by CDOT because much of the benefits of freight accrue across multiple MPO jurisdictions and a CDOT-led analysis will ensure consistency in methodologies for estimating freight-related economic benefits across the State.

Safety data is similar to economic data in that it is becoming increasingly important for project- and system-level analysis. In many instances, the economic benefits of safety improvements are estimated. Therefore, these analyses can be thought of as complementary. It would be beneficial for CDOT to conduct a statewide freight-related analysis to identify the accident rates and number of accidents related to truck and rail, where these accidents tend to occur, what the impacts of the accidents are, and what potential accident reduction projects can be considered. This would involve a comprehensive analysis of the State's safety database along with interviews of regional engineers to corroborate high-accident locations and problematic road segments in the State. Related to the safety analysis, is an analysis of truck parking throughout the State. Inadequate truck parking causes safety issues as overflow trucks tend to park on medians and ramps creating road hazards. It is a recommendation of this study that as part of the interview of district engineers that CDOT also inquire about truck parking deficiencies in the State and follow-up with site studies of problematic locations.

The data collection options available for the high funding option was provided in the CDOT Freight Data Assessment Study and is shown below in Table 4. Based on the five-year budget utilized in the Freight Data Assessment Study, it is recommended that CDOT conduct 76 roadside origin-destination surveys, 200 establishment surveys, one economic analyses and one safety analysis with the specific survey inclusions mentioned earlier in this section.

Table 4. CDOT Freight Data Program – High Funding Option

Year	Scenario 1 76 O-D Surveys, 200 Establishment Surveys, 2 Economic Analyses, Freight Flow Database	Scenario 2 108 O-D surveys, 2 Economic Analyses, Freight Flow Database	Scenario 3 28 O-D surveys, 2 Economic Analyses and Lite Model
1	Freight flow database, 25 –D surveys	Freight flow database, 36 –D surveys	14 O-D surveys
2	Economic significance of freight (local data), 100 establishment surveys	Economic significance of freight (local data)	Economic significance of freight (available data), Economic impact of projects (available)
3	25 O-D surveys	36 O-D surveys	14 O-D surveys

4	Economic impact of projects (local data), 100 establishment surveys	Economic impact of projects (available data)	Develop “lite” statewide truck model
5	26 O-D surveys	36 O-D surveys	

Source: 2005 CDOT Freight Data Assessment Study.

Appendix D – CDOT Scope of Work

Background

Freight and commodity flow has long been a neglected element in transportation planning and has not been accounted for in any explicit way when predicting future freight traffic volumes and activities. Based on national trends, freight movement is forecasted to double in the next 20 years. In order to improve the accuracy of predicted transportation needs in Colorado, CDOT and Colorado Metropolitan Planning Organization (MPO) would like to incorporate freight data into their transportation models. Such practice is new to Colorado and we need to determine the state of the art and the most effective way to do this.

Transearch Data Base provides information on commodity flow and freight data by state and county and has been purchased by CDOT. The North Front Range MPO plans to use it in their long range transportation model along with many other data elements to determine transportation needs in their region. Also, other MPOs have shown interest to incorporate such data in their long range planning studies.

Objectives of Study

This research should provide a synthesis of practice for using freight data in transportation planning. The synthesis should answer the following questions.

- Cargo or commodities (specific or related to what industry)
- Truck weights
- Vehicle type or configuration
- Origins and destinations of freight
- Urban and rural

What is the use of freight data for the following activities?

- Cost projection for roadway improvement based on freight and weight
- Projection of pavement preservation needs
- Focusing enforcement of weight limits
- Truck Rest parking planning
- Homeland security
- Truck only lane planning
- Oil and gas development impact analysis
- Truck growth independent of automobile traffic growth

What have other MPOs and DOTs done relative to freight data that specifically aided in developing long range transportation plans?

What is the value and weaknesses of the Freight Analysis Framework for use in statewide freight planning, Regional/MPO planning or county to county data.

How effectively has freight data been used in completing transportation plans?

What state DOTs or MPOs are leaders in the use of freight data for transportation planning and what are their practices?

What models are available for factoring freight data into transportation planning?

What assistance is available at the Federal level?

What is the recommended approach for CDOT and Colorado's MPOs?

Expected Benefits of Study

This synthesis will determine the most cost-effective approach in Colorado to incorporate freight flow into the transportation planning process and other activities. Implementing the approach will insure increased accuracy in transportation planning without excessive cost.

Research Approach

[Describe your approach, task by task, to meeting the objective of the study.]

Deliverables

- Progress reports submitted at the end of each calendar quarter that document progress in terms of percent complete of each task
- A draft final report documenting work, results of synthesis, and recommendations
- A final report in the attached format addressing comments of study panel