Identifying Potential Freeway Segments for Dedicated Truck Lanes

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This is dedicated to my loving family. To my sister (Charity) and my brother-in-law (Dave), for their unfailing support and encouragement. To my beloved Susan, for her support and patience. And finally, this is dedicated to my mother (Deborah), who I have dearly missed over the last year and a half since starting this program.

Table of Contents

List of Figures

List of Tables

Executive Summary

Many state DOTs and MPOs, in conjunction with the USDOT, and the overall transportation community are tasked with finding solutions that can help reduce the number of fatal crashes and incidents on the interstate freeway systems and, at the same time, employ congestion management techniques that help reduce delay and improve travel on those same freeway systems.

With an ever-growing number of non-commercial vehicles on freeway systems across the country, DOTs have shifted to employing several congestion management measures and lane management strategies for automobiles. However, any measures to reduce the impact of commercial vehicles have not been explored as deeply. One such measure is the implementation of dedicated truck lanes on the interstate freeway system. In the last decade, other efforts to bring truck-only lanes have been investigated, but lane management strategies on commercial vehicles have not been implemented as much as automobiles.

This study aims to answer two main questions: 1) what conditions warrant the implementation of dedicated truck lanes? And 2) are there any candidate facilities located in the Bay Area? These research questions would help the difficult task establishing a criterion for evaluating existing facilities and providing a basis for selecting roadway segments for dedicated truck lanes implementation.

Of the six jurisdictions analyzed, California and Georgia were observed to have the highest level of usage (in terms of AADT and Truck AADT) for both the SR-60 (California) and the I-20 (Georgia) facilities. Additionally, for both of these facilities, the analysis showed contrasting measures when incident data for both jurisdictions were evaluated. The percentage of truck-related/truck-involved incidents for I-20 in Georgia was almost twice the amount observed in California (25 percent to 13 percent). However, AADT for California was approximately 1 million more than Georgia. These observations suggest that the I-20 facility in Georgia may benefit from dedicated truck lanes, at a greater degree than the SR-60 in California.

Background

In the 1960s, marked growth in the suburbanization of urban populations and growth in passenger vehicle usage propelled a dramatic increase in traffic congestion on freeway facilities. The interstate highway system, built in the 1940s and 1950s, were meant to serve the movement of goods and raw materials vital to the national economy. Sprawling communities, in addition to the expansion of freight operations carried out by trucks promulgated the need for more freeway facilities. The growth of new freeway facilities throughout the country in the last four decades, a direct response to the demand created by a vast increase in the number of passenger vehicles (cars) and commercial vehicles (trucks), led to the commute patterns that define each metropolitan area in the United States today.

With significant increases in the number of vehicle types (cars, trucks, and motorcycles) on the freeway system, the number of accidents and fatalities involving these vehicles also increased. On average, fatal crashes involving passenger vehicles were estimated at 39,482 annually since 1975. For fatal crashes involving commercial vehicles, trucks were involved in approximately 5,566 crashes annually since 1975.

Improvements in safety technology for passenger vehicles, such as better braking mechanisms, airbags, seatbelts, etc., have contributed to a reduction in the number of fatal crashes over the past few decades. However, commercial vehicle technology has seldom improved over the years. Data collected and studies on fatal crashes involving commercial vehicles suggest that the decrease in the number of fatal crashes is mostly due to a reduction in the number of trucks on the road during an economic decline or recession.[1]

While it is true that in comparison, the number of fatal incidents involving commercial vehicles is dwarfed by the number of fatal incidents among passenger vehicles, the impact of these commercial vehicle accidents affect the community at an economic, social, and at a much more

[1] Ralph Craft, 2010 Large Truck and Bus Crash Data: An Overview, Federal Motor Carrier Safety Administration – Office of Analysis, Research and Technology, June 2012. "http://www.fmcsa.dot.gov/facts-research/media/webinar-6-21-12-slides.pdf" Accessed February 15, 2013.

cultural level. Trucks, since its boom in the 1960s have incurred very negative social stigmas of being unsafe due to their large mass, unreasonable blind spots, and poor reaction times.

An example of the cultural hostility that was a byproduct of the poor public perception of trucks was Senate Bill No. 1491 (S-1491) in New Jersey. In 2001, S-1491 made permanent a temporary ban ordered by the New Jersey Department of Transportation (NJDOT) on heavy truck traffic on certain portions of State Route 29 (SR-29). Specifically, the bill prohibited truck and truck-trailer combinations that exceeded 26,000 pounds in gross registered vehicle weight, gross vehicle weight rating, or gross combination weight rating from using both northbound and southbound travel lanes on SR-29, from its intersection with Interstate 95 (I-95) to the northern terminus at State Route 12 (SR-12), a length of approximately 26 miles.

This form of vehicle restriction is not uncommon in the United States. Vehicle separation has been a typical response to the issues brought on by the natural conflicts between passenger vehicles and commercial vehicles. The earliest example of separating trucks from passenger cars dates back to the 1960s when the New Jersey Turnpike Authority (NJTA) and the NJDOT had imposed lane restrictions that did not allow trucks in the left lane of turnpike roadways that had three or more lanes for each direction. Other states across the country, facing similar problems of managing conflicts between trucks and passenger vehicles also employ this minor form of separation. In California, Oregon, and Illinois, trucks are restricted to the right-most travel lane to avoid further conflicts with other vehicles on congested roadways.

Even with the implementation of minor truck restrictions, congestion and safety on freeway systems remain a significant concern for the transportation industry today, as it has been for the past five decades. However, since 2009, the number of fatal collisions involving large trucks on the national highway system increased by 9 percent, according to the National Highway Traffic Safety Administration (NHTSA). In 2010, 80,000 people were injured in crashes involving large trucks – an increase of 8 percent from 74,000 in 2009.

Many state Departments of Transportation (DOTs) and Metropolitan Planning Organizations (MPOs), in conjunction with the United States Department of Transportation (USDOT), and the overall transportation community are tasked with finding solutions that can help reduce the number of fatal crashes and incidents on the interstate freeway systems and, at the same time, employ congestion management techniques that help reduce delay and improve travel on those same freeway systems.

This study aims to answer two main questions: 1) what conditions warrant the implementation of dedicated truck lanes? And 2) are there any candidate facilities located in the Bay Area? These research questions would help the difficult task establishing a criterion for evaluating existing facilities and providing a basis for selecting roadway segments for dedicated truck lanes implementation.

Introduction

With an ever-growing number of non-commercial vehicles on freeway systems across the country, DOTs such as the California Department of Transportation (Caltrans) have shifted to employing several congestion management measures and lane management strategies i.e., high-occupancy vehicle lanes (HOV), high-occupancy toll lanes (HOT), congestion-based toll pricing, and other restrictions on automobiles. However, any measures to reduce the impact of commercial vehicles have not been explored as deeply. One such measure is the implementation of dedicated truck lanes on the interstate freeway system. In the last decade, other efforts to bring truck-only lanes have been investigated, but lane management strategies on commercial vehicles have not been implemented in California to as great a degree as automobiles.

Over the past decade, the concept of adding dedicated truck lanes on existing freeways has been slowly emerging as a viable tool for transportation organizations and governing bodies. Recent initiatives to include dedicated truck lanes in long-range planning activities of DOTs have become important considerations in the task of decreasing the potential conflicts between cars and trucks on the existing freeway system. Across the country, several states have evaluated the feasibility of dedicated truck lanes. Some states, such as Oregon and California, have either a variation of dedicated truck lanes in operation (e.g., truck bypass lanes or truck climbing lanes) or employ measures such as imposing lane restrictions that prohibit heavy vehicles from traveling on certain lanes.

For the most part, studies on exclusive truck lane facilities have focused on separated facilities without considering changes on gross weight limits, axle load limits or truck sizes. The main purpose for these studies is to completely separate trucks from passenger vehicles and refrain from considering longer combination vehicles (LCVs) since these truck-types are not as prevalent as single-unit trucks. Studies on the concept of adding an exclusive truck facility also assumed that and upgrades (pavement strengthening, etc.) would only be required for the truck lane, and not in the entire facility. Focusing improvements on the new truck lanes would significantly reduce the potentially considerable investment costs, and would enable the proposed truck-only facility to accrue benefits, such as fewer conflicts with cars, while enhancing the economic and financial feasibility of the proposed system.

Of particular interest of this research is the applicability of dedicated truck lanes on California freeways. Trucks have been the predominant mode of freight transportation in California for the last few decades. According to Caltrans, trucks serve virtually all markets, from long-distance interstate commerce to the "last mile" of intermodal goods movement. Trucking is the essential mode for intrastate, regional, and local goods distribution, including manufactured goods, resource extraction (e.g., logs, sand and gravel), food and farm-to-market products, containers, machinery and industrial supplies, petroleum products, air cargo ground transportation, and other goods.

Congestion on the California freeway system affects trucks to a similar degree as automobiles, however, since the entire state depends heavily on commercial vehicles for goods movement, measures that improve travel on the California freeways must also include truck travel impacts. In addition, of the top 250 major freight chokepoints and bottlenecks in the nation, as identified by the Federal Highway Administration (FHWA) and American Trucking Research Institute (ATRI) in 2011, 15 were in California – 6 in Los Angeles, 3 in Sacramento, 2 in Oakland, and 1 each in San Bernardino, Corona, San Rafael, and San Diego.

As freeway systems continue to crowd and travel times increase, safety and free flow or even just less congested travel conditions may not be as easy to achieve without considering other approaches to managing commercial vehicle travel. Current congestion management strategies do not incorporate more aggressive truck traffic management, despite the fact that the California freeway systems are crucial to the west coast in terms of goods movement.

Research Focus

This study will analyze the implications of establishing dedicated truck lanes on existing freeway facilities. In order to meet this task, a baseline condition would need to be established through a quantitative evaluation of roadway conditions where dedicated truck lane projects have been considered in the United States. Comparison of common metrics such as daily traffic volumes, truck traffic volumes, accident data, length of proposed facility, and existing congestion, the research study would gain important information about the justification for implementing dedicated truck lanes or truck restriction projects. The theoretical justification for dedicated truck lanes and essential "roadmap/blueprint" gained from analysis of existing conditions would then be applied to a case study which identifies segments of the Bay Area freeway system that would benefit from the implementation of dedicated truck lane projects.

The purpose of this study is to contribute to the existing knowledge base by providing guidance on important considerations required for implementing dedicated truck lanes on existing freeway systems. The overall research goals of this study, as outlined below, seeks to analyze existing applications of dedicated truck lanes and provide an analytical method for identifying potential existing conditions and potential benefits in implementing dedicated truck lane projects.

Research Question # 1:

What conditions would warrant the implementation of dedicated truck lanes?

While theoretical applications of dedicated truck lanes have been studied in the past few decades, the actual implementation of dedicated truck lane facilities are a relatively new concept. Neither the USDOT nor the state DOTs that are seeking to address congestion and safety issues between passenger vehicles and trucks do not have a specific set of conditions that would provide justification for implementing dedicated truck lanes. This research aims to provide an analysis of existing conditions at selected jurisdictions that established the need for dedicated truck lanes.

Question 1a:

Does the addition of dedicated truck lanes on a particular freeway segment improve safety (incidents and fatalities)?

This study aims to analyze available data on existing applications of dedicated truck lanes and estimate whether there are marked reductions in incidents.

Question 1b:

What possible operational benefits are gained by separating trucks from other passenger vehicles?

This study would analyze available data on travel time savings a due to any restrictions imposed on trucks. While there are very few dedicated truck lanes in the United States, restrictions on truck traffic, such as SR-29 in New Jersey, would provide an insight on the operational benefits gained by separating vehicle types on the existing freeway system.

In addition, this study aims to apply the theoretical findings to a case study focused on the Bay Area freeway system as candidate for the implementation of dedicated truck lanes. While larger goods movement hubs exist in the Central Valley and Southern California, the Bay Area is home to five seaports, including the Port of Oakland, which is the fourth busiest container port in the country and plays an important role in supporting the state's agricultural sector. There are also three commercial airports and rail facilities serving the two major freight railroads operating in the western United States and smaller short haul rail services. Truck-only lanes have not been approached in the Bay Area and congestion remains a problem despite automobile restrictions implemented in the last five years, thus making truck-only lanes a possible measure for improving travel and goods movement activities. A secondary research question focused on the Bay Area case study would need to be analyzed as follows with the goal to provide information about how Caltrans can make the best decision to create truck-only lanes on the California freeway system.

Research Question # 2:

Can dedicated truck lanes be implemented on the existing Bay Area freeway system?

Dedicated truck lanes can potentially be applied to any jurisdiction seeking alternatives to congestion management. The research aims to identify segments in the Bay Area freeway system that would be able to accommodate a new truck-only facility.

Question 2a:

Which Bay Area freeways warrant the implementation of dedicated truck lanes?

The research study would need to analyze relevant existing characteristics that are unique to the Bay Area in order to assess where dedicated truck lanes could be deployed.

Question 2b:

What performance measures does Caltrans need to establish prior to managing the new facilities?

This study aims to provide a specific set of performance measures in assessing the success or failure of a dedicated truck lane project. The research would analyze existing performance measures established for the truck climbing lane on Interstate 15 (I-15) in San Bernardino County. Since, there are no existing applications of truck-only lanes in California new facilities or modifications to existing freeways need to account for the changes in travel conditions and thus refine the methods of analyzing performance.

Literature Review

Over the past fifteen years, various studies have been conducted by State DOTs, the USDOT, as well as academic institutions, on dedicated truck lanes. While the implementation of dedicated truck lanes on existing urban facilities have not been common in the United States, the concept of separating trucks from other vehicles has been an emerging topic of interest for DOTs and regional transportation agencies, as a potential tool in alleviating congestion on urban freeway systems. Also, the growing number of fatal collisions between passenger vehicles and large commercial vehicles has compelled DOTs and regional agencies to analyze the separation of these vehicle types.

The following sections discuss previously completed studies and relevant academic literature on applications of separating trucks from passenger vehicles on urban freeway systems in the United States. Relevant studies on truck-only lanes as it applied to financing, safety, and the environment are also discussed. Ad

ditionally, a more specific focus on the implementation of dedicated truck lanes in California is also analyzed. Finally, a discussion of the key implications for the remainder of the research study, based on the literature review conducted, is also described in this section.

<u>Existing Applications of Dedicated Truck Lanes</u>

In the United States, the most common application of the dedicated truck lane concept exist today "through lane restrictions, whereby trucks are restricted from using certain lanes through urban areas or during certain congested times of the day" (Federal Highway Administration [FHWA], 2011).

A number of states, including California, have implemented truck lane restrictions in an attempt to improve safety and mobility on freeways. These restrictions typically prohibit trucks from traveling in the median lane, potentially increasing passing opportunities and reducing negative interactions between slow-moving trucks and other vehicles. However, these lane restrictions generally restrict trucks to the other, slower, mixed use lanes, rather than assigning lanes exclusively for truck use.

Dedicated truck lanes have not been implemented to a greater degree than lane restrictions in the United States. However, there have been a few states that have implemented the concept in order to improve roadway operations and alleviate congestion. One of the most successful applications of dedicated truck lanes is located in New Jersey. The New Jersey Turnpike is a limited access facility that has successfully improved operations by separating types of vehicle traffic. A 32-mile segment of the roadway has been expanded into two separate roadways, resulting in a dual-dual facility. Large trucks are limited to the outer roadway but passenger vehicles may travel on either the inner or the outer roadway. Each of these facilities provides very limited access and the available access is through independent ramps for the inner and outer roadways. Using gates, operators can limit access to a particular roadway as needed to manage demand or in the event of an incident. The result is a roadway that operates efficiently because turbulence in the traffic flow is minimized. (FHWA, 2008)

Within the last decade, only a handful of other dedicated truck lane facilities have been constructed in the United States. These facilities include the previously mentioned New Jersey Turnpike, but also the Clarence Henry Truckway (New Orleans), South Boston Bypass Road, and the Los Angeles I-5 truck bypass lanes. These facilities typically restrict use to commercial vehicles only – including taxis, jitneys, limos, and automobiles with commercial plates. The results of implementing dedicated truck lanes also typically ranged from reduced demand on saturated freeway facilities and free flow truck traffic operations on the facilities.

In more recent years, according to Abdelgawad et al, “several studies have been recently carried out to investigate potential development of [other] exclusive truck facilities, including studies in Atlanta, the I-81 in Virginia, SR-60 and I-710 in Los Angeles, Florida, and Texas” (American Society of Civil Engineers [ASCE], 2011).

A comprehensive 2005 study conducted by the Georgia State Road and Tollway Authority (SRTA) on the feasibility of dedicated truck lanes for the Atlanta region found that truck lanes (1) reduced vehicle hours traveled with a negligible change in vehicle miles traveled; trucks traveling through the Atlanta region can save a significant amount of time by using truck lane facilities; (3) congestion in non-truck lanes is significantly improved; and (4) respectable amounts of revenue can be generated to cover operating and maintenance costs through a tolling option.

The SRTA study also identified several challenges related to implementing truck lanes in the Atlanta region. Including, the financial structure attached to the truck lane strategy. The study surveyed representatives from the trucking industry and recommended that the truck lanes remain voluntary and commercial vehicles would not be required to use the lanes, especially if tolls are imposed on such facilities. The level of fees facing commercial vehicle users would clearly be a critical factor in their overall success. However, the surveyed industry representatives also recognized the growing problem of freight mobility in the Atlanta region therefore, the trucking industry can be flexible on a toll strategy to finance dedicated truck lanes.

The second challenge is associated with the actual placement of truck lanes. The SRTA study identified that truck lanes can be constructed in the I-75, I-85N, and the I-285 northern and western sections. SRTA conducted research on other feasibility studies of additional truck only lanes in these corridors and concluded that the concept is possible. However, this study did not conduct a more detailed engineering analysis of whether this assumption is indeed reasonable.

The SRTA study concluded that the Atlanta region is in a particularly critical stage now as it begins to implement a region-wide managed lane network. Thus, there is urgency behind any potential change to the region's concept of managed lanes. This urgency represents a challenge to the inclusion of truck facilities as a part of the overall managed lanes strategy for the region. Also, the linkages between HOV, HOT and truck-only lanes, as they relate to constructability, needs to be better understood. Thus, these are important considerations for further development of a managed lane strategy in the Atlanta region.

Financial Perspective

Like many public infrastructure projects, one of the most common barriers to implementation is the issue of funding for capital construction and operations. According to De Palma, Kilani, and Lindsey, "dedicated truck lanes tend to cost more per mile than do car lanes, but by concentrating heavy vehicles on part of the road infrastructure they allow the remainder to be built and maintained more cheaply (Journal of Urban Economics, 2008). Financing dedicated truck lanes remain one of the most significant challenges faced by state and regional transportation authorities. However, freeway management strategies often focus on the cost to build and operate the facility, thus other financing strategies have also been explored in recent years.

Tolls have been analyzed as an appropriate instrument to finance and operate dedicated truck lanes and also charge for the differential damage to roads caused by different classes of vehicles, which cannot be recovered through fuel taxes. Tolls on trucks, like those introduced in Switzerland or in Germany, have been considered for implementation of truck lanes in the US. Such tolls may also provide an effective incentive for greater efficiency in the transport industry and for improving the quality of vehicles.

Truck-only Toll Lanes (TOT) recently became a crucial part of the discussion in implementing dedicated truck lanes. Although building TOT lanes would require higher construction costs than adding mixed travel lanes, TOT lanes could generate revenues to cover operating and maintenance costs, and some portion of capital costs to create self-financing potential. However, significant challenges remain as the implementation and enforcement of dedicated truck lanes may lead to much resistance by the trucking industry.

Relevant research by Zhou, et al, on dedicated truck lanes concluded that, through both one-on-one interviews and survey, there were significant differences in the attitude toward toll roads by different segments of the trucking industry. Smaller companies (owner–operators) clearly preferred the non-toll route, citing the fact that the toll came directly out of their pocket and it was difficult for them to pass on the cost to their customers. Larger companies were more likely to carefully weigh the benefits and costs of using the toll route when making their decision, rather than avoiding toll roads in general. However, respondents from the trucking industry showed much interest in off-peak discounts followed by a free trip after a number of paid trips. (Transportation Research Board, 2009)

Safety Perspective

Since 1975, the National Highway Traffic Safety Administration (NHTSA) has collected data on fatal crashes involving motor vehicles on public travel ways. The NHTSA's Fatality Analysis Reporting System (FARS) is recognized as the most reliable national crash database, but it contains information only on fatal crashes. Nonfatal crash statistics are available from 1990 through 2010. According to the NHTSA, fatal crash statistics generally are available from 1975, the first year of FARS data, through 2010. In some cases, such as for roadway function class or alcohol involvement, data are available only from 1981 or 1982 through 2010.

A large truck is defined in the FARS as a truck with a gross vehicle weight rating (GVWR) of more than 10,000 pounds. The NHTSA characterized trucks as a major contributor to the occurrence and consequences of traffic crashes due to their size, weight, and the amount of travel commercial vehicles accumulates compared to passenger vehicles (NHTSA, 1998).

NHTSA studies and data regarding fatal crashes between 1975 and 1995 showed that large trucks accounted for about 3 percent of motor vehicles involved in police-reported crashes of all severities, about 8 percent of vehicles in total fatal crashes, and are associated with about 12 percent of the annual total traffic fatality count. Large trucks are also estimated to account for about 7 percent of the total number of vehicle miles traveled each year within the same period (NHTSA, 1998).

In 2010, the Federal Motor Carrier Safety Administration (FMCSA) reported that there were:

- 3,261 large truck fatal crashes
- 3,484 large trucks in fatal crashes
- 3,675 people killed in large truck fatal crashes

In motor vehicle crashes, large trucks represented:

- 8 percent of vehicles in fatal crashes
- 2 percent of vehicles in injury crashes
- 3 percent of vehicles in property-damage-only crashes.

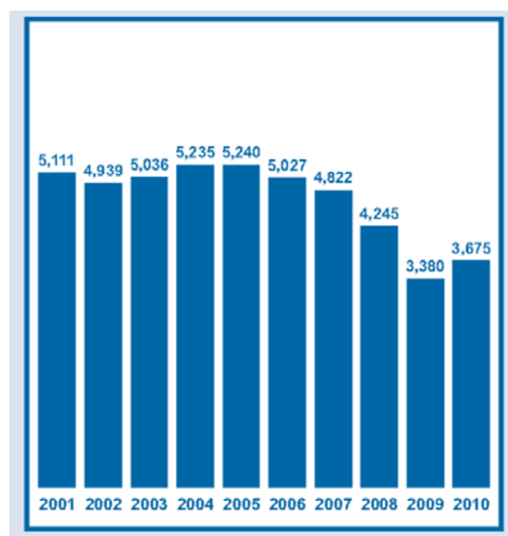

FIGURE 1 - Fatalities in Crashes Involving Large Trucks (2001-2010)

Another 80,000 people were injured in crashes involving large trucks; 14 percent of those killed, and 25 percent of those injured, were occupants of large trucks (FMCSA, 2012). Additionally, large trucks accounted for 10 percent of all vehicle miles traveled and 4 percent of all registered vehicles in the United States.

Early analysis of FMCSA crash data revealed that from 2007-2010, the number of large trucks involved in fatal crashes declined by 25 percent. Figure 1 shows data on fatal crashes involving large trucks from 2001 through 2010. During the same period, the number of passenger vehicles involved in fatal crashes also declined by 21 percent. From 2000-2010, the number of large trucks involved in fatal crashes decreased from 4,995 to 3,484, a decrease of approximately 30 percent. The number of large trucks involved in injury crashes decreased from 101,000 to 58,000, a decrease of approximately 42 percent. The number of large trucks involved in property damage only crashes decreased from 351,000 to 214,000, a decrease of approximately 39 percent.

While the number of significant crashes (fatal, injury, property damage) involving trucks declined between 2007 through 2010, studies conducted by the USDOT estimated that the costs associated with these incidents and fatalities remain significantly high at over $57 Billion per year for the same time period (See Table 1). In comparison, costs involving passenger vehicles was estimated at $334 billion, according to the Bureau of Transportation Statistics. This presents a significant disparity in the costs associated with commercial vehicles accidents and costs of passenger vehicle accidents since trucks represent approximately 2-4 percent of all vehicles on the existing freeway systems.

Table 1: Estimated Costs of Commercial Motor Vehicle (CMV) Crashes (2008 Dollars)

Year	Fatal Crashes	Injury Crashes	Property Damage Only Crashes	Total: All CMV Crashes
2009	$ 23 Billion	$ 20 Billion	$ 5 Billion	$ 48 Billion
2008	$ 29 Billion	$ 25 Billion	$ 6 Billion	$ 60 Billion
2007	$ 32 Billion	$ 27 Billion	$ 6 Billion	$ 65 Billion

Source: USDOT, 2011

Environmental Perspective

In 2010, studies by the Environmental Protection Agency (EPA) estimated that the largest sources of transportation greenhouse gases were passenger cars (43 percent), freight trucks (22 percent), light duty trucks, which include sport utility vehicles, pickup trucks, and minivans (19 percent), and commercial aircraft (6 percent). These figures included direct emissions from fossil fuel combustion, as well as Hydroflourocarbon (HFC) emissions from mobile air conditioners and refrigerated transport vehicles.

Since 2005, estimated data for passenger vehicles and light trucks showed that average fuel economy increased, partly due to the retirement of older vehicles and increasing fuel prices. However, fuel economy for commercial vehicles did not increase during the same period. Additionally, Vehicle Miles Traveled (VMT) for both passenger and commercial vehicles increased between 1990 and 2005 which also contributed to the level of Carbon Dioxide (CO2) emissions from both vehicle types. While passenger vehicles remain a dominant source of pollution, commercial vehicles still account for a significant portion of total greenhouse gases, despite passenger vehicles outnumbering commercial vehicles 4 to 1.

Previous studies on dedicated truck lanes have shown that its implementation on congested roadways can be very helpful in reducing VMT. According to a study by Chu and Meyer, mandatory TOT lane use strategies reduced VMT on the mixed travel lanes by an estimated 8 percent, while a voluntary TOT lane use strategy resulted in a 6 percent reduction. Both TOT lane strategies generated less air pollution for the traffic on the mixed travel lanes (Energy Policy, 2009). It is not a surprise that given the implementation of TOT lanes, the mandatory TOT lane use option reduced CO2 emissions on the mixed travel lanes by approximately 60 percent, whereas the voluntary TOT lane use option reduced CO2 by 48 percent when compared to a freeway without TOT options.

Moreover, according to the EPA, these reductions in VMT and CO2 emissions may not be a significant contribution on the global scale of climate change. However, metropolitan areas and states that are interested in finding ways of reducing CO2 emissions, strategies that provide a more reliable and faster trip for heavy vehicles, through dedicated truck lanes could be one of the more significant actions that could be taken.

California Goods Movement

California is a major gateway for products entering and leaving the United States and is home to eleven publicly-owned ports, in which three ports are known as "megaports." Two port locations, the Ports of Los Angeles and Long Beach, make up the largest port complex in the United States and are important hubs for global export and import activities that are crucial to the economy of the United States. These two Southern California ports process approximately 25 percent of all container cargo traffic in the United States (Caltrans-Freight Planning, 2011). One port in Northern California, the Port of Oakland, is the fourth largest port in the nation and manages trade from Pacific Rim countries, delivering 99 percent of the goods from ocean containers passing through Northern California to the rest of the United States (Caltrans-Freight Planning, 2011). The remaining eight port facilities are considered "niche" ports (Hueneme, Humboldt Bay, Redwood City, Richmond, West Sacramento, San Diego, San Francisco, Stockton, and Benicia); these ports manage exported and imported goods at a much lesser rate and volume compared to the megaports.

From the most active seaports in the state, the trucking community facilitates the movement of goods. Trucking serves every community in California and an estimated 78 percent of all California communities depend exclusively on trucks to move their goods (American Transportation Research Institute (ATRI), 2012). According to the California Department of Motor Vehicles (DMV), there were 5,645,836 registered commercial trucks and 2,380,417 commercial trailers in 2011. Studies by Caltrans' Freight Planning Unit, estimated that in 2010, trucks transported 88 percent of the total manufactured tonnage in the state or about 3,822,566 tons per day (Caltrans, 2011). Also, trucking's use of California public roads was about 24.8 billion miles in 2008. Similarly, with active seaports in each region, the largest numbers of truck vehicle miles are located in Southern California, the Central Valley, the Bay Area, and the Border Region.

Dedicated Truck Lanes in California

With significant transport activities conducted by trucks, it is surprising that the implementation of dedicated truck lanes on congested freeway systems has taken a similar path as other states. Similar to other goods movement hubs across the United States, only a few dedicated truck lane projects have been constructed. Many corridors and freeway segments in California, such as Northern California and the Bay Area, have not been studied. With the most active goods movement centers located in Los Angeles, San Diego, and other parts of southern California, Caltrans has focused the majority of dedicated truck lane projects in those areas of the state. As of 2012, only a few dedicated truck lane projects have been given serious considered and constructed (Caltrans, 2012). The following truck-only facilities are currently in construction or are in design/study phase under the jurisdiction of Caltrans:

1. **SR-14 to Pico Canyon Road/Lyons Avenue.** As shown on Figure 2, the project proposes to add northbound and southbound truck lanes on I-5 in Los Angeles County at the State Route 14 (SR-14) split. The total length of this dedicated truck lanes are approximately 3.7 miles in both northbound and southbound directions. The project will add a truck lane to the outside of southbound I-5 by paving the median area and outside shoulder, and shifting the mixed-flow lanes inward. Median retaining walls and two short sections of outside retaining walls will be built to accommodate this widening. Construction began in May 2012 and will be completed in 2014.

FIGURE 2 - SR-14 to Pico Canyon Road/Lyons Avenue

2. Southbound I-5 in Kern County at the State Route 99 (SR-99) junction near the Grapevine. This dedicated truck lane begins on SR-99 at Kern County postmile L000.629 (I-5 postmile R015.838) and ends on I-5 at postmile R015.492. The total length for the facility is 0.346 miles. The purpose of this project is to place truck merges further downstream of the automobile traffic merge on I-5 & SR-99. Currently, this project is in the preliminary design phase.

In addition to the abovementioned truck lane facilities, Caltrans has also supported other studies on dedicated truck lanes on California freeway system including facilities on SR-60 in Southern California.

The Southern California Association of Governments (SCAG) conducted the most ambitious study of implementing dedicated truck lanes in California. In a study released in February 2001, the SCAG feasibility study report (FSR) analyzed the implementation of dedicated truck lanes on State Route 60, from I-710 to I-15; a distance of approximately 38 miles. The study analyzed SR-60 for several characteristics including the number of lanes on existing grade, cross-sections, adjacent land use, clearances for both over- and undercrossings, and available right-of-way.

The study considered three main strategies:

(1) Allowing trucks to share the HOV lanes at limited time periods

(2) Adding truck lanes to the freeway at grade

(3) Adding lanes above the freeway grade.

The FSR recommended combining the two non-HOV strategies (Strategy 2 & 3), with at-grade truck lanes built where feasible, and above-grade mixed-flow lanes built where right-of-way acquisition would be difficult. Above-grade lane sections should be kept to a minimum due to safety and operational considerations, as well as higher construction costs. Also, trucks would always operate at grade for safety. These strategies, as SCAG concluded, called for massive financial resources (estimated at $4.3 Billion USD) to build, thus requiring a more in-depth study of other potential freeway segments that would be eligible for the application of dedicated truck lanes.

The FSR also provided a metric outlining the conditions for which dedicated truck lanes were feasible for a congested freeway facility. Dedicated truck lanes were deemed plausible should these three factors exist: (1) truck volumes exceed 30 percent of the vehicle mix, (2) peak hour volumes exceed 1,800 vehicles per lane-hour, and (3) off-peak volumes exceed 1,200 vehicles per lane-hour.

Summary

While there are various research previously completed on the concept of dedicated truck lanes on congested freeway systems, there are many key areas that still require further research. Particularly, relevant literature on the topic of dedicated truck lanes did not appear to provide a clear association between the most effective funding scenarios. While most studies assumed that funding for truck lane projects were automatically added to the financial commitments of DOTs, other studies identified more unpopular funding sources such as taxes and imposed fees on users, such as tolls. Additionally, the concept of tolling as a way to alleviate the financial burden of initial capital costs, maintenance, and operations is not clear between each research study reviewed.

Most previous studies on the topic of dedicated truck lanes concluded that there were potential benefits in terms of congestion and safety due to the implementation of dedicated truck lanes on congested urban freeways. However, just like the decision to add HOV or HOT lanes on existing freeway segments, adding dedicated truck lanes would require a specific set of conditions, such as available ROW on existing travel ways, a consideration of existing operations, truck volumes, and other relevant travel conditions.

Research Design

A combination of data analysis (quantitative) and a qualitative assessment of available information would be employed to answer the research questions and relative sub-questions previously discussed. The following section provides an overview of the research design proposed for this research study.

<u>Research Questions (RQ) Part 1:</u>

RQ # 1: What existing conditions would warrant the implementation of dedicated truck lanes?

RQ # 1a: Does the addition of dedicated truck lanes on a particular freeway segment improve safety (incidents and fatalities)?

RQ # 1b: What possible operational benefits are gained by separating trucks from other passenger vehicles?

In order to answer the primary Research Question (RQ # 1) an analysis of existing conditions must be conducted in order to establish the need for dedicated truck lane projects.

Information from existing studies conducted by various DOTs and MPOs on dedicated truck lanes and/or lane restriction for trucks would need to be reviewed. As discussed in the literature review, analyzing these studies, and the independent collection of available data on specific traffic metrics in each jurisdiction, would help the research establish a baseline of existing conditions that can identify corridors that would benefit from the implementation of dedicated truck lane projects. Recent studies by state DOTs on dedicated truck lanes and lane restriction for trucks on specific corridors would be analyzed and a separate data collection would be conducted to establish existing conditions measured through the following metrics:

1) <u>Roadway Information:</u>

   - Annual Average Daily Traffic (AADT) [all vehicles] **–RQ # 1–**

     (Data Sources: FHWA – Office of Highway Policy Information; State DOTs and US DOT)

   - Truck traffic volumes and percentages (Truck AADT) **–RQ # 1, 1a–**

     (Data Sources: FHWA – Office of Highway Policy Information; State DOTs and US DOT)

2) <u>Geographic Considerations:</u>

- o Length of corridor segments studied for dedicated truck lanes (in miles) **–RQ # 1–**

  (Data Sources: Feasibility Studies and other DOT reports)

- o Significance in the goods movement network **–RQ # 1–**

  (Data Sources: FHWA – Freight Management and Operations; US Census Bureau – Commodity Flow Survey Data)

3) <u>Safety:</u>

- o Existing crash data and other incident data involving trucks and passenger vehicles **–RQ#1, 1a, 1b–**

  (Data Sources: National Highway Traffic Safety Administration [NHTSA]; Federal Motor Carrier Safety Administration [FMCSA])

4) <u>Existing Facility Usage:</u>

- o Vehicle Miles Traveled **–RQ#1, 1a, 1b–**

  (Data Sources: State DOTs, FHWA – HPMS)

Furthermore, to answer research sub-questions (RQ # 1a and 1b); a different approach to the analysis of available information would need to be considered. Only a few applications of dedicated truck lanes exist in the United States today, therefore, available data may not be as abundant. However, there have been a number of projects that have sought to restrict the impact of trucks on other vehicles on the roadway.

Analysis of available incident data from several truck restriction cases such as New Jersey Senate Bill No. 1491 on SR-29, SCAG estimates from the dedicated truck lanes study on SR-60 in California, existing data from the truck climbing lanes project on I-15 in California, and others. These studies and cases would be examined to document (if any) changes from existing conditions have taken effect in the years after implementation of a dedicated truck lane or truck restriction project.

This study would analyze project-related impacts and provide a comparison with existing conditions, as follows, based upon available data from existing projects and other studies.

1) Safety Data (with Project):

    - Crash data and other incident data on corridors where dedicated truck lanes or truck restrictions were implemented **–RQ # 1a–**

      (Data Sources: NHTSA - Trucks Involved in Fatal Accidents [TIFA]; NJDOT)

2) Operations (with Project):

    - Level of Service (LOS) and peak period delay for segments where dedicated truck lanes or truck restriction projects were implemented. **–RQ # 1b–**

      (Data Sources: State DOTs – Traffic Data Branch)

    - Travel time and average speed information for segments where dedicated truck lanes or truck restriction projects were implemented. **–RQ # 1b–**

      (Data Sources: State DOTs – Traffic Data Branch)

Research Questions (RQ) Part 2:

RQ # 2: Can dedicated truck lanes be implemented on the existing Bay Area freeway system?

RQ # 2a: Which segments of the Bay Area freeways can benefit from dedicated truck lanes?

RQ # 2b: What performance measures does Caltrans need to establish prior to managing the new facilities?

Based on the initial findings from the literature review, dedicated truck lanes can be applied to any jurisdiction seeking to bolster congestion management strategies. However, a specific consideration of local conditions must be analyzed prior to the selection of a potential corridor. This research would need to analyze segments of the Bay Area freeway system that reflect existing conditions evaluated under RQ # 1 and determine whether the existing freeway system would be able to accommodate a new dedicated truck lane facility.

Once conditions specific to the case study have been evaluated, expected findings would be similar to other dedicated truck lane proposals/studies conducted over the past decade;

specifically, like other states such as Oregon, Illinois, and Texas, dedicated truck lanes would lead to a reduction in congestion and truck/car incidents, as well as an improvement in the traffic operations and safety. In addition, the Bay Area case study would need to be analyzed with the goal of providing information for Caltrans management to make the best decision to deploy dedicated truck lanes on the California freeway system.

1) Roadway Information:

   - Annual Average Daily Traffic (AADT) [all vehicles] **–RQ # 2–**

     (Data Sources: Caltrans – Traffic Data Branch; Caltrans – Traffic Operations)

   - Truck traffic volumes and percentages (Truck AADT) **–RQ # 2, 2a–**

     (Data Sources: Caltrans – Office of Truck Services; Caltrans – Traffic Data Branch)

2) Geographic Considerations:

   - Significance in the goods movement network **–RQ # 2–**

     (Data Sources: Caltrans – Freight Planning Branch; US Census Bureau – Commodity Flow Survey Data)

3) Safety:

   - Existing crash data and other incident data involving trucks and passenger vehicles **–RQ# 2, 2a, 2b–**

     (Data Sources: NHTSA – Fatality Analysis Reporting System; Caltrans – Traffic Operations)

4) Existing Facility Usage:

   - Vehicle Miles Traveled and VMT Growth **–RQ # 2, 2a, 2b–**

     (Data Sources: Caltrans – Traffic Operations)

In identifying potential segments in the Bay Area freeway system, which would benefit from the implementation of dedicated truck lanes, the research study aims to evaluate any measurable benefits from truck restrictions enforced in the Bay Area and nearby areas. Also, in considering local factors that is unique to the Bay Area case study, an analysis of potential barriers and challenges to implementation must be described by the project.

1) Safety Data (with Project):

- Crash data and other incident data on corridors where dedicated truck lanes or truck restrictions were implemented **–RQ # 2a–**

  (Data Sources: NHTSA - Trucks Involved in Fatal Accidents [TIFA], FARS)

2) Challenges and Opportunities:

   - Description of local conditions and potential barriers to specific to the Bay Area and the challenges in deploying dedicated truck lanes. **–RQ # 2a–**

     (Data Sources: Metropolitan Transportation Commission [MTC] – 2035 Plan)

Dedicated truck lanes are a relatively new concept in California; therefore, the research must be able to provide a preliminary set of performance measures to ensure that the implementation of dedicated truck lanes would achieve measurable levels of success. The study aims to provide a specific set of performance measures based on established performance measures for the Interstate 15 (I-15) Truck Climbing Lane Project in San Bernardino County and the proposed Interstate 580 (I-580) Truck Climbing Lane Project in Alameda County.

3) Performance Measures:

   - Develop a preliminary model for Caltrans to evaluate the applicability of dedicated truck lane projects. **–RQ # 2b–**

     (Data Sources: Caltrans - Metropolitan Transportation Commission [MTC] – TCIF Projects; Caltrans)

Summary

As provided in Table 2, a summary of research questions and key information needed to answer each question would be analyzed in this study. Table 3, as follows, shows a brief description of preliminary data sources used in the research design and also identified in the literature review.

In order to answer Research Questions # 1, 1a, and 1b, a baseline condition would need to be established by quantitative evaluation of roadway conditions at each jurisdiction studied. By finding a common metric such as roadway usage, accident data, length of proposed facility, and existing congestion, the research study would gain important information about the justification for implementing dedicated truck lanes or truck restriction projects.

The theoretical justification for dedicated truck lanes and essential "roadmap/blueprint" gained from analysis of Research Question # 1 would then be applied to answer the case study Research Questions # 2, 2a, and 2b. The application of established conditions from RQ # 1, as well as the consideration of local conditions, the study would identify segments of the Bay Area freeway system that could benefit from dedicated truck lanes.

Table 2: Summary of Research Questions and Required Information

Research Question	Existing and With Project Conditions				Local Challenges/ Opportunities	Performance Measures
	Roadway Information	Geographic Considerations	Safety Data	Usage/Congestion		
RQ # 1	●	●	●	●		●
RQ # 1a	●	●	●	●		
RQ # 1b	●	●	●	●		
RQ # 2	●	●	●	●	●	
RQ # 2a	●	●	●	●	●	
RQ # 2b					●	●

Table 3: Preliminary List of Identified Data Sources

Roadway Information	1) FHWA – Office of Highway Policy Information 2) US DOT 3) State DOTs (Virginia, Oregon, Illinois, Texas) 4) Caltrans – Traffic Data Branch 5) Caltrans – Traffic Operations
Geographic Considerations	6) Feasibility Studies and other DOT reports 7) FHWA – Freight Management and Operations 8) US Census Bureau – Commodity Flow Survey Data) 9) Caltrans – Freight Planning Branch
Safety Data	10) National Highway Traffic Safety Administration [NHTSA] 11) Federal Motor Carrier Safety Administration [FMCSA] 12) NHTSA - Trucks Involved in Fatal Accidents [TIFA] 13) NHTSA – Fatality Analysis Reporting System [FARS] 14) Caltrans – Traffic Operations
Usage/Congestion	15) FHWA – HPMS Data 16) Caltrans – Traffic Operations
Local Challenges/Opportunities	17) Metropolitan Transportation Commission [MTC] – 2035 Plan
Performance Measures	1) Metropolitan Transportation Commission [MTC] – TCIF Projects 2) Caltrans)

Methodology

Introduction

In order to answer the research questions identified through the previous sections and the literature review, an analysis of specific conditions involving trucks on urban freeway systems must be examined. The following section describes the methodology of this research and establishes a framework for analyzing the conditions necessary for dedicated truck lane implementation on existing urban freeways.

The methodology of the study is intended to address the research questions previously identified which involves the following tasks: 1) Identify potential corridors at several jurisdictions, 2) Establish baseline conditions from available state and federal data, and 3) conducting a comparison of potential impacts of dedicated truck lanes on several facilities across the country.

A comparative analysis of available data on common metrics such as average annual daily traffic volumes, truck traffic volumes and percentages, incident and fatality data involving trucks, length of facilities feasible, and existing travel conditions, would provide the research study with important information about the justification for implementing dedicated truck lanes or any form of truck management projects.

Description of Analytical Metrics

The initial research design and scope of work proposed for this study included several metrics that would be employed in comparative analysis of each facility selected. Early evaluations included several metrics aimed at providing information about the impacts of commercial vehicles on other vehicles through a segment of a specific facility, however, this proved difficult to quantify due to issues such as limited or incomplete data across all jurisdictions surveyed. Metrics such as vehicle miles traveled, decreases in level-of-service (LOS), and increases in average delay (over time) for each facility selected proved difficult to attribute solely to commercial vehicles since environmental factors such as various changes in grade, weather-related delays, incidents involving only passenger vehicles, or other factors were difficult to account for and initial data obtained from each jurisdiction did not account for each of these conditions specifically.

As the data collection activities continued, the development of a more refined set of metrics became a necessary step in the research. Although most of the metrics identified in the original research design remained valuable, a greater focus was given to interactions of passenger vehicles and trucks and quantifying the severity of impacts caused by conflicts between cars and trucks. This refined focus allowed for a more homogenous acquisition of specific data from each jurisdiction and reduced the need for a longitudinal evaluation of each of the 25 facilities selected (and each metric), which was beyond the proposed scope and schedule of this research study.

The following sections provide a description of common measures and metrics and their application across the selected jurisdictions and facilities.

Study Period

Initial evaluations of jurisdictions and potential freeway segments included an assessment of available data. Each of the six jurisdictions selected for analysis provided access to the most consistent traffic volume data and roadway information available. Assessment of federal data sources for incident and other accident data were also considered for consistency. Under a more-refined approach to the research, the time period determined to be appropriate for the study was 2011. This base year was selected based on available data from each of the six jurisdictions analyzed, federal data sources, and the most recent census data.

Traffic Volumes

Among the 25 facilities selected, a metric of overall usage through specific segments was indentified through the use of Annual Average Daily Traffic (AADT) volumes. AADT provides information on the average number of vehicles traveling through a specific segment of a given facility for a specific year. AADT for the study year (2011) was the primary metric for each facility selected, where the use of a specific segment by all vehicles were significantly large (approximately 10,000 vehicles per day, or greater). This metric was used to obtain information on the intensity of use by all vehicle types on a freeway segment and to identify the roadways with the largest volumes near goods movement hubs and/or major metropolitan areas.

Truck Volumes

Along with AADT, truck volumes (Truck AADT) and percentages of trucks (truck percent) served as a primary metric in analyzing the concentration of commercial vehicles using a specific freeway segment. Truck AADT for the study year (2011), where the use of a specific segment by commercial vehicles (including longer combination vehicles [LCVs] and multi-trailer vehicles] were determined to be significantly large and the corresponding truck volumes and percentages was also significantly large (greater than 6 percent). This metric was used to provide information regarding the intensity of use for a specific freeway segment and identified that the segment was either a primary link within the goods movement network (i.e., link to port or goods distribution centers) or a secondary link further away from the point of origin of the goods movement network.

Freeway Segment Length

For each of the 25 facilities selected, consideration was given to the freeway segment length to be analyzed within each jurisdiction. Each state included for analysis in this study inherently had very distinct local geographic conditions, such as the prevalence of steep grades in mountainous areas of Oregon, or the hub-and-spoke land use patterns in Georgia, or the sprawl-like dispersal of land use patterns in California. In order to identify specific freeway segments in each of the six jurisdictions, a county-by-county analysis of AADT and Truck AADT was performed to determine which freeway segments within the selected jurisdictions met the initial conditions of having approximately 10,000 AADT and greater than 6 percent Truck AADT.

Crash Data Statistics

Once the 25 facilities were selected, the use of incident data (crashes and fatalities) served as an important metric in establishing the number and severity of conflicts between cars and trucks on each selected facility. Typically, crash data collected from federal sources, such as NHTSA and FMCSA, provide information for all incidents involving all vehicles types. For the purposes of this study, specific crash data from NHTSA's FARS database were collected to provide information on the following metrics:

I. Crashes involving all vehicles types (includes passenger and commercial vehicles)
   a. Incidents resulting in an injury (greater than 54 incidents)
   b. Incidents resulting in fatalities (greater than 75 percent)

II. Crashes involving commercial vehicles only (excludes passenger vehicle-only crashes)
   a. Truck-related incidents resulting in an injury (greater than 60 incidents)
   b. Truck-related incidents resulting in fatalities (greater than 40 percent)

Property Damage Only (PDO) crashes were excluded from the selected analysis metrics since early analysis of incident data revealed that 1) PDO crashes were approximately two percent of all commercial vehicle crashes and 2) a significant number of incidents occurred between the hours of 12 a.m. and 6 a.m., suggesting that PDO crashes result from truck driver exhaustion and therefore can be mitigated through other improvements. In selecting data sources to support the metrics identified, FARS data collected and reported by the NHTSA

Goods Movement Network

An evaluation of national freight operations, using information from the FHWA – Freight Management and Operations was conducted to determine the significance of each facility to the state and national goods movement network. Each facility analyzed for this study was evaluated for its significance to the goods movement network through the following metrics:

I. Proximity to a "Freight Gateway"
   a. Specific metric: Less than 50 miles from an airport, seaport, border crossing

II. Identified as a Major Freight Corridor (FHWA)

III. Included in The National Network (Surface Transportation Assistance Act of 1982)

Each of the 25 facilities analyzed for this study met each criterion established for this study and were identified as key links for local, state, and national trade routes for international trade into and out of the United States. These facilities also serve a majority of the top foreign-trade gateways (measured by value of shipments) which are comprised of 9 ports, 2 land-border crossings to Canada and Mexico, and 7 air gateways as listed below in Table 4.

Table 4: Freight Gateways at Selected Jurisdictions

Seaport	Airport	Border Crossings
Port of Oakland	San Francisco International Airport	Otay Mesa, CA
Port of Long Beach	Oakland International Airport	Blaine, WA
Port of Los Angeles	Los Angeles International Airport	
Port of Seattle	Atlanta International Airport	
Port of Tacoma	Newark Liberty International Airport	
Port of Portland	Seattle-Tacoma International Airport	
Port of Savannah	Portland International Airport	
Port of Norkfolk		
Port of New York/New Jersey		

Other Metrics

In addition to the metrics previously discussed, the evaluation of other metrics such as existing geometry (number of lanes) at each facility was determined to be useful in analyzing the existing geographical constraints for each segment evaluated. Previous studies on dedicated truck lane projects, as discussed in the Literature Review section, typically involved the addition/construction of a new lane of traffic or the conversion of an existing lane to a truck-only lane. A cursory evaluation of the existing geometry at each segment provides a preliminary determination of physical possibility of adding or converting a lane of traffic to a dedicated truck lane and consequently, eliminating facilities that would not be ideal such as a two-lane rural facility.

Another metric used to evaluate freeway segments would be the location or proximity to a metropolitan area, where the identified facility is determined to be within at less than 40 miles from a metropolitan area. This metric was used to provide information on whether the selected freeway segments serve commuters traveling into a major metropolitan area, as well as regional travelers and commercial vehicles.

Summary

The analytical metrics discussed in this section identified several baseline conditions for analyzing existing freeway segments. The information that would be gained through the evaluation of analysis metrics would be used to filter out several facilities from selected jurisdictions that would not warrant, from a capacity, safety, and usage perspective, the implementation of dedicated truck lanes. Additionally, some metrics that were not included such as LOS or Average Delay proved difficult in determining whether a specific metric would be conclusively influenced by the deployment of dedicated truck lanes, since those existing metrics were not so easily attributed to trucks.

Data Collection / Analysis

In order to answer the Research Questions (RQ) identified at the beginning of this study, a framework for analyzing specific conditions at each selected facility was developed. First, the analytical metrics, as discussed in the previous section, provided a set of baseline conditions which would be essential in identifying potential candidates (that satisfied each analytical metric/criteria) for dedicated truck lane improvements. Second, throughout the data collection process and the evaluation of raw data from various state and federal sources, a Data Analysis Matrix was developed to document each quantifiable metric and measure identified. As presented in this section, the Data Analysis Matrix (Table 5) provides a summary of each facility reviewed and several key measures used to identify local conditions, as well as information on the intensity of use by both passenger vehicles and trucks.

Table 5: Data Analysis Matrix

Jurisdiction	Facility	Location (County)	Segment Length (in Miles)	Number of Lanes	Volumes			Crash Data						
					AADT	Truck AADT	Truck Percent	Incidents (All Vehicles)	Fatalities (All Vehicles)	% Fatalities (All Vehicles)	Incidents (Trucks)	% Incidents (Trucks)	Truck Fatalities	% Truck Fatalities
Caltrans (California)	I-5	San Joaquin	49.2	4	1,472,800	356,028	24.8%	265	224	84.5%	36	13.6%	28	77.8%
	I-15	San Diego	48.5	10	2,813,000	162,491	6.3%	595	505	84.9%	46	7.7%	41	89.1%
	SR-60	San Bernardino / Riverside	45.9	10	2,477,000	308,481	12.5%	1,313	1,243	94.7%	172	13.1%	148	86.0%
	SR-99	Kern	55.6	8	763,500	188,252	26.1%	289	291	100.7%	89	30.8%	74	83.1%
	SR-115	Imperial	19.9	2	9,850	2,578	40.3%	33	30	90.9%	2	6.1%	2	100.0%
	I-710	Los Angeles	15.5	8	2,475,000	254,595	10.9%	1,577	1,444	91.6%	179	11.4%	145	81.0%
GADOT (Georgia)	I-16	Bibb*/Chatham/Laurens/ Treutlen/Bryan/Candler	100.9	4	990,680	208,043	21.0%	172	145	84.3%	65	37.8%	52	80.0%
	I-20	Fulton/Dekalb*/Newton/Richmond/ Morgan/Warren/Taliaferro/ Haralson/Douglas	126.6	10	1,083,380	140,839	13.0%	566	504	89.0%	141	24.9%	100	70.9%
	I-75	Bibb/Bartow/Butts/Clayton/Cobb*/ Fulton/Gordon/Henry/Houston/ Lowndes/Monroe/Peach/Tift/Whitfield	256.1	6	2,254,300	247,973	11.0%	885	753	85.1%	135	15.3%	93	68.9%
	I-85	Dekalb/Franklin/Fulton/Gwinnett*/ Harris/Hart/Jackson/Meriwether/Troup	132.2	8	3,460,100	211,066	6.1%	614	517	84.2%	111	18.1%	84	75.7%
	I-285	Clayton/Cobb/Dekalb/Fulton*	65.8	8	1,321,740	126,887	9.6%	564	471	83.5%	78	13.8%	50	64.1%
WSDOT (Washington)	I-5	Clark/Cowlitz/Lewis/Thurston/Pierce (MP 1.98 - 131.22)	129.2	6	110,300	14,229	12.9%	222	175	78.8%	44	19.8%	30	68.2%
	I-90	King/Kititas/Grant/Adams/Lincoln /Spokane (MP 33.56 - 298.79)	265.2	6	22,700	5,058	22.3%	409	358	87.5%	67	16.4%	44	65.7%
	I-82	Yakima (MP 24.86 - 48.50)	23.6	4	28,333	5,194	18.3%	111	102	91.9%	10	9.0%	7	70.0%
	US-2	Chelan (MP 103.92 - 119.77)	15.9	4	17,000	1,913	11.3%	18	18	100.0%	5	27.8%	3	60.0%
	US-395	Benton/Franklin (MP 22.72 - 36.24)	13.5	4	15,857	4,123	26.0%	69	53	76.8%	17	24.6%	9	52.9%

Jurisdiction	Facility	Location (County)	Segment Length (in Miles)	Number of Lanes	Volumes			Crash Data						
					AADT	Truck AADT	Truck Percent	Incidents (All Vehicles)	Fatalities (All Vehicles)	% Fatalities (All Vehicles)	Incidents (Trucks)	% Incidents (Trucks)	Truck Fatalities	% Truck Fatalities
VDOT (Virginia)	I-81	Augusta/Frederick/Roanoke	72.1	4	24,073	5,537	22.9%	138	114	82.6%	21	15.2%	17	81.0%
	I-95	Henrico/Spotsylvania/Stafford	34.3	6	58,203	6,402	11.0%	131	112	85.5%	29	22.1%	25	86.2%
	I-295	Henrico/Hanover/Chesterfield/Prince George	48.6	8	26,454	3,704	13.6%	214	168	78.5%	27	12.6%	23	85.2%
ODOT (Oregon)	I-5	Multnomah/Polk/Lane/Douglas/ Josephine/Jackson	257.8	6	49,410	8,562	22.0%	292	241	82.5%	60	20.5%	45	75.0%
	I-84	Multnomah*/Hood River/ Wasco/Umatilla	175.8	4	16,605	4,713	29.8%	172	103	59.9%	31	18.0%	19	61.3%
	US-26	Washington/Clatsop/Jefferson/ Multnomah	128.7	4	32,605	2,225	11.3%	171	126	73.7%	41	24.0%	27	65.9%
NJDOT (New Jersey)	I-78	Warren/Hunterdon/Somerset/Union	49.1	6	69,954	12,681	16.9%	208	171	82.2%	12	5.8%	8	66.7%
	I-295	Burlington/Camden/Gloucester/Salem	39.8	6	48,159	6,874	18.1%	444	341	76.8%	69	15.5%	45	65.2%
	I-287	Somerset/Morris/Passaic/Bergen	49.5	6	59,310	12,743	22.0%	297	211	71.0%	56	18.9%	27	48.2%

Notes: Traffic Volumes from (Caltrans, GADOT, WSDOT, VDOT, ODOT, NJDOT; 2011); Crash Data from NHTSA-FARS 2011

Facilities Analyzed

Freeway facilities included for analysis were considered due to several factors, including: significance in freight goods movement, truck traffic volumes, and proximity to urban centers, ports, agricultural, and industrial hubs of each state. The following section provides descriptions of each facility analyzed for this research and the location of each segment studied for potential dedicated truck lane improvements. Also, Appendix C provides a location map of each of the 25 facilities analyzed for this study.

California

Interstate 5 (I-5)

I-5 is a major regional transportation corridor that extends the entire length of the western United States from Mexico to Canada. Considered as the "backbone" of the transportation system connecting the major urban centers located in Northern and Southern California, this facility is approximately 796 miles in length, between the International Border Crossing at San Ysidro to the south and the California/Oregon border to the north. As an Interregional Road System (IRRS) route, this major north-south facility plays a critical role in California's economy by accessing a multitude of interstate, state, and local facilities and providing throughput to accommodate high volumes of commute and interregional traffic along with rapid growth in interstate/interregional freight movements. This facility serves as a critical transportation "backbone" of not only California, but also the Pacific Northwest, and is the only Interstate that reaches to both Mexico and Canada. The segment of I-5 analyzed for this research includes a four-lane, approximately 49.2-mile, stretch between the Sacramento/San Joaquin and San Joaquin/Stanislaus county borders.

Interstate 15 (I-15)

I-15 is a major transportation corridor running roughly parallel to the I-5 and then terminates at the Montana/Canada border crossing to the northeast. The I-15 facility serves as a main route for truck movements out of the ports and agricultural regions of Southern California and onward to major cities such as Las Vegas and Salt Lake City. The entire I-15 facility is approximately 1,434 miles in length and traverses the states of California, Nevada, Arizona, Utah, Idaho, and Montana. The segment analyzed for this research includes a 10-lane, 48.5-mile, stretch within San Diego County between the San Diego/Riverside County line and the I-15/I-8 Junction near the Mission Valley Area.

State Route 60 (SR-60)

SR-60 is a major east-west corridor serving Southern California beginning in Los Angeles County to the east and terminating in Riverside County to the west. The SR-60 facility is approximately 76.3 miles in length and serves as a main truck route for commercial vehicles traveling to, and from, the Ports of Los Angeles and Long Beach. The SR-60 corridor is considered as one of the most heavily truck-trafficked corridors in Southern California. Throughout the San Gabriel Valley, the SR-60 facility provides main access to industrial sections, freight rail mainlines, and the burgeoning warehouse districts near the Ontario International Airport. The segment analyzed for this research includes a 10-lane, approximately 45.9-mile, stretch between the counties of San Bernardino and Riverside.

State Route 99 (SR-99)

SR-99 is a major north-south freeway running parallel to the I-5 facility beginning in Kern County in the Central Valley and Shasta County in northern California. SR-99, to a similar degree as the I-5 facility, provides access to freight rail lines between the Bay Area, Central Valley, and Southern California. The segment analyzed for this research includes an eight-lane, approximately 55.6-mile, stretch of Kern County, between the borders of Tulare/Kern County to the north and the Kern/Los Angeles County to the south.

State Route 115 (SR-115)

SR-115 is primarily a two-lane conventional highway located within the rural Imperial County area. SR-115 serves both intraregional and interregional automobile and commercial vehicular traffic. In addition, this facility serves as a key route for agriculture-related truck traffic from production centers to processing and distribution centers in nearby areas, as well as access for local small-scale agriculture traffic. This facility has been identified as a significant link in the North American Free Trade Agreement (NAFTA) network of highways. The segment analyzed for this research includes a two-lane, approximately 19.9-mile, stretch within Imperial County between the SR-78/SR-115 junction to the north and the SR-115/I-8 junction to the south.

Interstate 710 (I-710)

Also known as the "Long Beach Freeway," the I-710 is an essential arterial route, linking the ports of Long Beach and Los Angeles to major goods distribution centers and intermodal rail facilities located in Southern California. The I-710 facility also serves both passenger and commercial vehicles. An essential component of the regional, statewide and national transportation system, it serves both passenger and goods movement vehicles. The segment analyzed for this research includes an eight-lane, approximately 15.5-mile stretch within Los Angeles County, between the I-710/I-10 junction and the Del Amo Boulevard interchange in Long Beach.

Georgia

Interstate 16 (I-16)

I-16, also known as the Jim Gillis Historic Savannah Parkway, is a major east-west facility linking the cities of Macon and Savannah, located in Bibb and Chatham counties, respectively. The I-16 facility provides a key link for commercial and passenger traffic traveling between agricultural centers located near Chatham County and industrial and more urban centers located near Bibb County. The segment analyzed for this research includes a six-lane, approximately 100.9-mile stretch between Bibb County to the east and Chatham County to the west.

Interstate 20 (I-20)

I-20 is a major east-west facility providing regional access for the state of Georgia to Alabama to the west and South Carolina to the east. The I-20 facility bisects the Atlanta metropolitan area providing passenger and commercial vehicle access to significant urban areas as well as access to industrial/agricultural sectors within the state. The segment analyzed for this research includes a six-lane, approximately 126.6-mile stretch between the Alabama State border/Haralson County to the west and Richmond County/South Carolina State border to the north.

Interstate 75 (I-75)

I-75 is a major north-south facility providing critical regional access to Tennessee to the north and Florida to the south. The I-75 corridor plays a significant role in supporting the economic and social ties in the northwest part of Georgia. The facility is also an important link for freight connectivity between ports in Savannah and Florida with the Midwest. In addition, the I-75 severs as an important link to the goods movement network and would be critical to the Panama Canal Expansion, to be completed in 2015. The segment analyzed for this research includes a four-lane, approximately 256.1-mile stretch between the Florida State border/Lowndes County to the south and Whitfield County/Tennessee State border to the north.

Interstate 85 (I-85)

I-85 is a major transportation corridor running roughly from southwest-northeast beginning in the State of Alabama and terminating in the State of Virginia. Similar to major transportation corridors in the State of Georgia, this facility serves as a main route for truck traffic and provides access for the Deep South Region, connecting Atlanta to Charlotte, North Carolina. The entire I-85 facility is approximately 669 miles in length and traverses the states of Alabama, Georgia, South Carolina, North Carolina, and Virginia. The segment analyzed for this research includes an eight-lane, 132.2-mile, stretch between the Harris County/Alabama State border to the southwest and the Hart County/South Carolina State border to the northeast.

Interstate 285 (I-285)

Also known as "The Perimeter," I-285 is considered the lifeline of the metropolitan Atlanta's transportation infrastructure. The I-285 facility is essentially a loop which traverses a four-county section surrounding the City of Atlanta and surrounding suburbs. While primarily used for passenger traffic, the I-285 facility is an essential link to commercial vehicle travel, linking the I-20, I-75, I-85, and other main facilities in the state. The segment analyzed for this research includes an eight-lane, 65.9-mile segment between the counties of Clayton, Cobb, DeKalb, and Fulton.

Washington

Interstate 5 (I-5)

I-5 is a major regional transportation corridor in the State of Washington, extending from the Oregon/Washington State borders through the Washington State/US-Canadian border to the north. I-5 is approximately 276.62 miles in length and serves a critical role in the Seattle-Tacoma and other growing areas of the state. In comparison with Oregon and California, I-5 in Washington is the shortest segment of the three. I-5 also traverses a roughly 80-mile long urban corridor from Olympia to Everett which also contains nearly two-thirds of the Washington's population. Additionally, this facility provides access to both commercial and passenger traffic throughout the state. The segment of I-5 analyzed for this research includes a four-lane, approximately 129.24-mile, stretch between the Oregon/Washington State border to the south and the City of Tacoma in Pierce County.

Interstate 90 (I-90)

I-90 is a major east-west facility beginning in the State of Washington and continues east to major cities in such as Chicago, Cleveland, Buffalo, Albany, and Boston. The I-90 facility is one of the longest highways at approximately 3,020.54 miles and provides access to 13 states in the northern part of the United States. This facility serves as a key link for interstate commercial vehicle travel, as well as passengers traveling east. The segment of I-90 analyzed for this research includes a six-lane, approximately 265.23-mile, stretch beginning in King County to the west and the Spokane County/Idaho State border to the east.

Interstate 82 (I-82)

I-82 is a northwest to southeast, approximately 143.58-mile freeway which provides key access to Oregon and Washington. The I-82 facility parallels the Yakima River and provides an alternate access to the I-5 facility as well as key connections to other state highways such as the US-12, US-97, and US-395. The segment of I-82 analyzed for this research includes a four-lane, approximately 23.64-mile, stretch within Yakima County.

State Route 2 (US-2)

US-2 is a primarily east-west facility providing access to more rural areas of the State of Washington. The US-2 facility, also known as the "Stevens Pass Highway," is approximately 326.26 miles, which begins in Snohomish County to the west and ends at the Idaho State border. This facility provides passenger and commercial access to rural agriculture sectors of the state as well as access through the mountainous areas of central Washington State. The segment of US-2 analyzed for this research includes a four-lane, approximately 15.9-mile, stretch within Chelan County.

State Route 395 (US-395)

US-395 is a primarily north-south facility providing key commercial and passenger vehicle access traveling from the State of Oregon and through the State of Washington. The US-395 facility, also known as the "North Spokane Corridor Freeway," is approximately 277.1 miles, which begins in the State of Oregon to the south and ends at the US-Canadian border, north of Spokane, Washington. The segment of US-395 analyzed for this research includes a four-lane, approximately 13.52-mile, stretch within Benton and Franklin counties.

Virginia

Interstate 81 (I-81)

I-81 is a major regional transportation corridor providing access through the Appalachian Mountains and links northeastern states to the mid-southern states. I-5 is approximately 854.89 miles in length and is critical to commercial vehicle travel for states between Tennessee and the eastern terminus in the State of New York. This facility is particularly preferential to the trucking industry since I-81 does not enter major metropolitan areas. The segment of I-5 analyzed for this research includes a four-lane, approximately 72.1-mile, stretch within the Roanoke, Augusta, and Frederick counties.

Interstate 95 (I-95)

I-95 is a major north-south transportation corridor serving 16 states from Florida to the south to Maine in the north. The I-95 facility is an important factor in commerce and tourism, linking scenic New England with the tropical-like conditions of southern Florida. This facility, at approximately 1,919.74 miles in length, traverses through more states than any other Interstate highway. The segment of I-5 analyzed for this research includes a six-lane, approximately 34.3-mile, stretch within the Henrico, Spotsylvania, and Stafford counties.

Interstate 295 (I-295)

I-295 is a significant arterial facility providing access to the cities of Richmond and Petersburg. Originally meant to be a complete beltway loop around the City of Richmond, this facility provides key northwest-southeast access to commercial and passenger vehicles traveling from the Port of Virginia in Norfolk. The segment of I-5 analyzed for this research includes an eight-lane, approximately 48.6-mile, stretch within Henrico, Hanover, Chesterfield, and Prince George counties.

Oregon

Interstate 5 (I-5)

I-5 is a major north-south facility between California and into Washington. The I-5 facility provides access to commercial and passenger vehicles serving the communities of Medford, Grants Pass, Roseburg, Eugene, Salem, and Portland. Through the State of Oregon, I-5 is approximately 308.14 miles in length and is a key interstate facility which links freight movements between California and Canada. The segment of I-5 analyzed for this research includes a six-lane, approximately 257.8-mile, stretch within the Multnomah, Polk, Lane, Douglas, Josephine, and Jackson counties.

Interstate 84 (I-84)

I-84 is a major east-west transportation corridor through Oregon routing through the more mountainous areas east of the Portland metropolitan area. This facility provides primarily passenger vehicle access due to the scenic and difficult terrain; however commercial vehicles are present on this facility. The I-84 facility is the primary route linking the northwestern cities of Salt Lake City, Boise, and Portland. The segment of I-5 analyzed for this research includes a four-lane, approximately 175.8-mile, stretch within the Multnomah, Hood River, Wasco, Sherman, and Umatilla counties.

State Route 26 (US-26)

US-26 is a significant east-west facility providing access from more rural and industrial areas of Oregon, beginning from the Oregon Coast to the west and terminates at the Idaho State border to the east. This facility provides commercial and passenger vehicle access from rural Oregon and through the City of Portland and nearby urban areas. Throughout Oregon, the US-26 facility is approximately 472 miles in length and serves as a key link to the mountainous areas of Oregon. The segment of US-26 analyzed for this research includes a four-lane, approximately 128.7-mile, stretch within Clatsop, Washington, Multnomah, and Jefferson counties.

New Jersey

Interstate 78 (I-78)

I-78 is a major east-west facility linking the states of Pennsylvania, New Jersey, and New York. I-78 is considered a major interstate commuter facility, at approximately 143.56 miles in length, and provides commercial and passenger vehicle access through major urban areas in each state it traverses. Throughout New Jersey, I-78 is approximately 67.83 miles in length and serves local and regional traffic, as well as major commercial traffic, as part of the Newark Bay Extension of the New Jersey Turnpike. The segment of I-78 analyzed for this research includes a six-lane, approximately 49.1-mile, stretch within the Warren, Hunterdon, Somerset, and Union counties.

Interstate 295 (I-295)

I-295 is a major southeast-northwest facility linking the states of Delaware and New Jersey. I-295 is considered as metropolitan Philadelphia's eastern bypass, even though it currently does not enter Pennsylvania. I-295 is considered a major interstate auxiliary facility, at approximately 73.5 miles in length, and provides commercial and passenger vehicle access for municipalities in Newport, Wilmington, Camden, and Trenton. Throughout New Jersey, I-295 is approximately 68.06 miles in length and serves local and regional traffic, as well as major commercial traffic, providing an alternate route to the New Jersey Turnpike. The segment of I-78 analyzed for this research includes a six-lane, approximately 39.8-mile, stretch within the Burlington, Camden, Gloucester, and Salem counties.

Interstate 287 (I-287)

I-287 is a major facility linking the states of New York and New Jersey. I-287 is considered as a main bypass of the City of New York to the west and through New Jersey. Through New Jersey, I-287 runs relatively north-south and provides access to commercial and passenger vehicle travel. I-287 is approximately 98.72 miles in length and serves local and regional traffic, as well as major commercial traffic. The segment of I-287 analyzed for this research includes a six-lane, approximately 49.5-mile, stretch within the Somerset, Morris, Passaic, and Bergen counties.

Note on Facilities Analyzed

Initial evaluations of jurisdictions outside of California that were evaluated in this study (Georgia, Virginia, Oregon, Washington, and New Jersey) revealed a stark difference in segment length with California facilities was needed due to the significant number of trucks utilizing those selected facility. For example, I-16 in DeKalb County (Georgia) is 8.96 in length, however, truck traffic volumes for I-16 between DeKalb and Laurens counties, does not decrease, suggesting that trucks continue to use I-16 for several counties (or perhaps through the state of Georgia). Thus, for jurisdictions and facilities outside of California, a multi-county approach has been employed to account for the thru truck trips using a specific facility. A summary of all facilities and roadway segments analyzed are listed in Table 6.

Table 6: Selected Facilities and DOT Jurisdictions

Jurisdiction	Facility	Location (County)	Segment Length (in Miles)
Caltrans (California)	I-5	San Joaquin	49.2
	I-15	San Diego	48.5
	SR-60	San Bernardino / Riverside	45.9
	SR-99	Kern	55.6
	SR-115	Imperial	19.9
	I-710	Los Angeles	15.5
GADOT (Georgia)	I-16	Bibb*/Chatham/Laurens/ Treutlen/Bryan/Candler	100.9
	I-20	Fulton/DeKalb/Newton/Richmond/ Morgan/Warren/Taliaferro/ Haralson/Douglas	126.6
	I-75	Bibb/Bartow/Butts/Clayton/Cobb/ Fulton/Gordon/Henry/Houston/ Lowndes/Monroe/Peach/Tift/Whitfield	256.1
	I-85	DeKalb/Franklin/Fulton/Gwinnett/ Harris/Hart/Jackson/Meriwether/Troup	132.2
	I-285	Clayton/Cobb/DeKalb/Fulton	65.8
WSDOT (Washington)	I-5	Clark/Cowlitz/Lewis/Thurston/Pierce (MP 1.98 - 131.22)	129.2
	I-90	King/Kititas/Grant/Adams/Lincoln /Spokane (MP 33.56 - 298.79)	265.2
	I-82	Yakima (MP 24.86 - 48.50)	23.6
	US-2	Chelan (MP 103.92 - 119.77)	15.9
	US-395	Benton/Franklin (MP 22.72 - 36.24)	13.5
VDOT (Virginia)	I-81	Augusta/Frederick/Roanoke	72.1
	I-95	Henrico/Spotsylvania/Stafford	34.3
	I-295	Henrico/Hanover/Chesterfield/Prince George	48.6
ODOT (Oregon)	I-5	Multnomah/Polk/Lane/Douglas/ Josephine/Jackson	257.8
	I-84	Multnomah*/Hood River/ Wasco/Umatilla	175.8
	US-26	Washington/Clatsop/Jefferson/ Multnomah	128.7
NJDOT (New Jersey)	I-78	Warren/Hunterdon/Somerset/Union	49.1
	I-295	Burlington/Camden/Gloucester/Salem	39.8
	I-287	Somerset/Morris/Passaic/Bergen	49.5

Research Summary

The following section provides an overview of findings from the analysis of 25 freeway facilities, selected from six (6) states throughout the United States. These findings document results from the application of several metrics established in the Methodology section. Also, these sections provide key observations, future research needs, and attempts to answer the initial Research Questions (RQ) introduced in the Research Focus section.

Key Findings

The evaluation of each of the 25 selected facilities illustrated the stark variations in local existing conditions and the need for a homogenous collection of measurable information for analysis. While most of the selected facilities satisfied the analysis metrics established for the research, a closer look at these freeway segments revealed that they lacked the demand. Whether those facilities just did not have enough usage (AADT) or incidents involving trucks, some facilities were not logical choices for dedicated truck lane implementation. The following section provides a discussion of the most suitable candidates for dedicated truck lanes in each jurisdiction analyzed.

California

SR-60 was determined to be one of the strongest candidates for dedicated truck lane implementation. This is due to several factors, such as its characteristic as a high volume roadway with approximately 2.4 million AADT (Table 7). Since this facility serves the Port of Long Beach and the Port of Los Angeles, this facility consistently carried approximately 13 percent trucks. The 45.9-mile segment between San Bernardino and Riverside counties provides 10 total travel lanes throughout the length of the segment. From a safety perspective, SR-60 met the criteria for total incidents involving all vehicles at approximately 1,313 incidents, of which, 172 were truck-involved. For the 172 truck involved incidents, approximately 86 percent resulted in a fatality.

Table 7: California Freeways (SR-60) - Screening Metrics Analysis

Screening Metric	Measure	SR-60	Result
Traffic Volumes – All Vehicles	2011 AADT > 10,000	2,477,000	Pass
Traffic Volumes – Trucks only	2011 Truck AADT > 6%	13%	Pass
Crashes (Incidents) – All Vehicles	All-Vehicle Crashes ± 150	1,313	Pass
Crashes (Incidents) – Trucks only	Truck-involved Crashes ± 12%	13%	Pass
Fatalities – All Vehicles	All Vehicle Fatalities ± 75%	1,243	Pass
Fatalities – Truck-related/involved	Truck-involved Fatalities ± 70%	148	Pass
Significance to Goods Movement Network	< 50 miles to Freight Gateway (Ports, etc.)	<10 mi to Ports (Long Beach and LA)	Pass
Freeway Segment Length	± 10 miles	45.9 mi	Pass
Proximity to Metropolitan Area	< 40 miles	San Bernardino/Riverside County	Pass
Number of Lanes (Existing)	Existing Lanes > 2	10	Pass

Georgia

In Georgia, I-20 was determined to be one of the strongest candidates for dedicated truck lane implementation. This facility is considered as a high volume roadway with approximately 1.1 million AADT (Table 8). This facility serves the Port of Savannah and therefore consistently carried approximately 13 percent trucks. The 126.1-mile segment between Haralson and Richmond counties provide 10 total travel lanes throughout the length of the segment. From a safety perspective, I-20 met the criteria for total incidents involving all vehicles at approximately 566 incidents, of which, 24.9 percent were truck-involved. For the 141 (24.9 percent) truck involved incidents, approximately 71 percent resulted in a fatality.

Table 8: Georgia Freeways (I-20) - Screening Metrics Analysis

Screening Metric	Measure	I-20	Result
Traffic Volumes – All Vehicles	2011 AADT > 10,000	1,083,380	Pass
Traffic Volumes – Trucks only	2011 Truck AADT > 6%	13%	Pass
Crashes (Incidents) – All Vehicles	All-Vehicle Crashes ± 150	566	Pass
Crashes (Incidents) – Trucks only	Truck-involved Crashes ± 12%	25%	Pass
Fatalities – All Vehicles	All Vehicle Fatalities ± 75%	504	Pass
Fatalities – Truck-related/involved	Truck-involved Fatalities ± 70%	100	Pass
Significance to Goods Movement Network	< 50 miles to Freight Gateway (Ports, etc.)	<15 mi to Port of Savannah	Pass

Freeway Segment Length	± 10 miles	126.1 mi	Pass
Proximity to Metropolitan Area	< 40 miles	Metropolitan Atlanta	Pass
Number of Lanes (Existing)	Existing Lanes > 2	10	Pass

Washington

In the state of Washington, I-5 was determined to be one of the strongest candidates for dedicated truck lane implementation. This facility is considered as a high volume roadway with approximately 111,300 AADT (Table 9). This facility serves as one of the primary truck routes linking Oregon and California with Canada and therefore consistently carried approximately 13 percent trucks. The 129.1-mile segment between Clark and Pierce counties provide 6 total travel lanes throughout the length of the segment. From a safety perspective, I-5 met the criteria for total incidents involving all vehicles at approximately 222 incidents, of which, 20 percent were truck-involved. For the 44 (20 percent) truck involved incidents, approximately 68 percent resulted in a fatality.

Table 9: Washington Freeways (I-5) - Screening Metrics Analysis

Screening Metric	Measure	I-5	Result
Traffic Volumes – All Vehicles	2011 AADT > 10,000	110,300	Pass
Traffic Volumes – Trucks only	2011 Truck AADT > 6%	13%	Pass
Crashes (Incidents) – All Vehicles	All-Vehicle Crashes ± 150	222	Pass
Crashes (Incidents) – Trucks only	Truck-involved Crashes ± 12%	20%	Pass
Fatalities – All Vehicles	All Vehicle Fatalities ± 75%	175	Pass
Fatalities – Truck-related/involved	Truck-involved Fatalities ± 70%	69%	Not Pass*
Significance to Goods Movement Network	< 50 miles to Freight Gateway (Ports, etc.)	<50 mi to SeaTac airport	Pass
Freeway Segment Length	± 10 miles	129.2 mi	Pass
Proximity to Metropolitan Area	< 40 miles	Portland, OR – Tacoma & Seattle, WA	Pass
Number of Lanes (Existing)	Existing Lanes > 2	6	Pass
* Truck-related/ involved fatalities are within 1% of metric is still considered high.			

Virginia

In Virginia, I-95 was determined to be one of the strongest candidates for dedicated truck lane implementation. This facility is considered as a high volume roadway with approximately 58,203 AADT (Table 10). This facility serves as one of the primary truck routes linking Virginia to

Delaware and Canada therefore consistently carried approximately 11 percent trucks. The 34.2-mile segment between the counties of Henrico, Spotsylvania, and Stafford counties provide 6 total travel lanes throughout the length of the segment. From a safety perspective, I-95 met the criteria for total incidents involving all vehicles at approximately 131 incidents, of which, 22 percent were truck-involved. For the 25 (22 percent) truck involved incidents, approximately 86 percent resulted in a fatality.

Table 10: Virginia Freeways (I-95) - Screening Metrics Analysis

Screening Metric	Measure	I-95	Result
Traffic Volumes – All Vehicles	2011 AADT > 10,000	58,203	Pass
Traffic Volumes – Trucks only	2011 Truck AADT > 6%	11%	Pass
Crashes (Incidents) – All Vehicles	All-Vehicle Crashes ± 150	131	Not Pass
Crashes (Incidents) – Trucks only	Truck-involved Crashes ± 12%	22%	Pass
Fatalities – All Vehicles	All Vehicle Fatalities ± 75%	86%	Pass
Fatalities – Truck-related/involved	Truck-involved Fatalities ± 70%	86%	Pass
Significance to Goods Movement Network	< 50 miles to Freight Gateway (Ports, etc.)	<50 mi to Port of Norfolk	Pass
Freeway Segment Length	± 10 miles	34.2 mi	Pass
Proximity to Metropolitan Area	< 40 miles	<10 mi to Richmond, VA	Pass
Number of Lanes (Existing)	Existing Lanes > 2	6	Pass

Oregon

It is not surprising that in Oregon, that I-5 was determined to be one of the strongest candidates for dedicated truck lane implementation. This facility is a key link for freight between California and Canada. Considered as a high volume roadway, this facility carries approximately 49,410 AADT (Table 11). This facility serves as one of the primary truck routes linking California and Washington and therefore consistently carried approximately 22 percent trucks. The 257.8-mile segment between the Multnomah and Jackson counties provide 6 total travel lanes throughout the length of the segment. From a safety perspective, I-5 again met the criteria for total incidents involving all vehicles at approximately 292 incidents, of which, 21 percent were truck-involved. For the 60 (21 percent) truck involved incidents, approximately 75 percent resulted in a fatality.

Table 11: Oregon Freeways (I-5) - Screening Metrics Analysis

Screening Metric	Measure	I-5	Result
Traffic Volumes – All Vehicles	2011 AADT > 10,000	49,410	Pass
Traffic Volumes – Trucks only	2011 Truck AADT > 6%	22%	Pass
Crashes (Incidents) – All Vehicles	All-Vehicle Crashes ± 150	292	Pass
Crashes (Incidents) – Trucks only	Truck-involved Crashes ± 12%	21%	Pass
Fatalities – All Vehicles	All Vehicle Fatalities ± 75%	83%	Pass
Fatalities – Truck-related/involved	Truck-involved Fatalities ± 70%	75%	Pass
Significance to Goods Movement Network	< 50 miles to Freight Gateway (Ports, etc.)	<10 mi to Portland International	Pass
Freeway Segment Length	± 10 miles	257.8 mi	Pass
Proximity to Metropolitan Area	< 40 miles	< 15 mi to Portland, OR	Pass
Number of Lanes (Existing)	Existing Lanes > 2	6	Pass

New Jersey

In the state of New Jersey, I-287 was determined to be the strongest candidate for dedicated truck lane implementation. This facility is considered as a high volume roadway with approximately 59,310 AADT (Table 12). This facility serves as one of the primary truck routes New Jersey with New York and consistently carried approximately 22 percent trucks. The 49.5-mile segment between the counties of Somerset, Morris, Passaic, and Bergen counties provide 6 total travel lanes throughout the length of the segment. From a safety perspective, I-287 met the criteria for total incidents involving all vehicles at approximately 297 incidents, of which, 19 percent were truck-involved. However, the I-287 facility did not meet the criteria for incidents at 71 percent of all vehicle incidents resulted in a fatality and only 48 percent of all 27 (19 percent) of truck involved incidents , also resulted in a fatality. While the fatality rates involving trucks are less than 50 percent, this may suggest that dedicated truck lanes may not have much of an impact on reducing conflicts between cars and trucks within this jurisdiction. Part of the reason may be due to the presences of a dual-dual roadway in the New Jersey Turnpike which already separates cars from trucks.

Table 12: New Jersey Freeways (I-287) - Screening Metrics Analysis

Screening Metric	Measure	I-287	Result
Traffic Volumes – All Vehicles	2011 AADT > 10,000	59,310	Pass
Traffic Volumes – Trucks only	2011 Truck AADT > 6%	22%	Pass
Crashes (Incidents) – All Vehicles	All-Vehicle Crashes ± 150	297	Pass
Crashes (Incidents) – Trucks only	Truck-involved Crashes ± 12%	19%	Pass
Fatalities – All Vehicles	All Vehicle Fatalities ± 75%	71%	Not Pass
Fatalities – Truck-related/involved	Truck-involved Fatalities ± 70%	48%	Not Pass
Significance to Goods Movement Network	< 50 miles to Freight Gateway (Ports, etc.)	<40 mi to Port of NJ/NY	Pass

Freeway Segment Length	± 10 miles	49.5 mi	Pass
Proximity to Metropolitan Area	< 40 miles	<40 mi to Newark	Pass
Number of Lanes (Existing)	Existing Lanes > 2	6	Pass

Of the six jurisdictions analyzed, California and Georgia were observed to have the highest level of usage (in terms of AADT and Truck AADT) for both the SR-60 (California) and the I-20 (Georgia) facilities. Additionally, for both of these facilities, the analysis showed contrasting measures when incident data for both jurisdictions were evaluated. The percentage of truck-related/truck-involved incidents for I-20 in Georgia was almost twice the amount observed in California (25 percent to 13 percent). However, AADT for California was approximately 1 million more than Georgia. These observations suggest that the I-20 facility in Georgia may benefit from dedicated truck lanes, at a greater degree than the SR-60 in California.

Research Questions - Evaluation

The following section addresses the research questions introduced at the beginning of the study, using information obtained from the data acquisition and evaluation.

RQ # 1: What existing conditions would warrant the implementation of dedicated truck lanes?

Based on data collected from state and federal sources, a potential candidate for dedicated truck lane implementation would display several existing conditions. While level of congestion and average delay may provide some information on the intensity of usage on a specific facility, these factors may not be easily attributable to trucks alone. Therefore other metrics, such as existing levels of AADT, Truck AADT, incident and fatality data involving trucks and cars, and other metrics, would provide a more homogenous or linear comparison of facility usage. Table 13 shows a summary of all analysis metrics and respective measures that were identified and used in the analysis of each of the 25 facilities selected.

Table 13: Screening Metrics Used to Identify Dedicated Truck Lane Candidates

Screening Metric	Measure

Traffic Volumes – All Vehicles	2011 AADT > 10,000
Traffic Volumes – Trucks only	2011 Truck AADT > 6%
Crashes (Incidents) – All Vehicles	All-Vehicle Crashes ± 150
Crashes (Incidents) – Trucks only	Truck-involved Crashes ± 15%
Fatalities – All Vehicles	All Vehicle Fatalities ± 75%
Fatalities – Truck-related/involved	Truck-involved Fatalities ± 70%
Significance to Goods Movement Network	< 50 miles to Freight Gateway (Ports)
Freeway Segment Length	± 10 miles
Proximity to Metropolitan Area	< 40 miles
Number of Lanes (Existing)	Existing Lanes > 2

RQ # 1a: Does the addition of dedicated truck lanes on a particular freeway segment improve safety (incidents and fatalities)?

RQ # 1b: What possible operational benefits are gained by separating trucks from other passenger vehicles?

The following research sub-questions (RQ # 1a and 1b) aimed to identify specific improvements, in operations and safety, after the implementation of dedicated truck lanes on a particular facility. As no real application of dedicated truck lane facilities have been implemented, to a large scale in the United States, improvements in safety and operations cannot be categorically determined within the scope of this research study.

On the other hand, one of the primary assumptions of this research study is that the implementation of dedicated truck lanes would result in significant improvements to operations and since there would be an absence of conflicts between cars and trucks for certain segments, then incidents or fatalities would be significantly reduced at these locations.

Evaluations of available safety data involving incidents and fatalities from the NHTSA's FARS database included detailed roadway information and a measure of truck-related incidents and fatalities. However, more detailed information on roadways lacked a differentiation between roads with active truck restrictions or truck-only lanes, if any, were enforced at the time.

Evaluating the impacts of removing trucks from a roadway can be assessed, at least partially, through the analysis of a particular freeway segment where trucks were removed by mandate or any other means. In the Literature Review section, State Route 29 (SR-29) in Mercer County, New Jersey, was identified as a facility by which state law banned trucks in 1999 under Senate Bill No. 1491 (S-1491). The research study aimed to encapsulate the changes in safety-related measures in the years after the implementation of the ban on trucks traveling on SR-29. As shown on Table 14, prior to the passage of S-1491, incidents on SR-29 was observed at 71 with 62 fatalities involving all vehicles in 1997; 26 of those incidents involved a truck with 21 fatalities. In 2011, about a decade after the passage of S-1491, truck-related fatalities were completely removed from this segment of the facility. While this legislation forced commercial vehicles from this segment of SR-29 onto other facilities in Mercer County or beyond, there is no doubt that there was a significant decrease in the incidents involving trucks and an improvement in overall incidents for this segment of the facility.

Table 14: SR-29 (Mercer County) New Jersey – 1997/2011 Incidents and Fatalities

Year	Lanes	Incidents	Fatalities	% Fatalities	Incidents (Trucks Only)	Fatalities (Trucks)	% Fatalities (Trucks)
1997	2	71	62	87.3%	26	21	80.8%
2011	2	57	40	70.2%	0	0	0.0%

Source: NHTSA-FARS Data: 1997 and 2011.

RQ # 2: Can dedicated truck lanes be implemented on the existing Bay Area freeway system?

While RQ # 2 and related research sub-questions aimed to determine whether there would be a candidate facility located in the Bay Area. While the screening metrics discussed above provided several criteria for selecting potential facilities, the application of those screening metrics revealed that no Bay Area freeway segments satisfied the criterion established for this research. Specifically, a major freeway near the Port of Oakland, a major goods distribution center, the Interstate 880 (I-880), did not warrant consideration based on Truck AADT and percentage. In fact, shown in Table 15 below, AADT at 207,375 was considerably large for Alameda County, but Truck AADT and the corresponding percentage at 15,555 trucks (7.45 percent) did not meet one of the most crucial criteria developed for this study. This finding would suggest that trucks are not necessarily an issue in the Bay Area and any implementation of dedicated truck lanes may be best deployed in other areas of the state.

Table 15: I-880 (Alameda County) California

AADT (All Vehicles)	AADT (Trucks)	AADT (% Trucks)
207,375	15,555	7.45 %

Source: Caltrans, 2013.

RQ # 2a: Which segments of the Bay Area freeways can benefit from dedicated truck lanes?

The lack of potential facilities within the Bay Area freeway system suggest that the truck trips through Bay Area freeways are comprised of mostly local trips and regional or intra-state truck trips use a different facility from those in the Bay Area. Since no potential facilities were identified within the Bay Area freeway system, a broader evaluation of the Northern California freeway system was conducted.

During the evaluation process of the study, a four-lane segment of I-5 within San Joaquin County was determined to be a suitable candidate for dedicated truck lanes, which includes an approximately 49.2-mile segment serving the nearby cities of Stockton, Tracy, Manteca, and Lodi (Figure 3). As shown in the Screening Metrics Analysis below (Table 16), I-5 within San Joaquin County satisfied the analytical metrics regarding volume with over 1.4 million AADT, approximately 25 percent trucks, and also met the analytical criteria for safety with over 260 incidents involving all vehicles and approximately 14 percent of those incidents involving trucks.

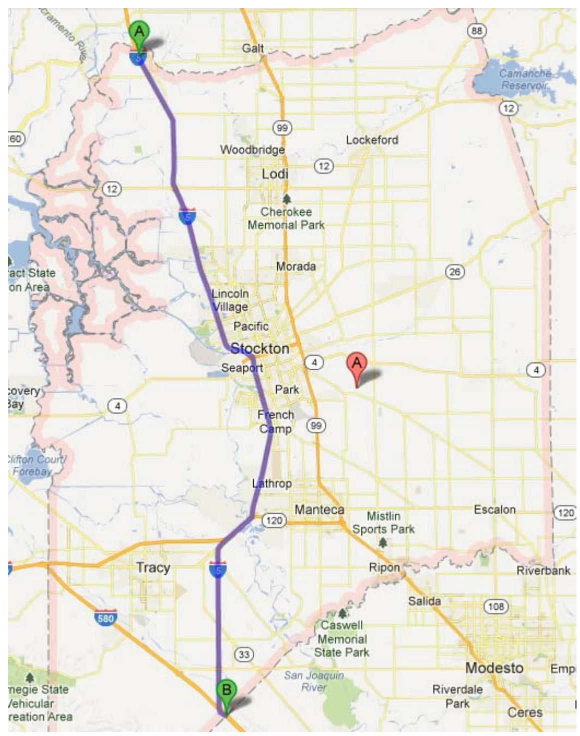

Figure 3 - I-5 (San Joaquin County)

Table 16: California Freeways (I-5) - Screening Metrics Analysis

Screening Metric	Measure	I-5	Result

Traffic Volumes – All Vehicles	2011 AADT > 10,000	1,472,800	Pass
Traffic Volumes – Trucks only	2011 Truck AADT > 6%	25%	Pass
Crashes (Incidents) – All Vehicles	All-Vehicle Crashes ± 150	265	Pass
Crashes (Incidents) – Trucks only	Truck-involved Crashes ± 12%	14%	Pass
Fatalities – All Vehicles	All Vehicle Fatalities ± 75%	85%	Pass
Fatalities – Truck-related/involved	Truck-involved Fatalities ± 70%	78%	Pass
Significance to Goods Movement Network	< 50 miles to Freight Gateway (Ports, etc.)	<40 mi to Port of Oakland	Pass
Freeway Segment Length	± 10 miles	49.2 mi	Pass
Proximity to Metropolitan Area	< 40 miles	<40 mi to Newark	Pass
Number of Lanes (Existing)	Existing Lanes > 2	6	Pass

While this facility is located in the Central Valley region, the existing conditions at this facility suggest that the majority of truck trips through this area include intra-state and more local trips. The addition of dedicated truck lanes would provide additional capacity for this segment and provide a necessary reduction in the conflicts between cars and trucks.

RQ # 2b: What performance measures do Caltrans need to establish prior to managing potentially new facilities?

Dedicated truck lanes are a relatively new concept in California, much less at any of the jurisdictions evaluated in this study. Therefore, a preliminary set of performance measures needed to be developed to have a process for estimating the impacts of dedicated truck lanes on a particular facility.

Caltrans established the Freeway Performance Measurement System (PeMS), which is a real-time Archive Data Management System that collects, filters, and processes, transportation data. This system includes measurements recorded by detectors and tag readers at specific mile-points on each freeway in California. PeMS stores and processes various traffic data such as AADT, measures of congestion, bottlenecks, and other roadway performance data on the California freeway system. Incident data, which includes injury, fatality, property damage only, and any other severity of collisions, are collected by both Caltrans and by the California Highway Patrol (CHP).

PeMS only aggregates incident data from both Caltrans and CHP records and is not fully integrated into PeMS. For Caltrans to be able to better assess the impacts of dedicated truck lanes on specific segments, this research suggests integration of the CHP incident reporting with PeMs. By integrating CHP incident reporting with PeMS, incidents on specific facilities would be better located and analyzed to provide better roadway information in selecting candidates for improvements such as dedicated truck lanes.

Research Observations

The most surprising and consistent themes that emerged through this research study was the dispersion of truck traffic through major metropolitan areas. For example, the I-95 segment within Fairfax County (Virginia) was observed to have AADT at 118,000 vehicles, yet Truck AADT was observed at approximately 4,720 trucks (4 percent). The pattern also emerged in the analysis of the other facilities in the Bay Area where a facility such as the I-580 would be observed to have a significantly large AADT, yet have fewer than 6 percent trucks when entering major metropolitan areas.

The diffusion of truck traffic, especially when approaching a major metropolitan area, suggests that trucks tend to divert to arterials or other lower functional class roads. One explanation for this trend is the presence of tolls for use of a particular segment, and since tolled roadways are typically present when entering major metropolitan areas, then this diffusion would need to be accounted for when analyzing potential facilities for dedicated truck lanes.

A final observation was determined during the evaluation of incident data involving trucks. Among all facilities analyzed through the six jurisdictions, consistent fatality rates in truck-related crashes were observed. As shown in the Data Analysis Matrix (Table 5), for all facilities analyzed, every truck-involved incident that occurred, there would be greater than 70 percent chance of a fatality. While car-only accidents have, as much (if not higher) fatality rates, decision-makers must consider the primary and secondary economic costs of a truck-involved accident.

When a truck-related collision occurs, primary and secondary economic impacts must be accounted for such as:

- Lifetime economic cost to society for each fatality measured by lost productivity
- Medical costs (includes non-injury, injury, and fatal crashes)
- Present and future medical costs due to injuries
- Lost workplace productivity
- Lost household productivity
- Total property damage costs for all crash types (fatal, injury, and property damage only)
- Travel delay costs

Finally, according to a 2000 report by the NHTSA, "approximately 9 percent of all motor vehicle crash costs are paid from public revenues. Federal revenues accounted for 6 percent and states and localities paid for approximately 3 percent. Private insurers pay approximately 50 percent of all costs. Individual crash victims pay approximately 26 percent while third parties such as uninvolved motorists delayed in traffic, charities, and health care providers pay about 14 percent. Overall, those not directly involved in crashes pay for nearly three quarters of all crash costs, primarily through insurance premiums, taxes and travel delay. In 2000 these costs, borne by society rather than by crash victims, totaled over $170 billion."

Recommendations and Conclusion

Estimating the demand for roadway capacity improvements, specifically improvements focusing solely on commercial vehicles, is a relatively new territory for state transportation agencies (DOTs). In the Literature Review section of this study, various efforts were identified over the last few decades that proposed the separation of cars and trucks. But, no such facilities have been implemented to a large scale in the United States.

The concept of managed lanes and improvements such as HOT lanes on congested urban facilities has only begun to be implemented in the last 13 years. This type of managed lanes has been put into practice as a necessary step in alleviating congested roadways. The management of commercial vehicles may not be as highly prioritized, but it should be. Dedicated truck lanes can serve as an important “next step” for state DOTs to re-gain control of the entire transportation system. Various studies completed on this subject have yielded mixed results, but each jurisdiction attempting to analyze this type of managed lanes (for commercial vehicles) do not encompass the depth of primary and secondary impacts of the conflicts between cars and trucks on any roadway segment as well as the many opportunities (benefits) in separating both vehicle types.

Further research is needed to address the depth of impacts such as lost productivity and short-term economic stoppages caused by commercial vehicle accidents. The benefits assumed upon implementation of dedicated truck lanes also require more research to include several operational improvements such as the ability to set higher speed limits on passenger vehicle-only lanes and the ability to allow LCVs on the dedicated truck lane facilities. Also, benefits to maintenance could be realized through less maintenance on cars-only lanes and thinner pavements which would save on roadway repair costs.

This research aimed to provide a set of baseline conditions (metrics) that would allow transportation agencies to set specific criteria based on local conditions in analyzing potential roadway segments for dedicated truck lanes. However, as with any research effort, no single set of metrics would provide decision-makers with enough information to fully support a relatively new course of action (or technology), when it comes to transportation. The potential benefits of dedicated truck lanes in safety and operations may eventually be outweighed by the sunk costs involved in separating two historically intertwined vehicle types.

According to the US Department of Commerce – Bureau of Economic Analysis (BEA), “real gross domestic product (GDP) increased in 43 states and the District of Columbia in 2011. Durable–goods manufacturing, professional, scientific, and technical services, and information services were the leading contributors to real U.S. economic growth. U.S. real GDP by state grew 1.5

percent in 2011 after a 3.1 percent increase in 2010.[2]" As the U.S. economy continues to climb out of the recession of 2007/08, goods movement networks will begin to influence demand for more commercial vehicles across the country. Since the growth in the number of trucks has consistently kept pace with the growth in the number of cars, therefore it is likely that more trucks will be on the already congested freeways in freight significant areas of the county within the next decade.

Transportation agencies, such as Caltrans, must be able consider urban areas for truck separation since predominant congestion problems are more present in facilities leading to (or within) urban areas. Segments such as the I-5 facility within San Joaquin County would be an ideal candidate for dedicated truck lane improvements since this facility would be considered as an interregional "hinge" for the California goods movement network due to its proximity to both the Bay Area and the Greater Sacramento Area. Providing adequate focus on the behavior of commercial vehicles in these areas would help DOTs identify corridors that carry significant thru truck trips and finally justify the implementation of a dedicated truck lane facility.

[2] http://www.bea.gov/newsreleases/regional/gdp_state/gsp_newsrelease.htm

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Appendix A: Scope of Work

In order to answer the proposed research questions, this research study would need to examine the conditions necessary for the implementation of dedicated truck lane projects on existing freeways. The study would need to identifying potential corridors at several jurisdictions, establishing baseline conditions from available state and federal data, and conducting a quantitative comparison of potential impacts of dedicated truck lanes on several locations across the country. Comparative analysis of available data on common metrics such as daily traffic volumes, truck traffic volumes, accident data involving trucks, length of proposed truck-lane facilities, and existing congestion, would provide the research study with important information about the justification for implementing dedicated truck lanes or truck restriction projects.

Task 1 – Data Collection

The research would focus on specific freeway facilities within several State DOTs such as California, New Jersey, Oregon, Georgia, Virginia, Oregon, and Washington. Data collection activities involving available data from the selected State DOTs, as well as the US DOT, would be required to create a database of existing conditions at each jurisdiction that would be eligible for dedicated truck lane projects.

Data to be collected will include available information as noted below.

1) Traffic volumes for passenger vehicles
2) Commercial vehicles volumes and truck percentages
3) Accident and other incident data involving trucks and passenger vehicles for each facility analyzed
4) Available highway travel data
5) Geographic information on proximity to ports and significance in the goods movement network

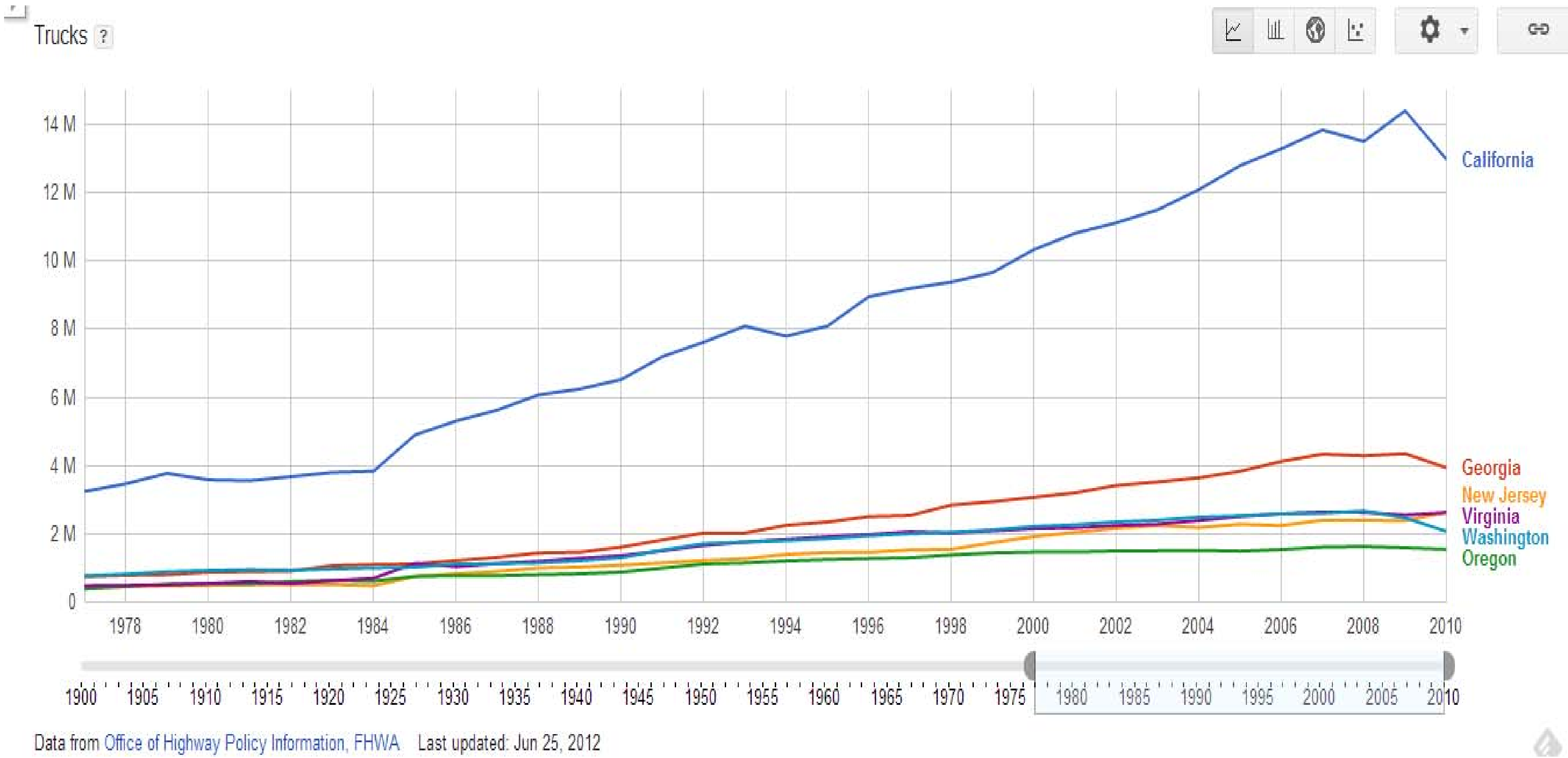
Task 2 - Determine Project Demand and Applicability

Comparative analysis of each facility will be conducted to determine the demand for the implementation of dedicated truck lanes. Using data collected from Task 1, a data table will be created to provide a quantitative comparison of the baseline conditions that is common for each jurisdiction. These baseline conditions would then be applied to identify specific segments of the Bay Area freeway system that may be eligible.

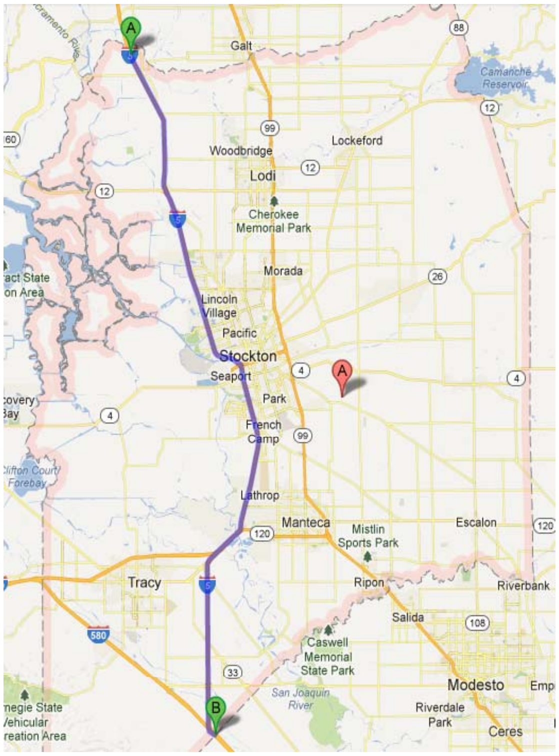
Task 3 – Document Results and Conclusions

The research would need to provide a detailed analysis of results, incorporating collected data, qualitative analysis, and provide quantifiable conclusions from the above tasks. A final report will be prepared and submitted by June 7th, 2013 to the Mineta Transportation Institute Office.

Appendix B: FHWA – Annual Truck Growth (1900-2010)



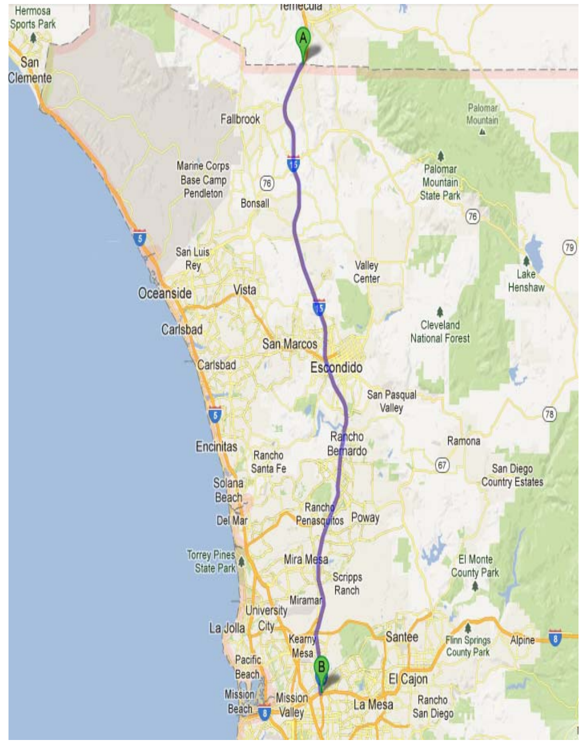
Appendix C: Location of Roadway Segments Analyzed



California Freeways

I-5 (San Joaquin County)

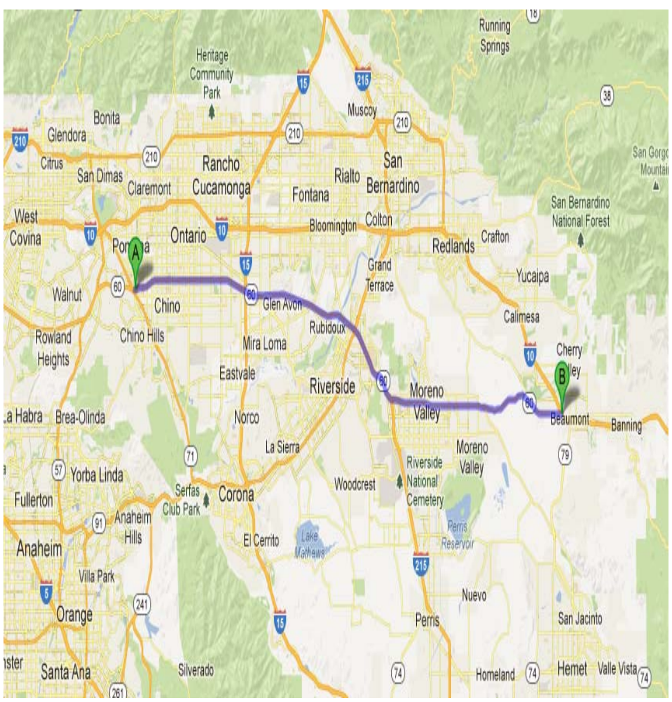
Length: 49.2 miles



California Freeways

I-15 (San Diego County)

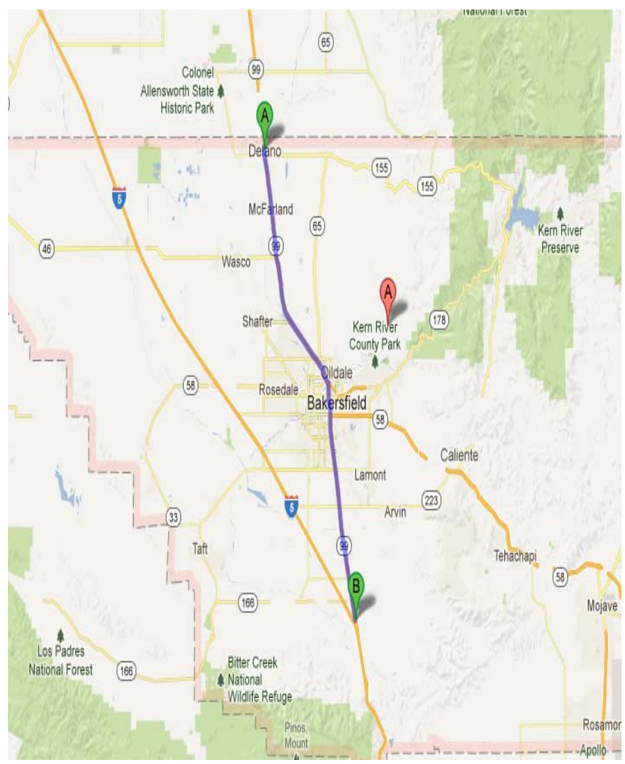
Length: 48.5 miles



California Freeways

SR-60 (San Bernardino/Riverside counties)

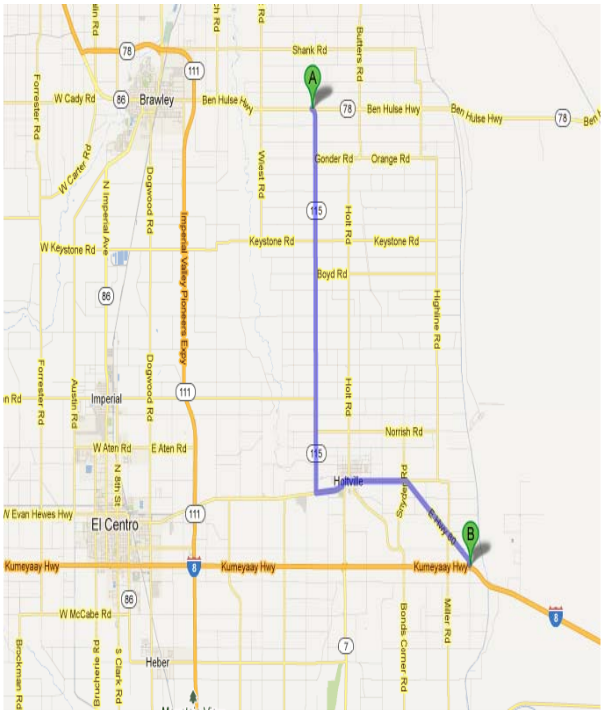
Length: 45.9 miles



California Freeways

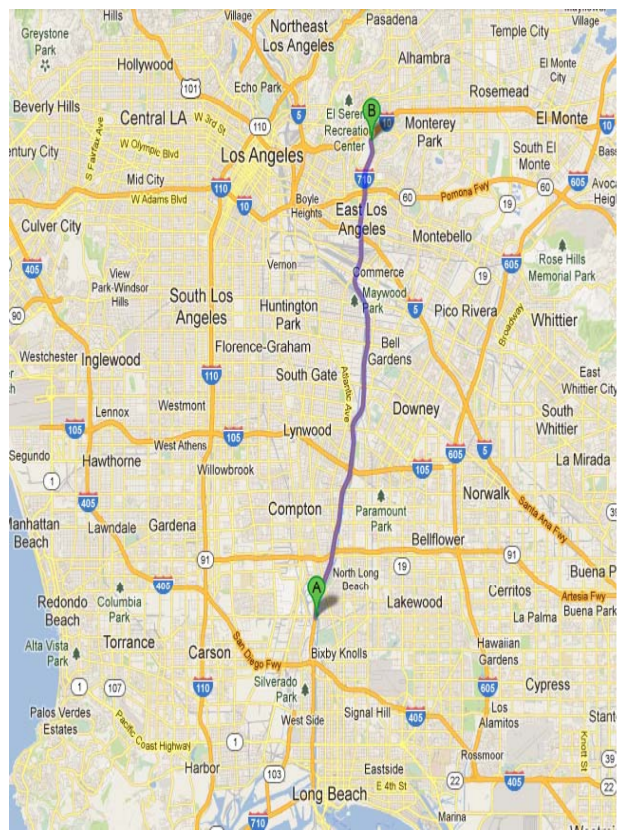
SR-99 (Kern County)

Length: 55.6 miles



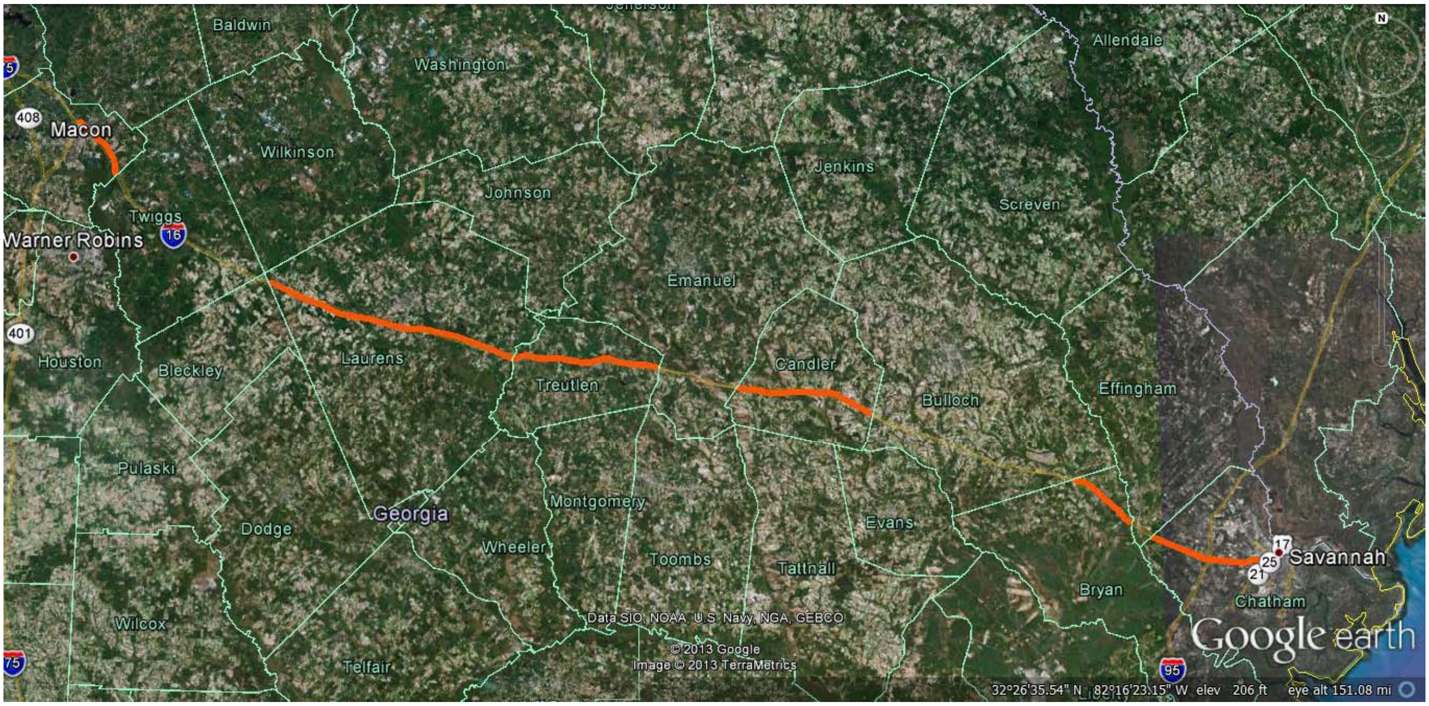
California Freeways

SR-115 (Imperial County)
Length: 19.9 miles



California Freeways

I-710 (Los Angeles County)
Length: 15.5 miles

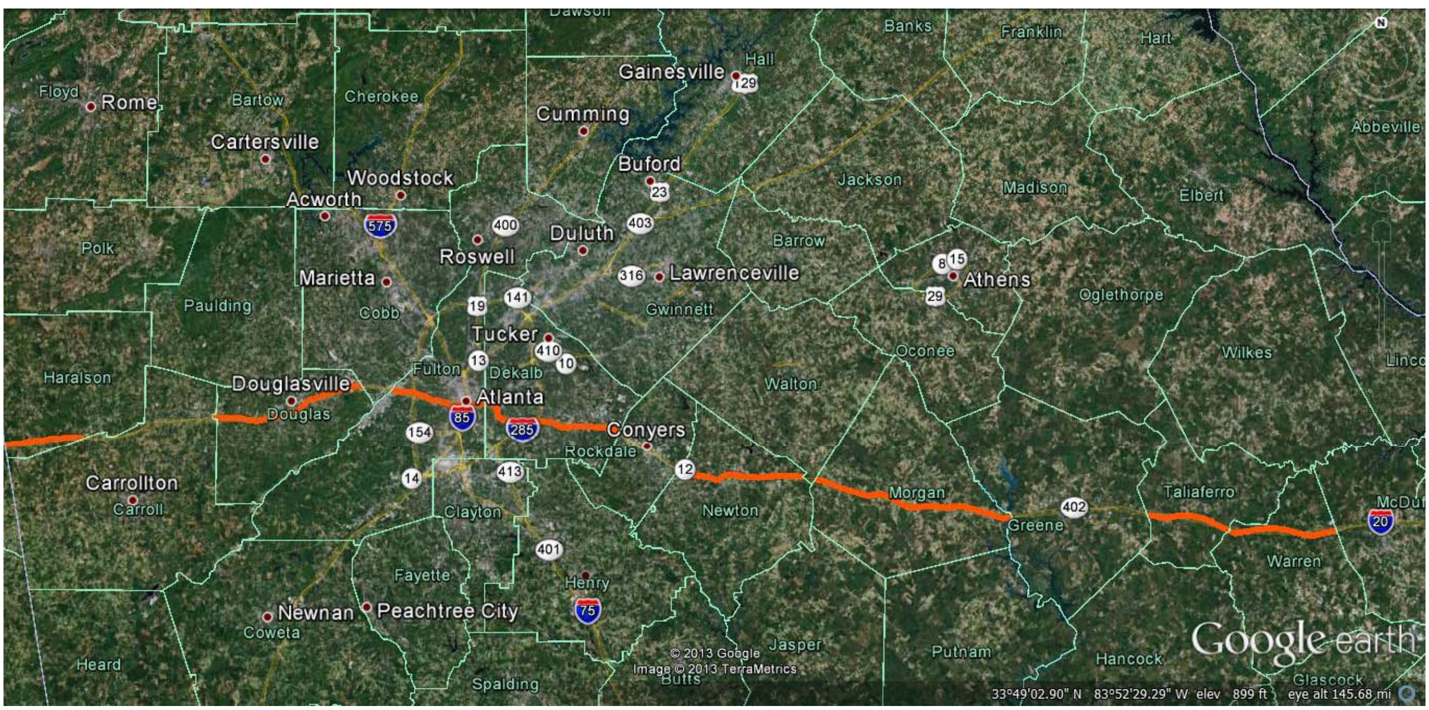


Georgia Freeways

I-16

(Bibb*/Chatham/Laurens/ Treutlen/Bryan/Candler counties)

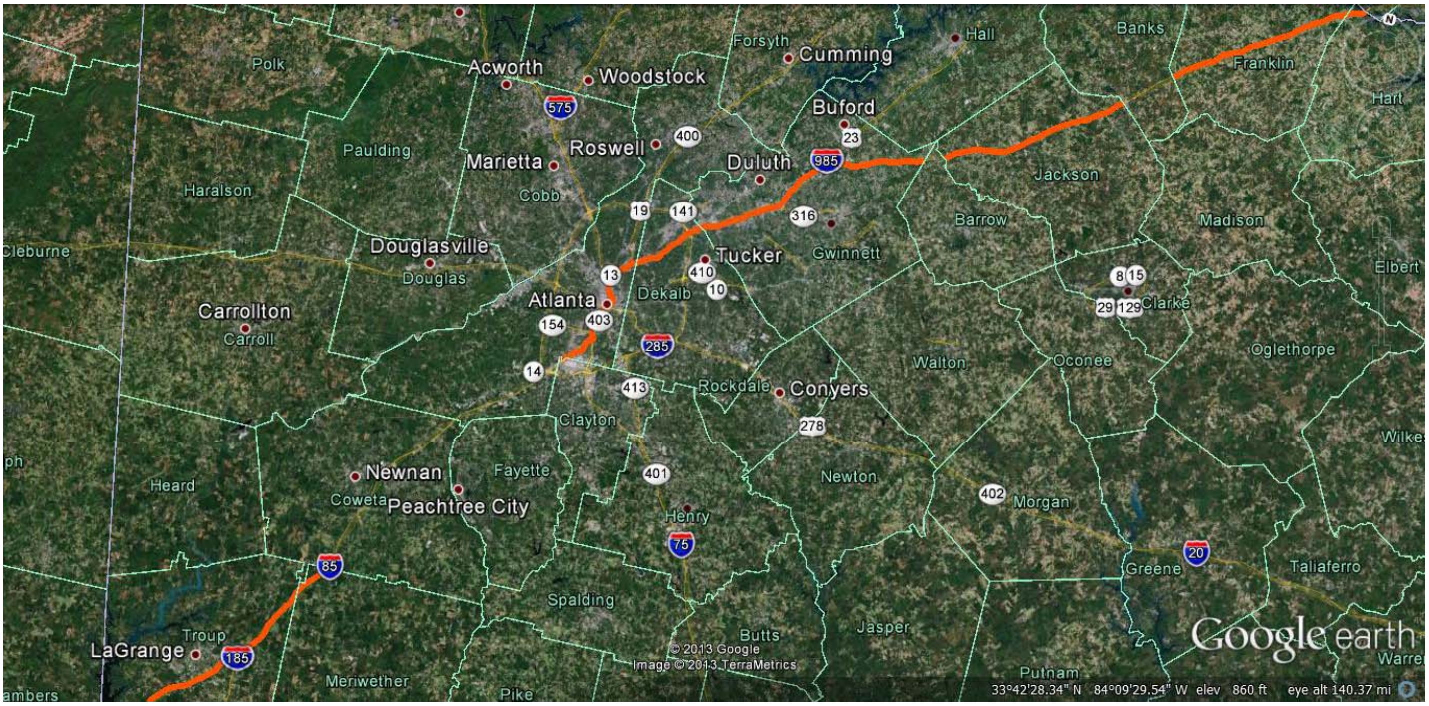
Length: 100.9 miles



Georgia Freeways

I-20 (Fulton/Dekalb*/Newton/Richmond/ Morgan/Warren/ Taliaferro/ Haralson/Douglas counties)

Length: 126.6 miles

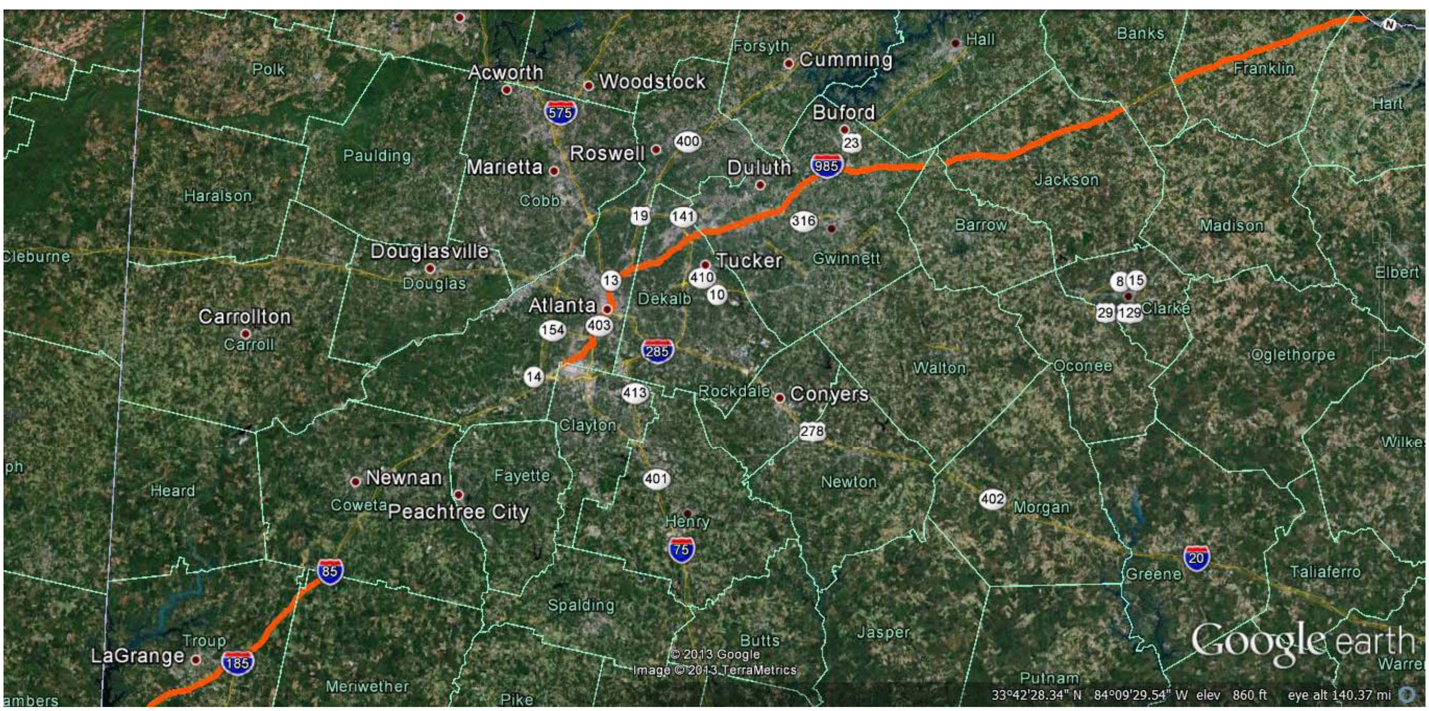


Georgia Freeways

I-85

(Dekalb/Franklin/Fulton/Gwinnett*/ Harris/Hart/Jackson/Meriwether/Troup counties)

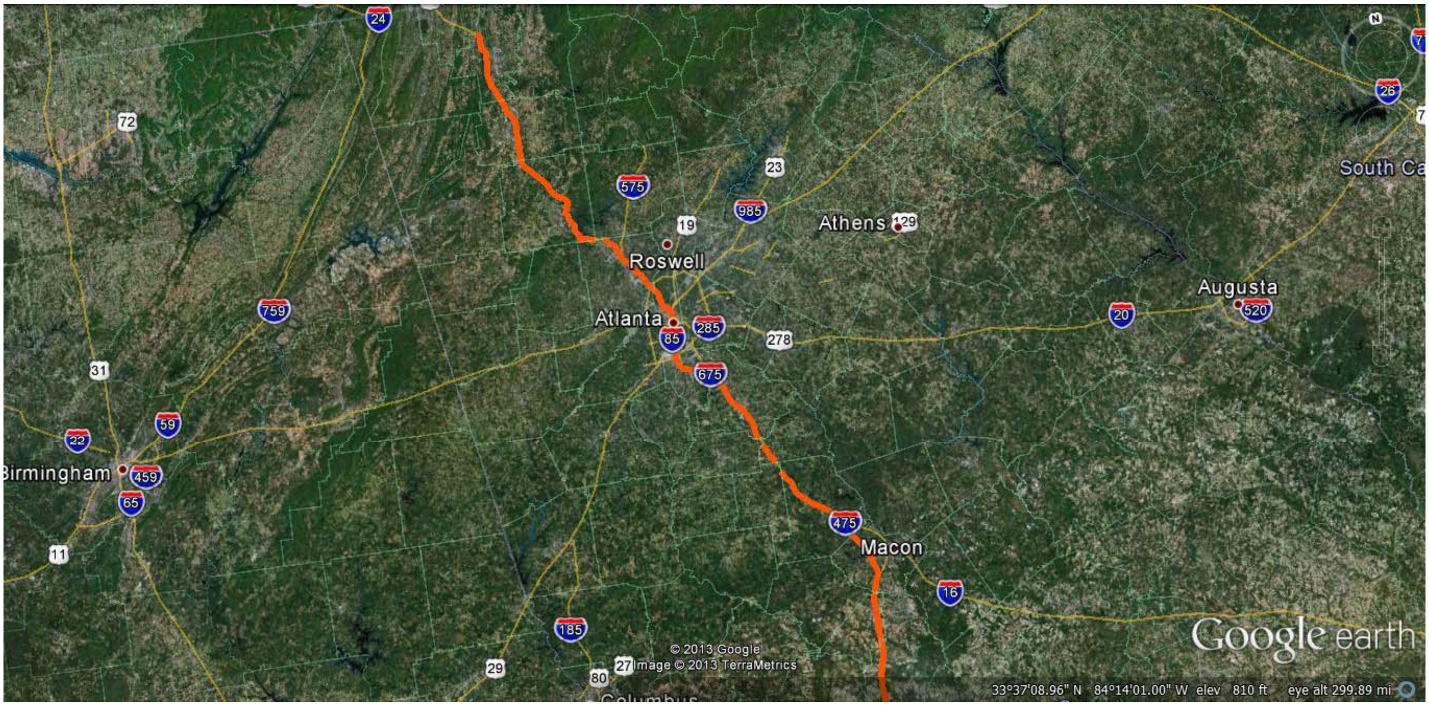
Length: 132.2 miles



Georgia Freeways

I-285 (Clayton/Cobb/Dekalb/Fulton counties)

Length: 132.2 miles



Georgia Freeways

I-75

(Bibb/Bartow/Butts/Clayton/Cobb*/ Fulton/Gordon/Henry/Houston/ Lowndes/Monroe/Peach/Tift/Whitfield)

Length: 256.1 miles

Washington Freeways

I-90

(King/Kititas/Grant/Adams/Lincoln/Spokane counties)

Length: 265.2 miles

Washington Freeways

I-5 (Clark/Cowlitz/Lewis/Thurston/Pierce counties)

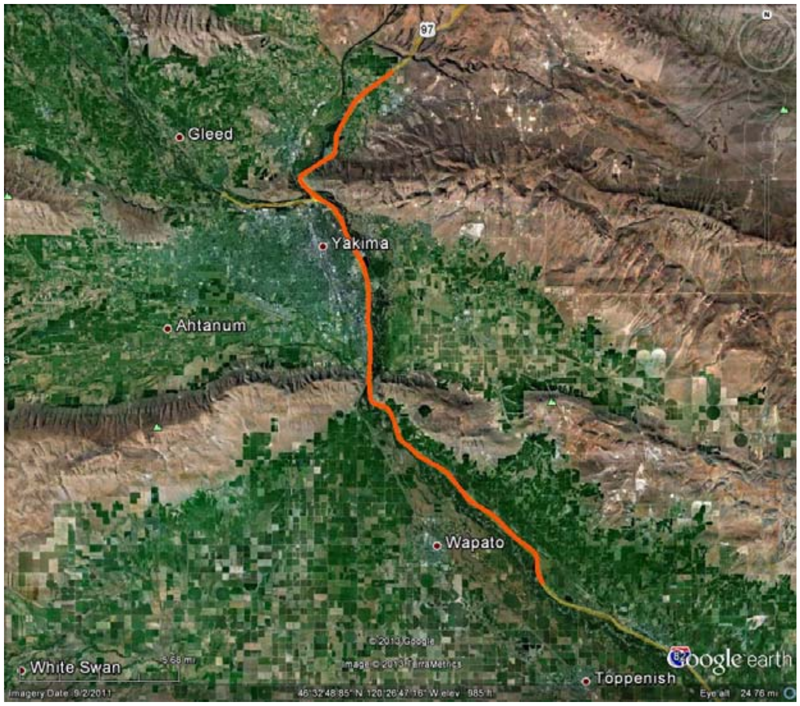
Length: 129.2 miles

Washington Freeways

US-2
(Chelan County)
Length: 15.9 miles

Washington Freeways

US-395 (Benton/Franklin counties)
Length: 13.5 miles



Washington Freeways

I-82

(Yakima County)

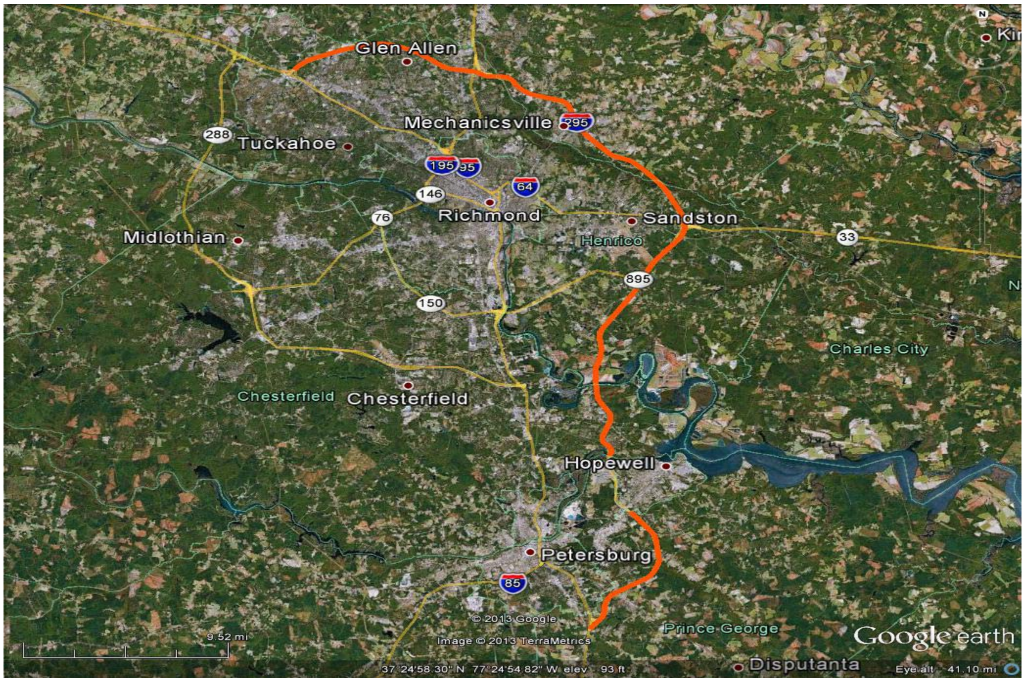
Length: 23.6 miles

Virginia Freeways

I-81
(Augusta/Frederick/Roanoke counties)
Length: 72.1 miles

Washington Freeways

I-95
(Henrico/Spotsylvania/Stafford counties)
Length: 34.3 miles

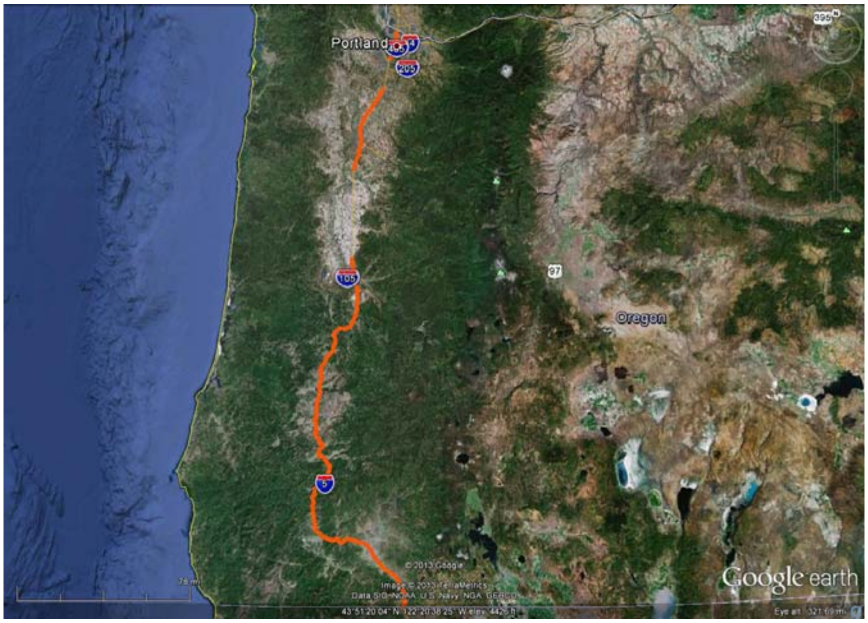


Virginia Freeways

I-295

(Henrico/Hanover/Chesterfield/Prince George counties)

Length: 48.6 miles

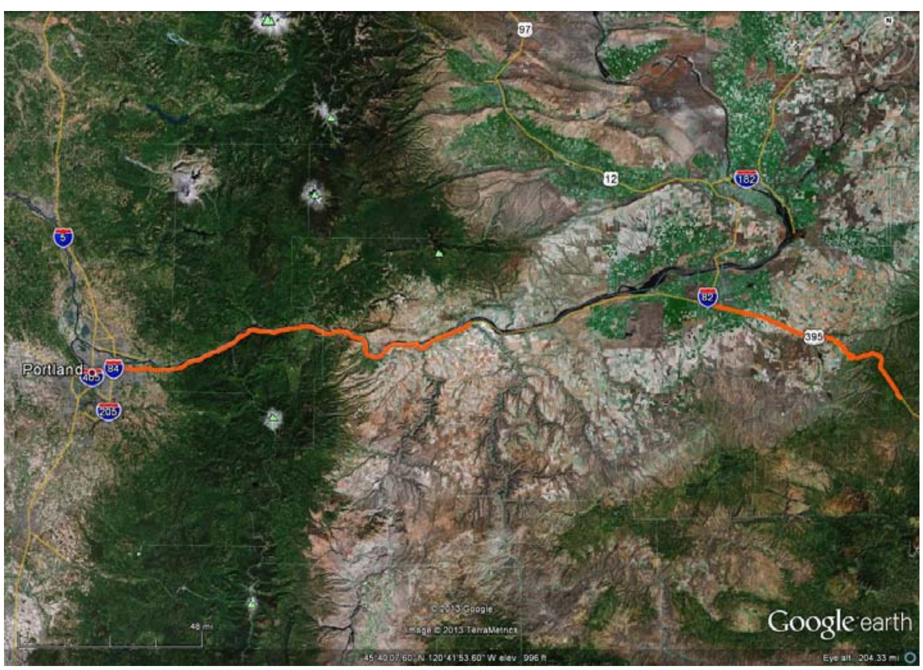


Oregon Freeways

I-5

(Multnomah/Polk/Lane/Douglas/Josephine/Jackson counties)

Length: 257.8 miles

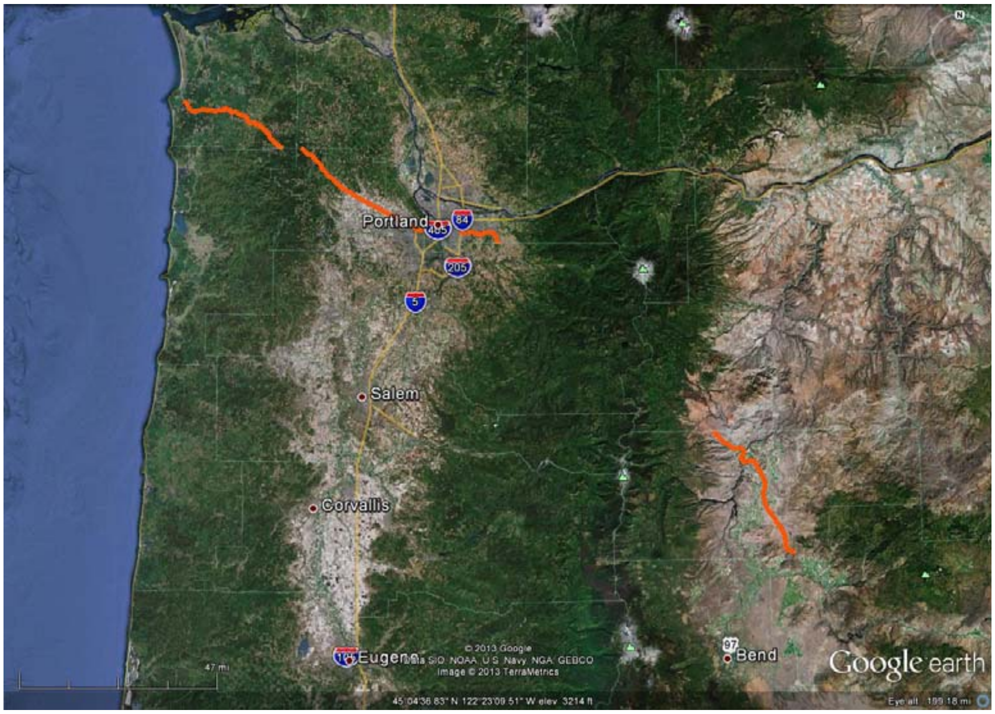


Oregon Freeways

I-84

(Multnomah*/Hood River/ Wasco/Umatilla counties)

Length: 175.8 miles

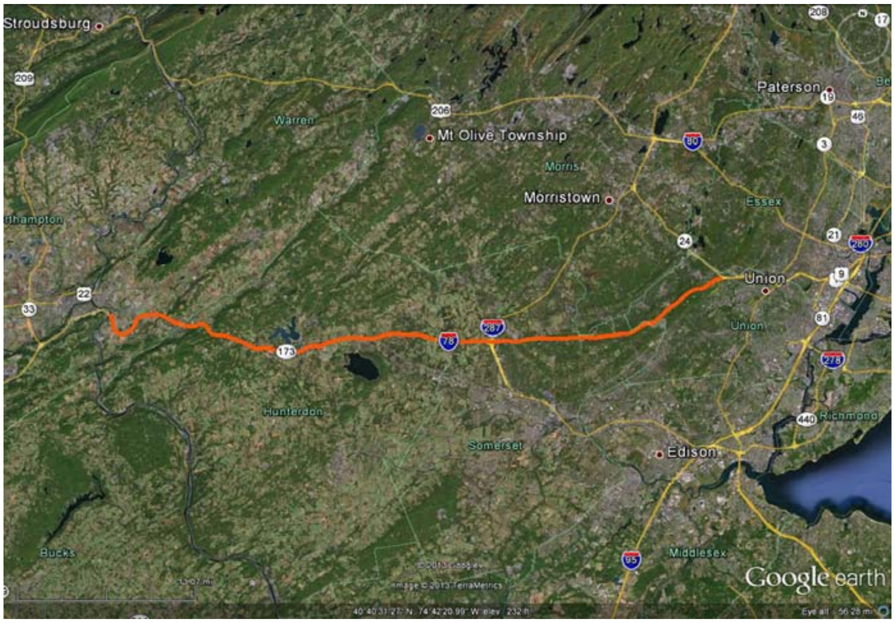


Oregon Freeways

US-26

(Washington/Clatsop/Jefferson/Multnomah counties)

Length: 128.7 miles



New Jersey Freeways

I-78

(Warren/Hunterdon/Somerset/Union counties)

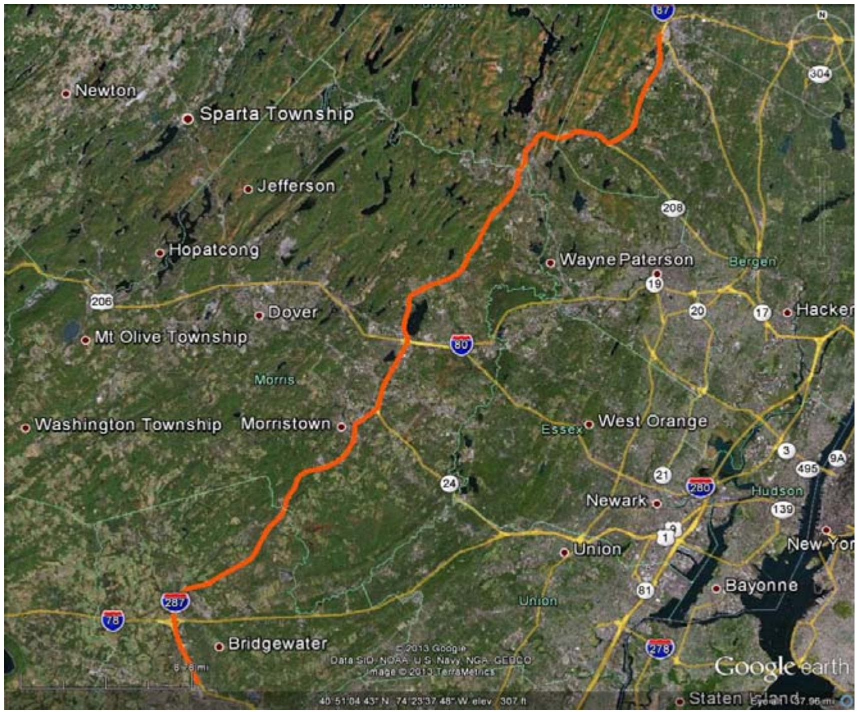
Length: 49.1 miles

New Jersey Freeways

I-295

(Burlington/Camden/Gloucester/Salem counties)

Length: 39.8 miles



<u>New Jersey Freeways</u>

I-287

(Somerset/Morris/Passaic/Bergen counties)

Length: 49.5 miles

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