

# **Dedicated truck lanes as a solution to capacity and safety issues on interstate highway corridors**

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Midwest Transportation Consortium  
Iowa State University  
2901 S. Loop Drive, Suite 3100  
Ames, Iowa 50010

Principal Investigator:

Neil Burke  
Transportation (M.S.) Student  
MTC Scholar  
Iowa State University  
(515) 294-7188  
email: [nburke@iastate.edu](mailto:nburke@iastate.edu)

**TABLE OF CONTENTS**

TABLE OF FIGURES..... III

ABSTRACT.....IV

1.0 INTRODUCTION.....1

1.1 Problem Statement.....1

2.0 IMPROVEMENT ALTERNATIVES.....2

2.1 Construction of additional capacity.....2

2.2 Restricted lane for heavy vehicles.....3

*Restriction of vehicles from the left lane*.....3

*Restriction of vehicles from the right lane*.....3

2.3 Truck only lanes.....3

*Truck only lane design*.....4

*Expansion of the LCV network*.....5

*Funding for truck only lanes*.....5

3.0 DEDICATED TRUCK LANE CASE STUDIES.....6

3.1 Suggested locations for truck only lane pilot programs.....7

*Identifying gaps and key routes*.....7

*Revenue*.....8

*Right of way*.....8

*Relative Cost*.....8

*I-80 in Illinois and Iowa*.....8

3.2 Truck only lane feasibility Study for Florida’s Interstate Highways.....9

*The between cities model*.....9

*The within cities model*.....9

3.3 Trans-Texas Corridor.....9

4.0 CONCLUSION.....10

4.1 Recommendations for I-80 in Iowa.....10

**LIST OF FIGURES**

Figure 2.1 Map of the existing LCV routes in the United States.....12

Figure 3.1 Proposed Dedicated Truck Lane Designs for the Florida’s Turnpike.....16

**LIST OF TABLES**

Table 3.1 Revenue Potential Scores of Candidate Corridors.....13

Table 3.2 High Cost Factors for the top ten corridors.....14

Table 3.3 Highest scoring candidate corridors.....15

## **ABSTRACT**

The focus of this paper is the issue of trucking volumes on the I-80 corridor in Iowa. I-80 stretches from east to west for over 300 miles through the center of Iowa. I-80 is a popular route for freight because it connects some of the most vital economic centers in the United States such as New York, Cleveland, Chicago, and San Francisco. Heavy vehicles make up a third of the overall traffic on I-80 in Iowa. The mix of cars and trucks increases accidents, increases congestion, and impedes the flow of traffic. This paper will address the potential improvement options for an interstate corridor that handles heavy freight traffic. Widening, Restricting trucks to a particular lane, and dedicated truck only lanes are the potential improvement options for this corridor.

## **1. INTRODUCTION**

The growth and maturation of the United States economy in the twentieth century can be attributed to the efficient movement of goods within our nation. Construction of the U.S. Interstate highway system began in the 1960's and was completed by the 1980's, providing good, reliable transportation to key economic centers throughout the country.

During this time, the trucking industry overtook the rail system as the most efficient mode of transportation of product. Along with this transition came the change in many U.S. businesses from "push logistics" to "pull logistics." Pull Logistics did away with large inventory warehouses and opted for a "just-in-time" approach, where the product was created on a basis of need. The North American Free Trade Agreement (NAFTA) was passed in 1992, and has brought additional truck traffic to Interstates that traverse the U.S., and routes that lead to Canada and Mexico. This agreement brought extra demand on the trucking industry and produced higher trucking volumes to our nation's roadways.

Negative impacts such as congestion, pavement deterioration, and a spike in auto-truck accidents are being experienced to a greater degree on trans-national trucking routes such as I-80 and I-95, as well as highways that lead to major ports such as I-710 in Los Angeles. The Intermodal Surface Transportation Efficiency Act (ISTEA) imposed limits on Larger Combination Vehicles (LCV's) in 1992, banning these tandems from many important trucking routes. This restriction limits efficiency and leads to higher trucking volumes on U.S. Interstates. The construction of additional capacity or truck only lanes has been discussed as potential solutions to these issues.

### **1.1 Problem Statement**

In Iowa, I-80 corridor expansion is eminent between the metropolitan centers of Davenport and Des Moines. This 170-mile corridor connects some of Iowa's largest urban centers as well as serving as a vital link between the eastern and western portions of the United States. This corridor is a popular through-trucking route and heavy vehicles make up nearly a third of total traffic. Truck traffic is expected to grow at a rate of 4 -5% per year on the I-80 Corridor in Iowa. Expansion of the current four-lane facility of I-80 is being considered between these cities. Given the trucking volumes on I-80 in Iowa; consideration should

be given to the construction of an additional travel lane, the designation of a restricted truck only lane, or a new right of way designed specifically for trucks.

## **2. IMPROVEMENT ALTERNATIVES**

The I-80 corridor in Iowa was constructed to handle expected traffic volumes in the 1960's, and is becoming functionally obsolete with increased traffic volumes and additional truck traffic in the last decade. The improvement option for this corridor must address capacity issues, optimize safety, as well as be within the state of Iowa's budget for interstate rehabilitation. The most simplistic option would be to add an additional travel lane in each direction for the corridor.

The majority of the I-80 corridor from Davenport to Des Moines is a four lane alignment. Expanding this corridor to a six-lane facility would involve modifications to bridges and freeway interchanges. This improvement option would be carried out in stages, with the project lasting as long as twenty years. The Iowa Department of Transportation (IADOT) has considered the construction of an additional un-restricted through lane as the most feasible option for corridor improvement for I-80. Another alternative that IADOT has considered is the investment of funds in upgrading US Highway 30 to a four lane facility from Clinton, IA to Ames, IA. This is parallel route to I-80 that spans roughly the same distance. This aforementioned improvement would not address the safety and capacity issues for through truck trips on I-80. While adding additional lanes may be the most cost effective procedure, there are disadvantages to this strategy.

### **2.1 Construction of additional capacity**

A study conducted by the Reason Public Policy Institute indicates that highway crashes involving trucks resulted in 5,000 deaths in 1998. Many of these accidents can be attributed to conflicts between cars and trucks, due to their different operational characteristics <sup>(1)</sup>. Trowbridge, Nam, Mannering, and Carson explain that combination vehicles are involved in roughly 20% of all motor vehicle accidents. While this percentage is relatively small, the accidents that do involve trucks tend to be more severe <sup>(2)</sup>. Grenzeback, Reilly, Roberts, and Stowers have concluded that the sheer volume of trucks does not have a significant effect on congestion, but accidents involving trucks will impact congestion levels significantly. Congestion is affected by trucks when truck volumes exceed 10 % <sup>(3)</sup>.

Adding additional capacity to the I-80 without addressing the issue of truck volumes would not improve safety on the corridor. In order to optimize safety on the corridor, some degree of separation between trucks and cars must be considered. LCV's are prohibited from traveling on I-80 in Iowa. In order for LCV's to be permitted for travel on I-80, physical separation from other automobiles must be constructed, along with a durable pavement to handle these heavy vehicles.

## **2.2 Restricted Lane for Heavy Vehicles**

### *Restriction of vehicles from the left lane*

A similar solution involves the restriction of heavy vehicles to specific lanes of the freeway. A study conducted by Hoel and Peek explores the benefits and downfalls from restricting truck traffic from a specific lane of travel. All completed studies involved six-lane interstate facilities. Several states have prohibited truck traffic from traveling in the left lane, thus allowing for greater through movement of other vehicles. This method creates conflicts when autos must change lanes to exit the freeway, or when vehicles must find a spot to merge into the lane with a majority of truck traffic <sup>(4)</sup>.

### *Restriction of vehicles for the right lane*

Another scenario in the study involved the restriction of heavy vehicles from the right lane of travel. This caused more lane changes to occur for trucks wishing to exit the freeway. Prohibiting trucks from the right lane created a greater speed differential, which increased the possibility of an accident occurring. In effect, prohibiting truck traffic from a specific lane limits the mobility of trucks, causes increased danger to smaller vehicles, and is unproven as an effective result in managing truck traffic flows <sup>(4)</sup>.

## **2.3 Truck Only Lanes**

The increased percentage of trucks on U.S. highways coupled with the spike in truck related fatalities in the last decade have mobilized regional governments and research agencies to investigate the possibility of dedicated truck lanes on interstate highways. A Reason Public Policy Institute (RPPI) survey was conducted in 2002 to determine the benefit of dedicated truck lanes on heavy truck traffic corridors. According to RPPI, dedicated truck lanes would be located on the inside of the existing freeway and separated by a jersey barrier from existing vehicle traffic. Designated truck lanes would be placed on interstate highway corridors that have a high percentage of long haul trucking <sup>(1)</sup>. The only separated truck

lanes that exist currently is a 30 mile segment of the New Jersey Turnpike, where trucks are separated from non-commercial traffic (7).

A Managed Lanes State of the Practice conducted by the Texas Transportation Institute described a set of specific feasibility thresholds for the consideration of constructing dedicated truck lanes. The study found that the truck facilities were most cost-effective when they were constructed with barrier separation in the existing median. Barrier separated dedicated trucks lanes achieve optimum feasibility when truck volumes exceed 30% of the total vehicle mix, peak hour volumes exceed 1800 vehicles per lane-hour, and off-peak volumes exceed 1200 vehicles per lane hour (9).

Several case studies have been completed that explore the possibility of the implementation of dedicated truck lanes on urban freeway corridors. While this report project focuses on rural interstate corridors, several relevant case studies have been conducted on urban freeway corridors. The Southern California Association of Governments (SCAG) has included dedicated truck lanes on its long range transportation plan. These dedicated truck lanes would provide a reliable through route for truckers along with access to the Ports of Los Angeles and Long Beach (8).

Literature associated with research that was completed by Trowbridge, Nam, Mannering, and Carson questions the validity of dedicated truck lanes. An international study completed by the Organization for Economic Co-operation and Development indicates that dedicated truck lanes will reduce the operational flexibility of the facility. Additional difficulties may arise when accidents occur or maintenance needs to be conducted. Truck only lanes may be unpopular with the public because the efficient movement of goods is not clearly understood as a potential benefit to taxpaying citizens. Truck only lanes are viewed to the public as providing a minimal overall benefit because the citizens will not be able to use them (2).

#### *Truck Lane Design*

In a study conducted by Poole et al, the preliminary design for these truck lanes has at least one travel lane in each direction with a passing lane every few miles. Each direction of the designated truck facility would have a breakdown lane. Another proposed design involves a three lane truck facility would have a continuous alternating passing lane for the two directions of travel. The facility would have a jersey barrier-separated 24 foot traveled way, with six feet in each direction dedicated to the breakdown lane. The pavement and structures for the designated truck lanes would be stronger and more durable than typical

pavement currently being used on U.S interstate highways. Similarly, design of structures and pavements for the mainline could be designed using inexpensive, less durable materials. Rehabilitation of the mainline would not be necessary because the truck only facility would be constructed in the median of the existing highway (7).

According to a study by Samuel et al, the dedicated truck lanes would have advanced entrances and exits into the mainline to allow trucks adequate space to decelerate and change lanes for an exit. Another design option would involve separate entrance and exit ramps for the dedicated truck lanes. Safety would be optimized with the latter design because trucks would not need to mix with other traffic in the mainline in order to exit the freeway. However, separate entrance and exit ramps would require additional right of way acquisition and would make constructing the designated truck lanes inside the median difficult (1).

#### *Expansion of the LCV network*

Poole et al has noted that the states that permit LCV's on its interstate highways is limited and incomplete. While most of the turnpikes in the eastern U.S. and the interstates in the Western U.S. allow tandem trucking, there exists a gap throughout much of the Midwest and the south. Since the deregulation of freight and railroads in the 1980's, there is no trans-national route that will allow LCV's such as the double or the triple. Designated truck lanes would help span the gaps from the interstates that allow LCV's (7). Figure 2.1 displays the states and interstate highways that allow LCV travel. Tandem staging areas would be constructed near important destinations to allow doubles and triples to be assembled for travel on the truck ways. The American Trucking Association has endorsed designated truck lanes because this project would allow significant gains in productivity in the freight industry. Allowing trucks to carry larger loads would increase productivity, decrease price, and decrease the amount of wear and tear on the trucks themselves. LCV's can handle twice the amount of goods that a standard 19-wheeler can haul. The EPA has explained that hauling more freight by using multiple trailers would reduce both fuel use and emissions. In effect, the construction of facilities that handle LCV's will save money for the freight industry as well as to decrease emissions (7).

#### *Funding for truck only lanes*

The initial funding of designated truck lanes would come from tolling that would be implemented to fund the construction. In order to do this, federal law must be reversed to allow toll collection on interstate

highways. In a study completed by Poole et al, American Road and Transportation Builders Association have suggested that legislation must include the following requirements. Additional right of way must be granted for the construction of truck only lanes and public-private partnerships could be enhanced by allowing truck only lane projects to qualify for federal tax exempt bond status. According to a study on constructing truck ways on Florida's freeways, Reich et al; has estimated costs for constructing truck lanes to be \$4 to \$8 million per mile. High costs are due to right of way acquisition, heavy duty construction, and expensive design work <sup>(7)</sup>.

Fischer, Ahanotu, and Waliszeuski identify the Southern California Association of Governments proposed plan to construct a \$10 billion network of dedicated truck lanes on Interstate Highway Corridors in the Los Angeles metro area. The truck lanes would be physically separated from the general purpose lanes, with grade separation from existing freeway ramps to minimize the weaving interactions with general purpose traffic.

\$4.3 Billion in funding was allocated for the development of truck lanes on State Highway 60 in Southern California for the 2001 Regional Transportation Plan. Of the \$4.3 Billion, 70% of the funding will be derived from public support, and the remaining 30% coming from toll revenue. According to Fischer, Ahanotu, and Waliszeuski, the I-710 and I-15 Corridors are being studied as potential corridors for dedicated truck lanes <sup>(6)</sup>.

Once construction of designated truck lanes on an interstate highway has been completed, trucks using the truck only lanes would be automatically tolled. Where each unit that wishes to use the truck only lanes must have an automated transponder that gives information on number of axles and the amount of miles driven on the facility.

### **3. DEDICATED TRUCK LANE CASE STUDIES**

The interstate highway system has provided reliable movement of freight in the U.S. for several decades. Increased trucking volumes and the predicted future congestion levels have caused state and local governments as well as researchers in the transportation field to investigate the feasibility of truck only facilities on U.S. Interstate highways. The following sections describe feasibility studies and selection criteria that state governments and transportation researchers have implemented for testing the validity of a truck only facility on interstate highways.

### **3.1 Suggested locations for pilot truck only lane projects**

In a study completed by the Research Public Policy Institute, the researcher has examined market data, physical elements of the corridors, and cost factors in suggesting potential multi-state corridors for truck only facilities. In order to obtain the market data in the analysis, trucking companies that operated LCV's (in states that permitted their use) were contacted. The researcher inquired about the corridor gaps that would be the most beneficial to the company if a toll truck only facility was constructed. These potential truck facilities would LCV's to travel from one state that allows tandem trucks to another. The routes that were favored by more than three trucking companies are listed below

- I-80 from Chicago to Salt Lake City
- I-81 from Knoxville to Harrisburg, PA
- I-70 from Denver to the Pennsylvania Turnpike
- I-76 on the Pennsylvania Turnpike

In all, 17 routes were favored by trucking companies that would consider paying tolls to operate LCV's <sup>(8)</sup>.

#### *Identifying gaps and key routes*

Next, the researchers examined maps of the interstate highway system to determine the remaining gaps and purposeful extensions to create a national LCV network. The criterion was heavily weighted on connecting large regional urban centers with truck only facilities, such as I-10 from Houston to San Antonio. I-10 handles significant long haul volumes in addition to serving shorter trips between the two cities. A truck only facility was considered for I-85 that would link the rapidly growing industry in North Carolina to the major transportation hub of Atlanta.

#### *Revenue*

Revenue and cost criteria were examined in detail in this study to determine the benefits to constructing a truck only facility on the selected corridors. In order to finance a truck only corridor, there must exist a significant demand for trucks that are willing to pay a toll for its use. Therefore, the researcher has only considered corridors with volumes that are over 10,000 trucks per day. Forecasted congestion levels for 2020 were examined for these potential corridors. Connectivity was utilized in the selection process to eliminate routes that would not connect to other existing facilities that allow LCV's. Table 3.1 displays the scores for candidate corridors.

#### *Right of way Costs*

Right of way availability is a variable cost in the analysis. The addition of a truck lane in an existing wide median of an interstate would lower land acquisition costs. When outward expansion is necessary, significant right of way costs can be expected with the construction of new roadbed and the realignment of interchanges. Terrain factors were also considered in the analysis. Building highway facilities in mountainous regions is more expensive than construction in a flat area.

#### *Relative Cost*

This study analyzed relative cost by computing a cost factor. This value is derived from the factors listed below:

- Cumulative mileage
- Cumulative mileage of the interstate that has a median of less than 48 feet
- Right of way cost
- Terrain cost
- Percentage of hilly terrain

The cost factor provides the ultimate determination for how attractive a corridor is for consideration of a truck only lane. Table 3.2 displays the cost factor calculations for the ten corridors in consideration.

#### *I-80 in Illinois and Iowa*

The study completed by Poole et al determined the I-80 corridor in Illinois and Iowa as the highest scoring candidate corridor. Of the ten corridors examined, the I-80 corridor had the highest revenue potential cost score of 0.78. This suggests that there would be enough potential heavy truck volumes to warrant a toll truck only lane and the I-80 corridor is flat with a wide median, so construction costs would be less expensive than other corridors in the study (7). Table 3.3 shows the candidate corridors. This corridor would serve as a link from the turnpikes in the eastern portion of the U.S. to the western states that allow LCV's to travel on the interstate highways.

### **3.2 Truck only lane feasibility Study for Florida's Interstate Highways**

In a different study conducted by the Center for Urban Transportation Research (CUTR) at the University of Southern Florida, Reich, Davis, Catala, Ferraro, and Sisinnno have studied the feasibility of truck only lanes on Florida's Interstates and Turnpikes. The researchers at CUTR implored a detailed methodology in selecting pilot corridors for truck lanes. The study has considered dedicated truck lanes on six lane

interstate facilities throughout Florida. The researchers have considered dedicated truck lanes built into the existing median as well as on the right side of the roadway. Figure 3.4 displays the two designs that have been proposed in the research conducted by the CUTR.

Several GIS models were constructed to identify “hot spots” based upon truck crashes, volumes, and the percentage of heavy vehicles and level of service. The researchers have created two GIS-based models to evaluate the need for dedicated truck lanes on interstates between urban areas and inside large urban areas. These truck lanes would be constructed inside the present median. Trucks would utilize existing interchanges by merging with existing mainline traffic (7).

#### *The between cities model*

The Between Cities model determines the corridors where the median is at least 64 feet wide and interchanges are spaced at adequate distances. The within cities model identifies urban highway corridors that may require additional truck capacities.

#### *The within cities model*

Emphasis of the within cities model is placed on special generator facilities for trucks and links that are vital in moving freight to the “last mile” to an intermodal facility. Alternatives to truck lanes in the study include allowing trucks to use the HOV lanes in off-peak hours and combining I-95 and Florida’s Turnpike and designating one highway as a truck only facility.

### **3.3 The Trans-Texas Corridor**

Several studies have been conducted concerning the construction of the Trans-Texas Corridor. Since the passing of NAFTA, Texas has seen increased congestion levels on its interstates due to a spike in truck traffic. This proposed project would involve the construction of 4,000 miles of toll expressways with dedicated truck lanes across Texas. The initial project would involve the construction of an 800 mile toll highway from Mexico to Oklahoma parallel to the existing I-35. The I-69 NAFTA corridor has also been proposed as a potential Trans-Texas Corridor for the reason that dedicated truck lanes could be easily built into the construction plans for the highway.

These highways would be nearly a quarter mile wide, and would carry cars, trucks, pipelines for water, oil, and natural gas. The Trans-Texas Corridor highways would bypass the already-congested urban centers such as Dallas, San Antonio and Austin. These transportation networks would cost over \$180 Million to

construct and would be funded with private money. In order to finance the construction of these superhighways, all vehicles using the facilities would be tolled for 50 years. The highways would be constructed parallel to existing interstate routes. The car and truck lanes may be constructed as far as 30 miles away from the existing interstate corridors. The Communities along I-35 would like the car and trucks lanes constructed closer to the highways so their cities will not lose the revenue that travelers generate (7).

#### **4.0 CONCLUSION**

Dedicated truck lanes on interstate highways are a new and innovative idea. The interstates were constructed as a means of rapid movement of defense, freight, and people. These highways are reaching the end of their useful lives, and heavy vehicle volumes have been increasing at a steady pace. Truck only lanes would separate heavy vehicles from the existing traffic flow, thereby decreasing driver-vehicle conflicts, reducing congestion, and maximizing the efficiency of freight movement. Interstate corridors that construct truck only facilities will be able to handle tandem vehicles, which lessens emissions and reduces freight costs.

#### **4.1 Recommendation for I-80 in Iowa**

The I-80 in Iowa is one of the nations most heavily traveled corridors for trucks. While the construction of a third travel lane in each direction may be the most cost effective solution to congestion, a dedicated truck only lane would provide optimum long term benefits. The Research Public Policy Institute has identified the I-80 corridor as the best candidate for a pilot project dedicated truck lane. Poole et al has identified this corridor for its high percentage of long haul trucking, the gap in states that allow LCV's, and the overall cost effectiveness due to the terrain and wide median (7). An in-depth study of the concept of truck only lanes on I-80 in Iowa will serve as the next step in this analysis. Truck only lanes could be the future to the United States freight industry and I-80 in Iowa could be at the forefront of this innovative idea.

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Figure 2.1 Map of existing LCV routes in the United States (5)

Route	Gross Truck Volume 35 points	Proportion of Route with > 10K 15 points	Congestion 15 points	Connectivity 20, 10 or 0	Trucking Company Interest 3 pts/vote	Total Score
I-80 Iowa, Illinois	26	14	8	20	12	80
I-90 Cleveland-Buffalo	25	15	8	20	6	74
I-75 Toledo-Tampa	29	14	9	10	6	68
I-75 Detroit-Toledo	35	15	6	10	0	66
I-76 Penna. Turnpike	21	7	10	10	18	66
I-15 Barstow-Las Vegas	35	5	10	10	3	63
I-81 Knoxville-Harrisburg	26	14	10	0	9	59
I-5 Bakersfield-Sacramento	32	12	10	0	3	58
I-65 Nashville-Gary	31	14	9	0	3	57
I-94 Chicago-Minneapolis	21	11	10	10	3	55
I-94 Chicago-Detroit	32	13	8	0	0	52
I-85 Montgomery-Richmond	26	12	10	0	0	48
I-78 Harrisburg-NY City	24	14	10	0	0	48
I-20 Dallas-Atlanta	22	10	8	0	6	46
I-30/I-40 Dallas-Nashville	23	11	7	0	3	44
I-81 Harrisburg-Canada	17	8	8	10	0	43
I-80 Oakland-Nevada line	18	4	10	10	0	41
I-10/I-20 Phoenix-Dallas	19	9	7	0	6	41
I-70 St. Louis-Denver	11	3	6	10	9	39
I-10 Los Angeles-Phoenix	14	14	8	0	0	36

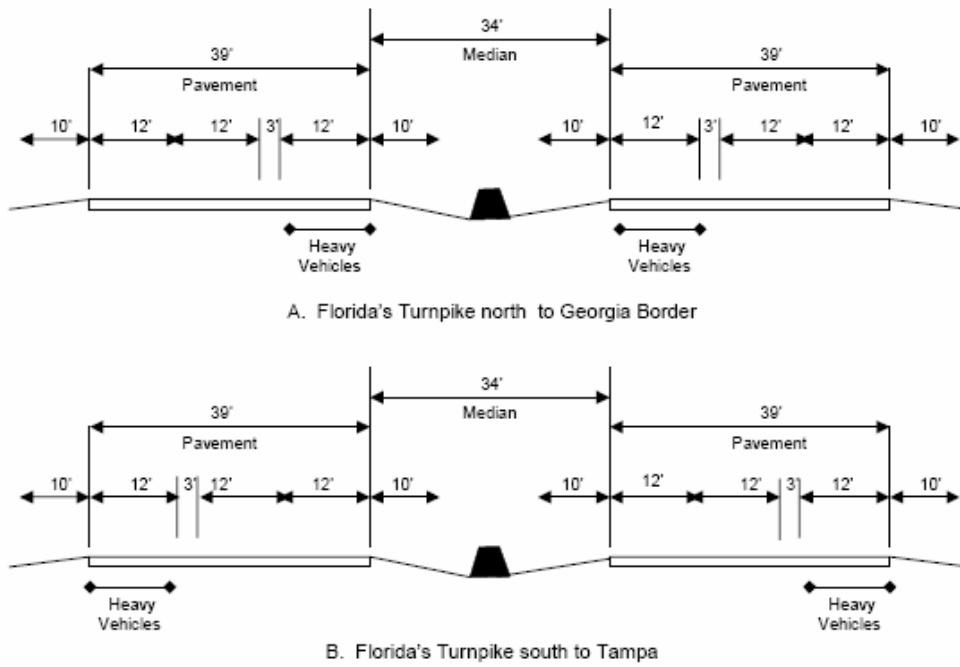
**Table 3.1 Revenue Potential Scores of Candidate Corridors <sup>(5)</sup>**

Route	State	Mileage	% <48ft	Miles <48ft	Terrain	ROW Cost 25 max	Terr. Cost 25 max	Tot. Cost Factor
I-5	CA	333	5	17	flat	1	0	101
I-15	CA	112	0	0	20% hilly	0	5	105
I-75	FL, GA to Tpk	125	100	125	flat			
	FL, Tpk-Tampa	59	10	6	flat			
	GA, I-75	355	83	295	part hilly			
	GA, I-285W	63	98	62	flat			
	TN	162	11	18	hilly			
	KY	193	13	25	hilly			
	OH	213	9	19	flat			
	MI	395	16	63	flat			
Total I-75 Corr.	1565	39	613	30% hilly	10	8	118	
I-75 OH-MI	OH	16	40	6	flat			
	MI	48	46	22	flat			
	Total I-75 short	64	44	28	flat	11	0	111
I-81	TN	75	0	0	flat			
	VA	325	23	75	hilly			
	WV	19	15	3	flat			
	MD	26	5	1	flat			
	PA	72	7	5	flat			
Total I-81 Corr.	517	16	84	50% hilly	4	12	116	
I-90	PA	49	2	1	flat			
	OH	85	9	8	flat			
	Total I-90 Corr.	134	7	9	flat	2	0	102
I-80	IA	306	7	21	flat			
	IL	163	24	39	flat			
	Total I-80 Corr.	469	13	60	flat	3	0	103
I-76 PA Tpk.	PA	359	100	359	80% hilly	25	20	145
I-65	TN	118	14	17	hilly			
	KY	137	21	29	hilly			
	IN	259	12	31	flat			
	Total I-65 Corr.	514	15	76	30% hilly	4	8	112
I-94	IL	44	80	35	flat			
	WI	353	18	64	flat			
	MN	18	75	14	flat			
	Total I-94 Corr.	415	27	112	flat	7	0	107

Table 3.2 High cost factors for the top ten corridors <sup>(5)</sup>

Route	States	Revenue Potential	Cost Score	Revenue Potential / Cost score
I-80	IA-IL	80	103	.78
I-90	OH-PA	74	102	.73
I-15	CA	63	105	.60
I-75	OH-MI	66	111	.59
I-75	FL-OH	68	118	.58
I-5	CA	52	101	.51
I-94	IL-MN	55	107	.51
I-65	TN-IN	57	112	.51
I-81	TN-PA	59	116	.51
I-76	Penn Tpk	63	145	.45

**Table 3.3 Highest Scoring Candidate Corridors <sup>(5)</sup>**



**Figure 3.1 Proposed Dedicated Truck Lane Designs for the Florida's Turnpike**