

# APPENDIX J • TRUCK LANE ANALYSIS

## Introduction

The North South Transportation Initiative has examined numerous alternatives to improve capacity, mobility and safety within the corridor. One option that was studied, at the request of the Kentucky Transportation Cabinet, was the implementation of dedicated truck lanes through the section, from the I-71/I-75 split in Boone County to the Brent Spence Bridge.

Trucks comprise a high percentage of the total vehicles in the traffic stream for this part of the corridor, as shown in Table A. Present average daily traffic volumes range from 95,500 to 161,000 over this section and truck volumes range from 23,500 to 45,100 trucks per day. The highest truck volumes have been observed between KY 18 (Burlington Pike) and KY 236 (Donaldson Road). By the year 2030, traffic volumes are projected to range from 128,000 to 226,000 vehicles per day, with daily truck volumes ranging from 38,300 to 47,800 (source: OKI).

The objective of the analysis was to determine the impacts and benefits of introducing dedicated truck lanes to the Kentucky section.

## Analysis Scenarios

Presently there are four general purpose lanes in each direction of Interstate 71/75 from the I-71/I-75 split in Boone County to the Ohio River. The underlying principle was that three lanes in each direction would remain as general purpose lanes, with the fourth lane being converted to a truck only lane. Under this scenario, no new lanes would need to be constructed. Should one truck lane not be sufficient, then additional truck lanes would be constructed (Figure J-1).

Analyses were conducted for a projected year 2030 p.m. peak hour (OKI 2030 Traffic Model). The following scenarios were analyzed:

- No Build (4 General Purpose Lanes)
- 3 General Purpose Lanes + 1 Truck Lane
- 3 General Purpose Lanes + 2 Truck Lanes (construct one additional lane)
- 3 General Purpose Lanes + 3 Truck Lanes (construct two additional lanes)
- 3 Narrow (10-foot) General Purpose Lanes + 3 Truck Lanes

## Methodology

Methodology prescribed in the 2000 Highway Capacity Manual (Chapter 23 Basic Freeway Segments) was used to determine capacity and level of service for the different scenarios. The following assumptions were made:

- Directional Distribution (D) and Peak Hour Factor (PHF) parameters based on current traffic data were assumed to be the same for year 2030 and were used in the analyses.
- Rolling terrain was assumed for most of the analysis section. The HCM uses a Passenger Car Equivalent (PCE) factor of 2.5 (i.e. one truck is the approximate equivalent of 2.5 passenger cars). For the section from Kyles Lane (KY 1072) to 12th Street, because of the steep grade, a larger PCE was used (3.0). This value was obtained from equivalency tables in the HCM.
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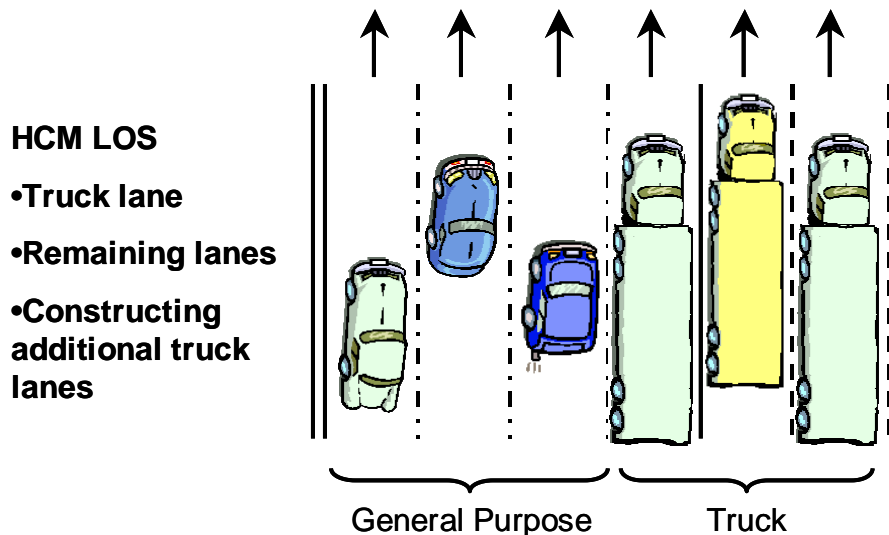
Table A  
Traffic Volumes and Truck Percentages

Section	Current*		Year 2030**	
	Average Daily Traffic	Percent Trucks	Average Daily Traffic	Percent Trucks
Brent Spence Bridge	147,000	16%	226,300	21%
KY 8 (4th/5th Streets)	138,000	18%	194,900	23%
KY 1120 (12th Street)	141,000	19%	217,400	22%
KY 1072 (Kyles Lane)	145,000	20%	206,300	22%
US 25 (Dixie Highway)	146,000	21%	195,300	22%
KY 371 (Buttermilk Pike)	159,000	23%	198,100	22%
Interstate 275	145,000	26%	202,700	22%
KY 236 (Donaldson Road)	160,000	27%	198,800	23%
KY 1017 (Turfway Road)	161,000	28%	187,500	24%
KY 18 (Burlington Pike)	121,000	29%	162,800	26%
US 42	104,000	32%	155,800	27%
KY 536 (Mt. Zion Road)	94,700	33%	145,800	28%
KY 338 (Richwood Road)	95,500	35%	127,700	30%
Interstate 71/75				

\* Source: 2001 Traffic Counts and Classification Counts, Kentucky Transportation Cabinet

\*\* Source: OKI 2030 No Build Model

Figure J-1: Analysis Procedure



Trucks were assumed to use the designated truck lanes to the point where the lanes would be filled to capacity. If the truck lanes were estimated to be at capacity, it was assumed that any remaining trucks would use the general purpose lanes.

- Autos were assumed to use only the general purpose lanes.
- For the sake of simplicity, no weaving was assumed to occur between the truck lanes and the general purpose lanes.

There are limitations to the methodology that was applied. Specifically:

- No methodology exists for analyzing truck lanes, at least at this level of analysis. The HCM converts trucks to an equivalent number of passenger cars as part of the computational procedure.
- The analysis was applied only to the basic freeway segments of I-71/I-75. It was not applied to ramp junctions, weaving sections/auxiliary lanes, or interchange areas between ramp junctions.
- Though capacity is expressed in terms of maximum flow rate (passenger cars per hour per lane), level-of-service thresholds are based on density (passenger cars per lane per mile) and are a function of flow rate and speed.

## Results

The results of the analyses are presented in Tables B through F. As a note, the two segments between US 25 and KY 1072 and between KY 236 and I-275 currently have a six-lane cross section. It was assumed that the same number of lanes would be present in the year 2030. Therefore, these two segments always have the highest volume to capacity ratios in each alternative because they each have one less lane in each direction. It should also be noted that the segment of I-75 between KY 1017 and KY 236 is currently a ten-lane cross section (including auxiliary lanes) and remains as such in the analysis.

The scenario with four general purpose lanes and no dedicated truck lanes had v/c ratios ranging from 1.0 to 1.9. The level of service for this alternative was almost entirely LOS F, except for the LOS E segment from I-71 to KY 338.

The scenario with three general purpose lanes and one dedicated truck lane indicated poorer results with the entire segment of I-75 at LOS F and v/c ratios ranging from 1.1 to 2.4 for the general purpose lanes. The dedicated truck lane was over capacity with v/c ratios from 2.1-2.9 and LOS F for all segments as well.

The scenario with three general purpose lanes and two dedicated truck lanes improved slightly with v/c ratios from 0.7 to 1.8 for the general purpose lanes and LOS F from US 42 to the Brent Spence Bridge. The general purpose lane segments between I-71 and US 42 were at LOS C and D. The two dedicated truck lanes also saw improvement in v/c ratios of 1.1 to 1.5. However, all portions of the dedicated truck lanes still remained at LOS F.

Table B  
Year 2030 LOS Summary - No Build

Number of General Purpose Lanes - 4  
Number of Truck Lanes - 0

Section	Traffic Characteristics		General Purpose Lanes			Truck Lanes	
	ADT	Pct. Trucks	Total Vehicles	v/c	LOS	v/c	LOS
Brent Spence Bridge	226,300	21%	226,300	1.7	F	NA	NA
KY 8 (4th/5th Streets)	194,900	23%	194,900	1.5	F	NA	NA
KY 1120 (12th Street)	217,400	22%	217,400	1.6	F	NA	NA
KY 1072 (Kyles Lane)	206,300	22%	206,300	1.4	F	NA	NA
US 25 (Dixie Highway)	195,300	22%	195,300	1.3	F	NA	NA
KY 371 (Buttermilk Pike)	198,100	22%	198,100	1.4	F	NA	NA
Interstate 275	202,700	22%	202,700	1.4	F	NA	NA
KY 236 (Donaldson Road)	198,800	23%	198,800	1.2	F	NA	NA
KY 1017 (Turfway Road)	187,500	24%	187,500	1.4	F	NA	NA
KY 18 (Burlington Pike)	162,800	26%	162,800	1.2	F	NA	NA
US 42	155,800	27%	155,800	1.2	F	NA	NA
KY 536 (Mt. Zion Road)	145,800	28%	145,800	1.1	F	NA	NA
KY 338 (Richwood Road)	127,700	30%	127,700	1.0	E	NA	NA
Interstate 71/75							

Table C  
Year 2030 LOS Summary - One Truck Lane

Number of General Purpose Lanes - 3  
Number of Truck Lanes - 1

Section	Traffic Characteristics		General Purpose Lanes			Truck Lanes	
	ADT	Pct. Trucks	Total Vehicles	v/c	LOS	v/c	LOS
Brent Spence Bridge	226,300	21%	209,400	1.8	F	2.5	F
KY 8 (4th/5th Streets)	194,900	23%	178,700	1.6	F	2.4	F
KY 1120 (12th Street)	217,400	22%	204,000	1.9	F	2.9	F
KY 1072 (Kyles Lane)	206,300	22%	189,200	1.6	F	2.3	F
US 25 (Dixie Highway)	195,300	22%	178,000	1.5	F	2.2	F
KY 371 (Buttermilk Pike)	198,100	22%	180,800	1.5	F	2.2	F
Interstate 275	202,700	22%	185,700	1.6	F	2.4	F
KY 236 (Donaldson Road)	198,800	23%	184,100	1.3	F	2.7	F
KY 1017 (Turfway Road)	187,500	24%	171,600	1.6	F	2.4	F
KY 18 (Burlington Pike)	162,800	26%	146,700	1.4	F	2.3	F
US 42	155,800	27%	139,700	1.3	F	2.3	F
KY 536 (Mt. Zion Road)	145,800	28%	130,300	1.2	F	2.3	F
KY 338 (Richwood Road)	127,700	30%	111,900	1.1	F	2.1	F
Interstate 71/75							

Table D  
Year 2030 LOS Summary - Two Truck Lanes

Number of General Purpose Lanes - 3  
Number of Truck Lanes - 2

Section	Traffic Characteristics		General Purpose Lanes			Truck Lanes	
	ADT	Pct. Trucks	Total Vehicles	v/c	LOS	v/c	LOS
Brent Spence Bridge	226,300	21%	183,700	1.3	F	1.2	F
KY 8 (4th/5th Streets)	194,900	23%	154,300	1.2	F	1.2	F
KY 1120 (12th Street)	217,400	22%	178,500	1.3	F	1.5	F
KY 1072 (Kyles Lane)	206,300	22%	165,100	1.2	F	1.1	F
US 25 (Dixie Highway)	195,300	22%	154,800	1.1	F	1.1	F
KY 371 (Buttermilk Pike)	198,100	22%	157,600	1.1	F	1.1	F
Interstate 275	202,700	22%	160,900	1.2	F	1.2	F
KY 236 (Donaldson Road)	198,800	23%	159,100	1.0	F	1.3	F
KY 1017 (Turfway Road)	187,500	24%	148,000	1.1	F	1.2	F
KY 18 (Burlington Pike)	162,800	26%	124,000	0.9	F	1.2	F
US 42	155,800	27%	117,100	0.9	D	1.2	F
KY 536 (Mt. Zion Road)	145,800	28%	107,300	0.8	D	1.1	F
KY 338 (Richwood Road)	127,700	30%	90,400	0.7	C	1.1	F
Interstate 71/75							

Table E  
Year 2030 LOS Summary - Three Truck Lanes

Number of General Purpose Lanes - 3  
Number of Truck Lanes - 3

Section	Traffic Characteristics		General Purpose Lanes			Truck Lanes	
	ADT	Pct. Trucks	Total Vehicles	v/c	LOS	v/c	LOS
Brent Spence Bridge	226,300	21%	179,000	1.2	F	0.8	D
KY 8 (4th/5th Streets)	194,900	23%	150,000	1.1	F	0.8	D
KY 1120 (12th Street)	217,400	22%	170,400	1.2	F	1.0	E
KY 1072 (Kyles Lane)	206,300	22%	162,000	1.1	F	0.8	D
US 25 (Dixie Highway)	195,300	22%	152,500	1.1	F	0.7	D
KY 371 (Buttermilk Pike)	198,100	22%	155,400	1.1	F	0.7	D
Interstate 275	202,700	22%	157,100	1.1	F	0.8	D
KY 236 (Donaldson Road)	198,800	23%	152,800	0.9	E	0.9	E
KY 1017 (Turfway Road)	187,500	24%	144,200	1.1	F	0.8	D
KY 18 (Burlington Pike)	162,800	26%	120,900	0.9	F	0.8	D
US 42	155,800	27%	114,100	0.8	D	0.8	D
KY 536 (Mt. Zion Road)	145,800	28%	104,500	0.8	D	0.8	D
KY 338 (Richwood Road)	127,700	30%	89,000	0.7	C	0.7	C
Interstate 71/75							

Table F  
Year 2030 LOS Summary - Three Truck Lanes and Narrow General Purpose Lanes

Number of General Purpose Lanes - 3 10-ft lanes  
Number of Truck Lanes - 3

Section	Traffic Characteristics		General Purpose Lanes			Truck Lanes	
	ADT	Pct. Trucks	Total Vehicles	v/c	LOS	v/c	LOS
Brent Spence Bridge	226,300	21%	179,000	1.3	F	0.8	D
KY 8 (4th/5th Streets)	194,900	23%	150,000	1.1	F	0.8	D
KY 1120 (12th Street)	217,400	22%	170,400	1.3	F	1.0	E
KY 1072 (Kyles Lane)	206,300	22%	162,000	1.2	F	0.8	D
US 25 (Dixie Highway)	195,300	22%	152,500	1.1	F	0.7	D
KY 371 (Buttermilk Pike)	198,100	22%	155,400	1.1	F	0.7	D
Interstate 275	202,700	22%	157,100	1.2	F	0.8	D
KY 236 (Donaldson Road)	198,800	23%	152,800	1.0	F	0.9	E
KY 1017 (Turfway Road)	187,500	24%	144,200	1.1	F	0.8	D
KY 18 (Burlington Pike)	162,800	26%	120,900	0.9	F	0.8	D
US 42	155,800	27%	114,100	0.9	D	0.8	D
KY 536 (Mt. Zion Road)	145,800	28%	104,500	0.8	D	0.8	D
KY 338 (Richwood Road)	127,700	30%	89,000	0.7	C	0.7	C
Interstate 71/75							

**Conclusions**

Both scenarios with three general purpose lanes (ten foot lanes or twelve foot lanes) and three dedicated truck lanes had similar results. For the narrow lane scenario, capacity of the general purpose lanes was slightly less. The v/c ratios for the general purpose lanes improved only slightly from the previous scenario with values ranging from 0.7 to 1.3. This was attributable to the assumption that all trucks would be using the dedicated truck lanes and there would be no trucks using the general purpose lanes. Again, the section from US 42 to the Brent Spence Bridge is at LOS F and the sections from I-71 to US 42 were at LOS C and D. The presence of a third truck lane greatly improved the v/c ratios and level of service for the dedicated truck lanes. The v/c ratios ranged from 0.7 to 1.0 and the level of services range from LOS C to E along the entire section analyzed.

From the analysis it is apparent that the use of dedicated truck lanes would only be beneficial if three dedicated truck lanes were present. However, the general purpose lanes do not benefit greatly from the presence of exclusive truck lanes. Even with three dedicated truck lanes the level of service from US 42 to the Brent Spence Bridge remains at LOS F, except for the LOS E segment between KY 1017 and KY 236. This segment would have four lanes in one direction since it is already a ten-lane section of interstate.

The alternative considering three narrow (ten foot) general purpose lanes and three dedicated truck lanes shows little distinction from the same alternative with twelve foot lanes. For the narrow lane scenario, the level of service remains at LOS F from US 42 to the Brent Spence Bridge and the dedicated truck lanes range from LOS C to E. The main difference

between the two alternatives is that the reduction in lane width reduces the free-flow speed on the segment by about seven mph. In this analysis, the reduction in free-flow speed made little impact on the level of service, except for the change from LOS E to F for the segment between KY 1017 and KY 236.

There are a number of issues that arise when considering the reduction of general purpose lanes and the addition of one or more dedicated truck lanes. Enforcement is one of the most important. As truck lanes approach capacity, truck drivers will have a tendency to use the general purpose lanes instead. Strong enforcement would be required to prevent this from occurring.

Location of the dedicated truck lanes is another issue. The most logical place would be on the right-hand side of the interstate. However, because entrance and exit ramp junctions usually are located to the right as well, there would be interactions with merging and diverging automobiles taking place. Thus, it would be impossible to restrict and dedicate lanes for use entirely by trucks; autos must be allowed as well. The assumption, then, that trucks will use truck lanes and autos will use only general purpose lanes is overly simplistic.

Locating truck lanes on the left-hand side of the road would result in high weaving activity between these lanes and ramps. Also, speed differentials between autos and trucks, especially on the left-hand side of the interstate, would make safety problems even worse.

Economically, this could be a very expensive endeavor, particularly if additional lanes are constructed. These preliminary results indicate that costs would far outweigh the benefits.

One of the alternatives involves narrowing the general purpose lanes from 12 feet to 10 feet in order to minimize the right-of-way required for building additional truck lanes. This would reduce the capacity and thus worsen the level of service for those lanes without providing any additional capacity for the truck lanes. Though difficult to quantify, it is assumed that the rate of incidents, including crashes, would increase with narrower lanes. Compounding this is the fact that today's vehicle fleet is growing larger with the proliferation of full-size pickup trucks and sport utility vehicles (SUVs). Many of the full-size pickups and SUVs are as wide as six and one-half feet. Finally, it is unlikely that narrowing interstate lanes from twelve to ten feet would gain federal approval.

It should be pointed out again that this was a cursory, broad-based analysis intended to answer basic questions about the feasibility of adding dedicated truck lanes. The Highway Capacity Manual is limited in its application in that it does not analyze trucks specifically; instead, trucks are converted to passenger car equivalents (PCEs). More sophisticated analytical tools do exist, but this level of analysis is sufficient from a decision-making perspective.