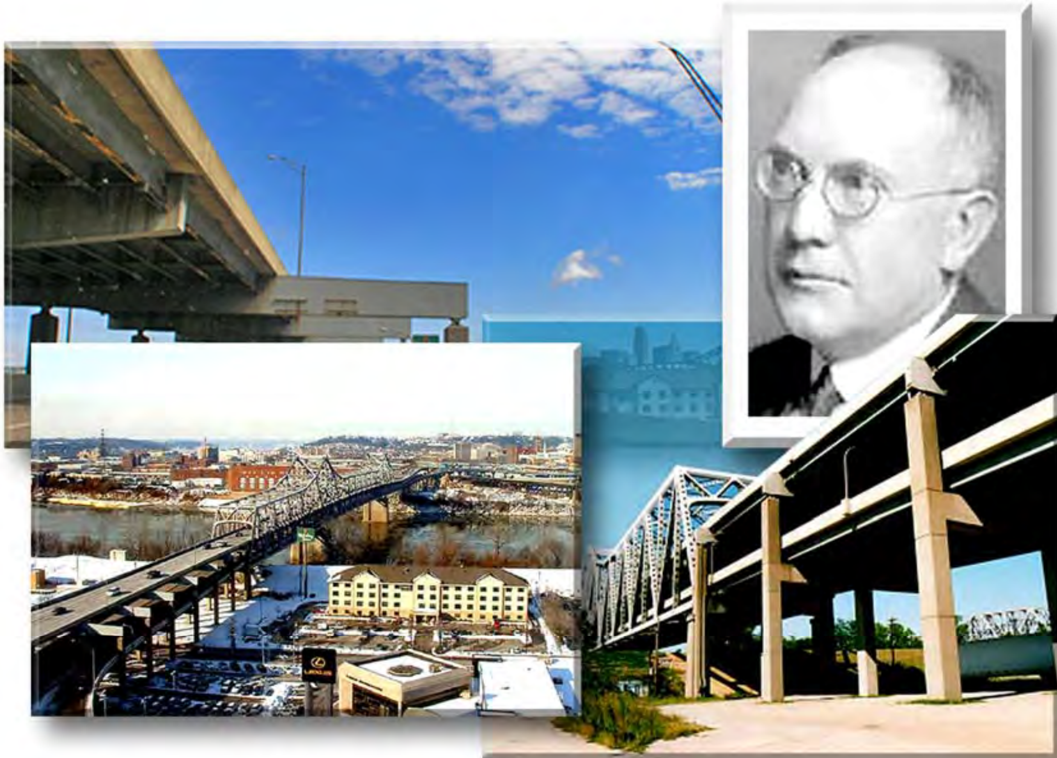

BRENT SPENCE BRIDGE
Truck Ban Analysis

December 19, 2007

Ohio-Kentucky-Indiana Regional Council of Governments
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Introduction and Background

The Brent Spence Bridge on I-71/75 across the Ohio River is arguably the single most important piece of transportation infrastructure the Ohio-Kentucky-Indiana (OKI) region. It is also one of the most congested.

The bridge connecting Covington, Kentucky with Cincinnati, Ohio opened in 1963. It was designed to carry 80,000 vehicles per day; currently, the bridge carries more than 150,000 vehicles daily and is projected to carry 200,000 each day by 2030. High traffic volumes generally relate to higher numbers of crashes and the Brent Spence Bridge is no exception.

While the bridge is structurally sound it is functionally obsolete. Heavy congestion and frequent accidents on the bridge routinely gridlock traffic on two major interstates. The bridge not only carries traffic through the Greater Cincinnati/Northern Kentucky area, it is a vital link for north-south commerce between Michigan and Florida.

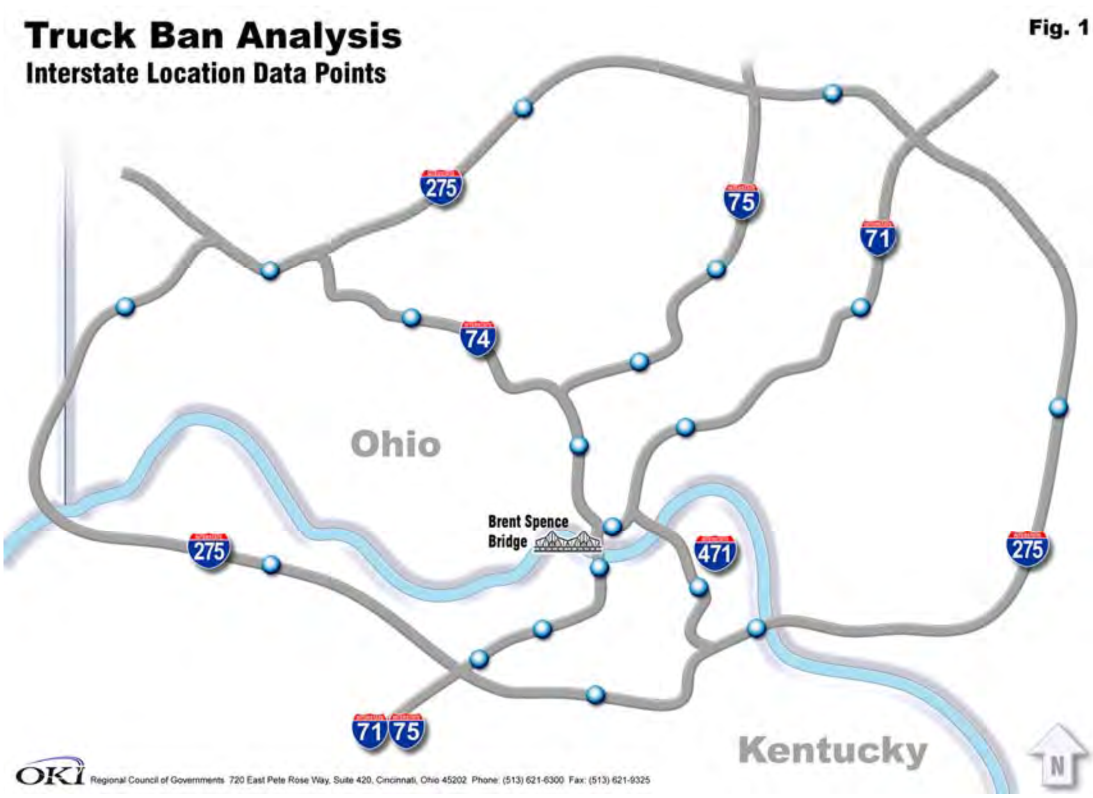
The Kentucky Transportation Cabinet (KYTC) and the Ohio Department of Transportation (ODOT) have begun the process to evaluate alternatives for replacing the bridge. The bridge replacement project is currently funded through the right of way acquisition. Future funding will go to the final design and construction phases. KYTC and ODOT anticipate selecting a preferred alternative in the fall of 2008.

The Brent Spence Bridge is typical of the cantilever truss design, with a main span of 830.5 feet and approach spans each measuring 453 feet. It opened in November 1963 with its two decks striped for three lanes each. In 1986 the emergency shoulders were eliminated and the decks were restriped for four 11-foot lanes in each direction from three 12-foot lanes to accommodate more traffic.

Study Purpose

On October 1, 2007 OKI received a request from the Honorable Butch Callery, mayor of the City of Covington to study the effects of banning trucks from using the Brent Spence (I-71/75) Bridge during the morning and afternoon rush hours.

Specifically, this report investigates the potential for improving safety on the Brent Spence (I-71/75) Bridge by estimating the impacts of banning large trucks that originate outside the I-275 beltway and have no stops within the beltway from traveling on I-71/75 during the morning (6:00 AM – 9:00 AM) and afternoon (3:00 PM – 6:00 PM) weekday peak periods. Figure 1 on the following page depicts the study area.



Methodology

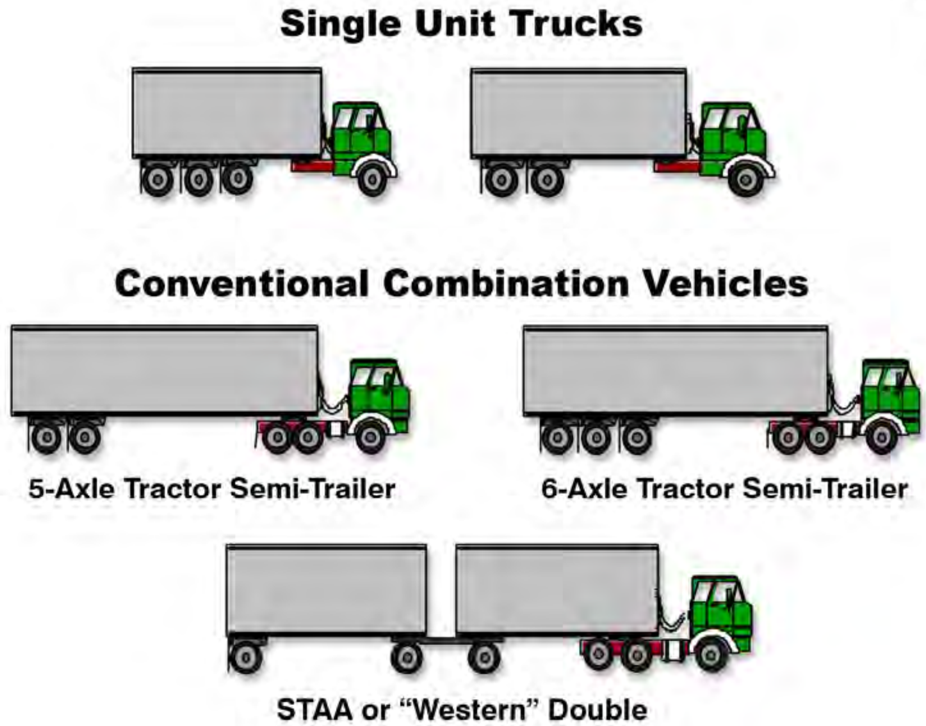
Travel Patterns

The impact of the truck ban on safety was measured by estimating the net change of severe crashes on the study area freeway system by first tracking the estimated changes in truck travel patterns at representative locations with and without a truck ban during peak periods. The various locations on the interstates identified for analysis are those for which the most recent traffic count data was available and are represented by the dots in Figure 1.

Changes in travel patterns were estimated using the OKI travel model. The model is a set of computer programs designed to estimate traffic flows and is used to forecast travel. The model estimates travel using information about where people live, work, shop, etc., within and through the region. Also incorporated into the model are a representation of the OKI region's highway and transit network alignments, capacity and operational characteristics. The model simulates average weekday traffic by hour of the day and can distinguish between the various travel modes including drive alone (auto or light truck), rideshare (auto or light truck), transit (bus), single unit (heavy) truck, and multi-unit truck (heavy, semi truck with trailer).

For purposes of this study, "truck" was defined as large single or multi-unit trucks because these are the types most likely to be the longer haul trips that would not have a stop within the beltway and would be impacted by a ban. They do not include pickup or panel trucks. The Figure 2 below indicates the type of vehicles considered trucks.

Fig. 2



The OKI travel model was applied to two conditions. First was the Baseline Scenario in which the model replicates year 2005 conditions. The current highway network configuration was used and traffic estimates were produced without any changes in where trucks were permitted to operate. The second scenario was the Truck Ban Scenario in which 2005 travel was once again applied but restrictions were placed on the routes available to trucks. Through trucks were not permitted to use I-71/75 between I-275 in Erlanger to the Ohio River during morning and afternoon weekday peak hours. Through trucks were those not having a pick-up or delivery stop within the I-275 beltway; peak hours were defined as 6:00 - 9:00 AM and 3:00 - 6:00 PM. The highway network was adjusted to force a diversion of northbound trucks using I-71/75 to use I-275 in Northern Kentucky. Southbound traffic from Ohio had no restrictions other than I-71/75 between I-275 in Erlanger to the Ohio River.

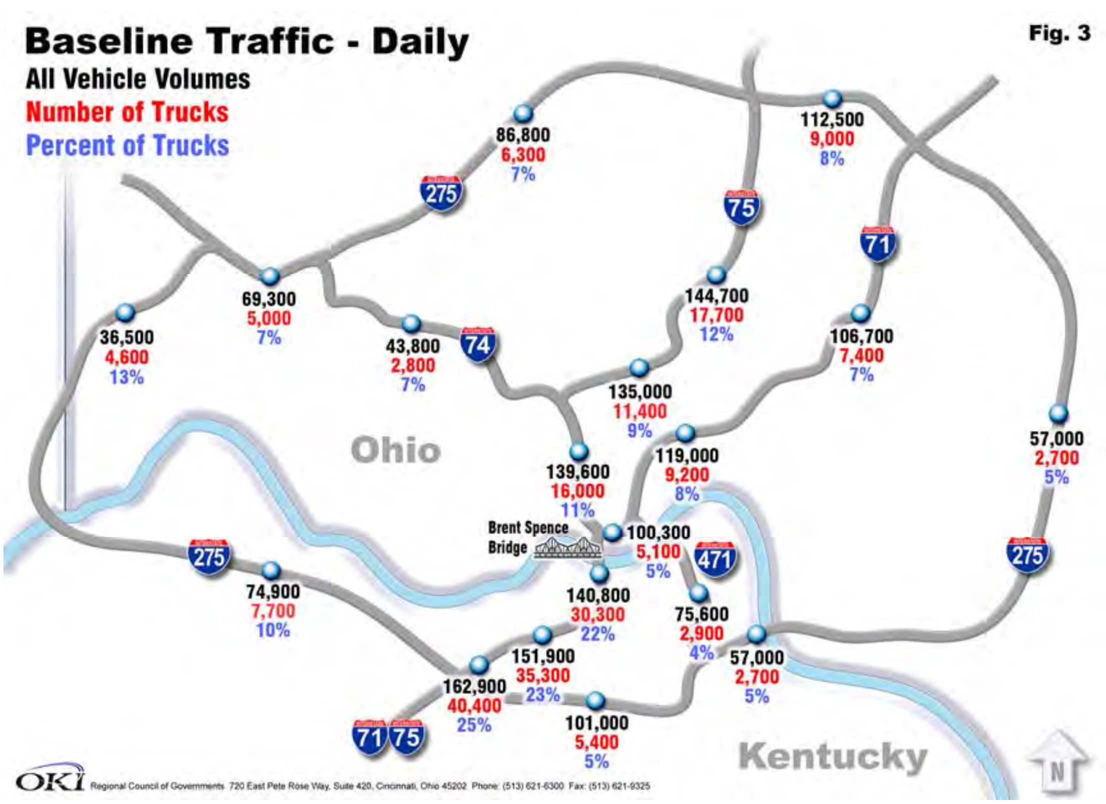
Traffic

To understand baseline conditions, OKI gathered recent vehicle classification counts collected in the region in 2005 and 2006 at several key locations. The observed counts were from mechanical vehicle classification counts conducted by OKI, KYTC or ODOT over multiple days. Application of the travel model under the Baseline and Truck Ban scenarios was used to estimate the relative change in traffic pre- and post-ban. The relative change (percent difference) was then applied to the observed count volumes to arrive at the post-ban traffic estimates.

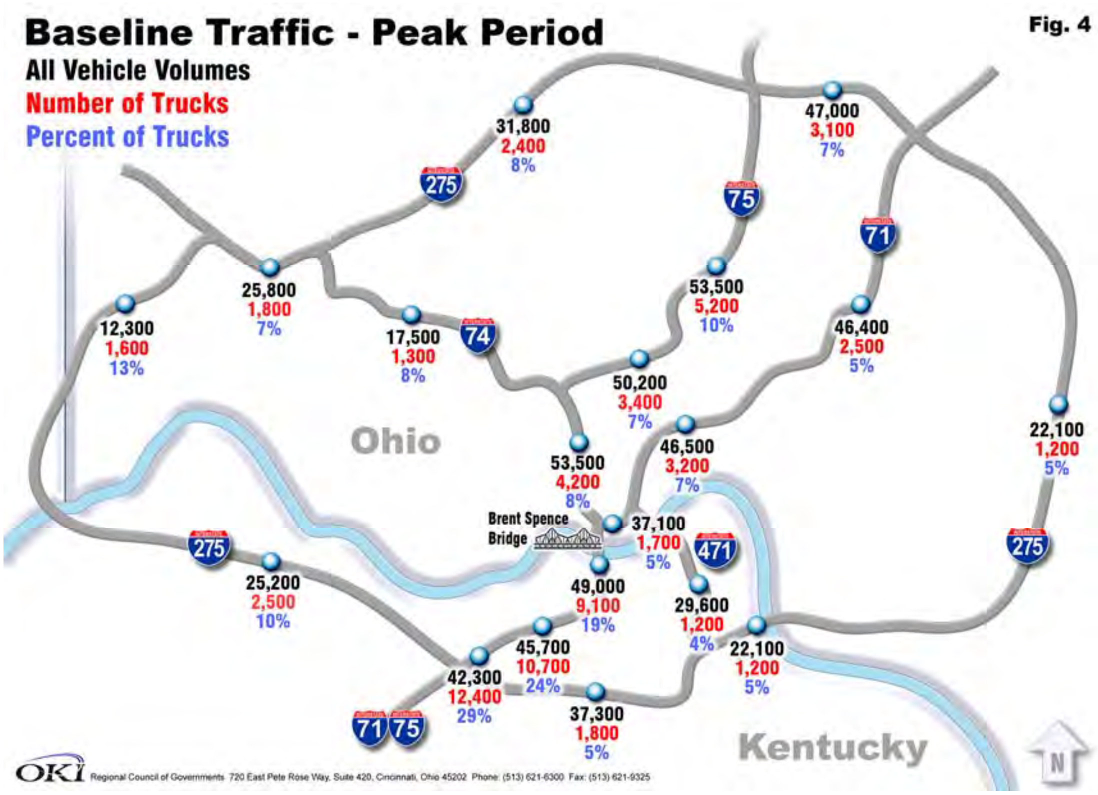
Crash Data
Individual crash records obtained from KYTC and ODOT for 2005 and 2006 contained exact location information. The crash locations were aggregated to roadway segments primarily defined by the junction of each interstate roadway in the study area. These aggregations were combined with observed traffic count data during morning and afternoon peak periods at the key locations described above to develop an observed peak period severe crash rate. (Severe crashes were those resulting in personal injury or fatality). An attempt was made to derive a truck peak period crash rate but several segments had no severe crashes involving trucks, thus no rate could be calculated. Crash rates are a function of the number of crashes and the vehicle miles of travel (number of vehicles multiplied by the distance traveled).

Baseline Scenario

Traffic
Figure 3 shows the baseline average daily traffic volumes, daily truck volumes and daily percentage of trucks for each location. Daily volumes range from a high of approximately 163,000 vehicles per day on I-75 in northern Kentucky just north of I-275 to a low of 37,000 on I-275 at the westernmost location in Hamilton County.



During peak periods, a volume of 49,000 vehicles occurred at a point just south of the Brent Spence Bridge. Approximately 19 percent of these vehicles were heavy trucks. North of the bridge on I-75, peak period volumes exceeded 53,000. The lowest peak period volume was recorded at the westernmost Hamilton County location.



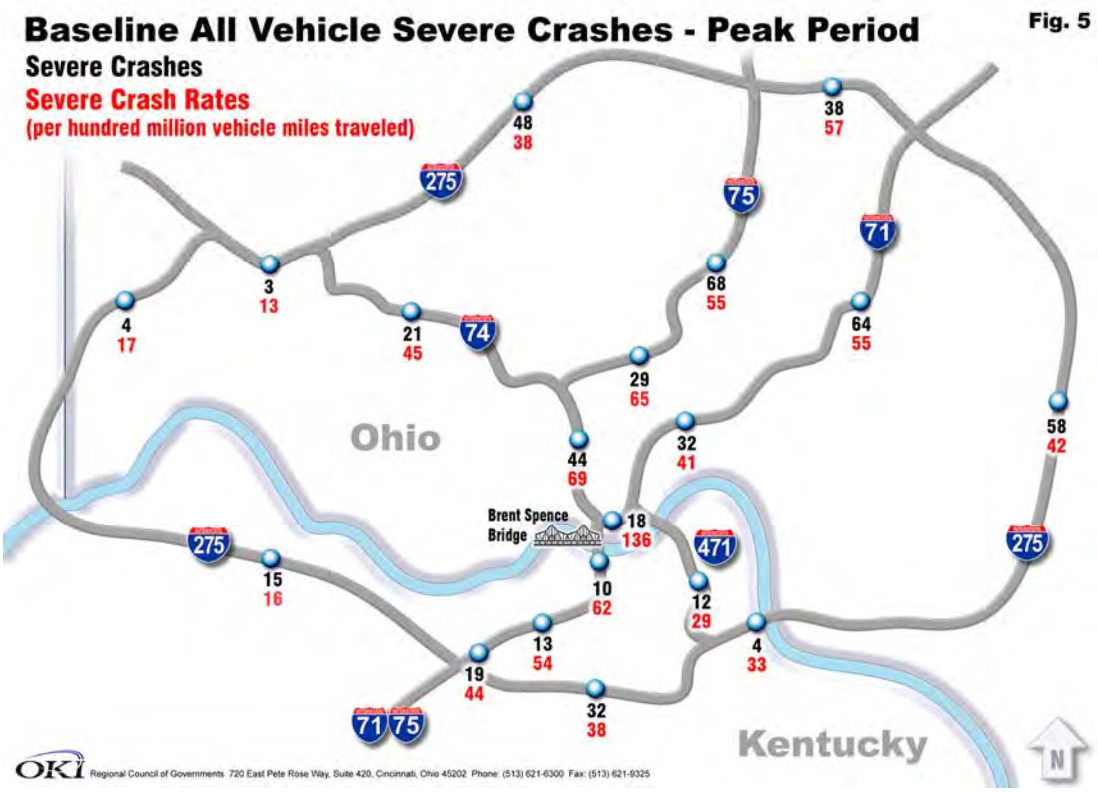
Crashes
As noted above, crash data was collected from the state departments of transportation and processed to calculate a peak period crash rate. By far, the peak period crash rate involving all vehicles was highest on Ft. Washington Way. The segment experiencing the highest number of severe crashes was I-75 between the Norwood Lateral (SR-562) and I-275 and the segment of I-71 between the Norwood Lateral (SR-562) and I-275. The number of severe crashes on these segments averaged 68 and 64 respectively. Each of these segments carries high volumes of truck and total traffic. The number of crashes and crash rates are presented in Figure 5.

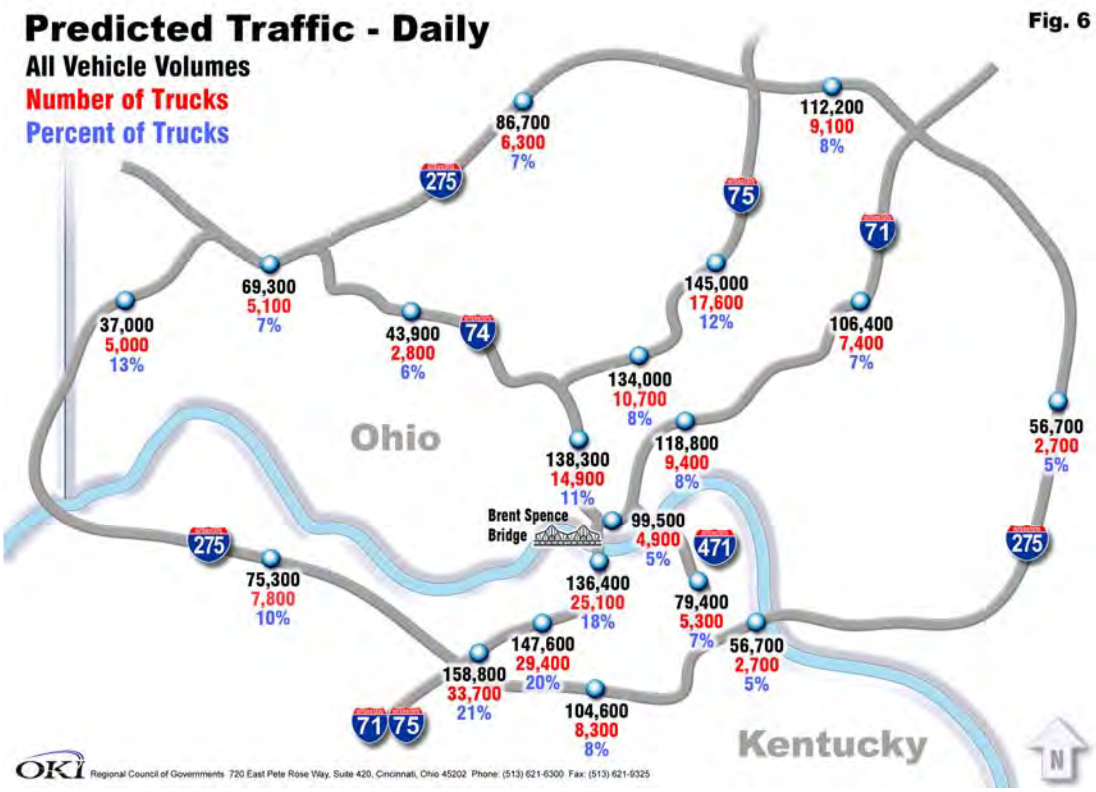
Truck Ban Scenario

Traffic
Figure 6 shows the estimated daily traffic volumes, peak period truck volumes and daily percentage of trucks for each location with the truck ban in place. The percent difference between travel model runs with and without the ban are applied to the observed count volumes to estimate the change in traffic. Volumes range from a high of approximately

158,000 vehicles per day on I-75 in northern Kentucky just north of I-275 to a low of 37,000 on I-275, the westernmost location in the study area.

Figure 7 shows the predicted peak period traffic volumes for total vehicles as well as the number and percent of trucks. Peak period all vehicle post-ban volumes range from a high of approximately 54,000 on I-75 between the Norwood Lateral (SR-562) and I-275 to a low of under 13,000 on I-275 at the westernmost location in Hamilton County. The highest post-ban peak period truck volume is predicted to be 5,600 on I-75 in northern Kentucky, just north of I-275.




Predicted Traffic - Daily
Fig. 6
All Vehicle Volumes
Number of Trucks
Percent of Trucks
86,700
6,300
7%
112,200
9,100
8%
275
75
71
37,000
5,000
13%
69,300
5,100
7%
43,900
2,800
6%
74
145,000
17,600
12%
134,000
10,700
8%
106,400
7,400
7%
Ohio
138,300
14,900
11%
118,800
9,400
8%
56,700
2,700
5%
Brent Spence
Bridge
99,500
4,900
5%
471
275
275
75,300
7,800
10%
136,400
25,100
18%
79,400
5,300
7%
147,600
29,400
20%
56,700
2,700
5%
158,800
33,700
21%
104,600
8,300
8%
71
75
Kentucky
N
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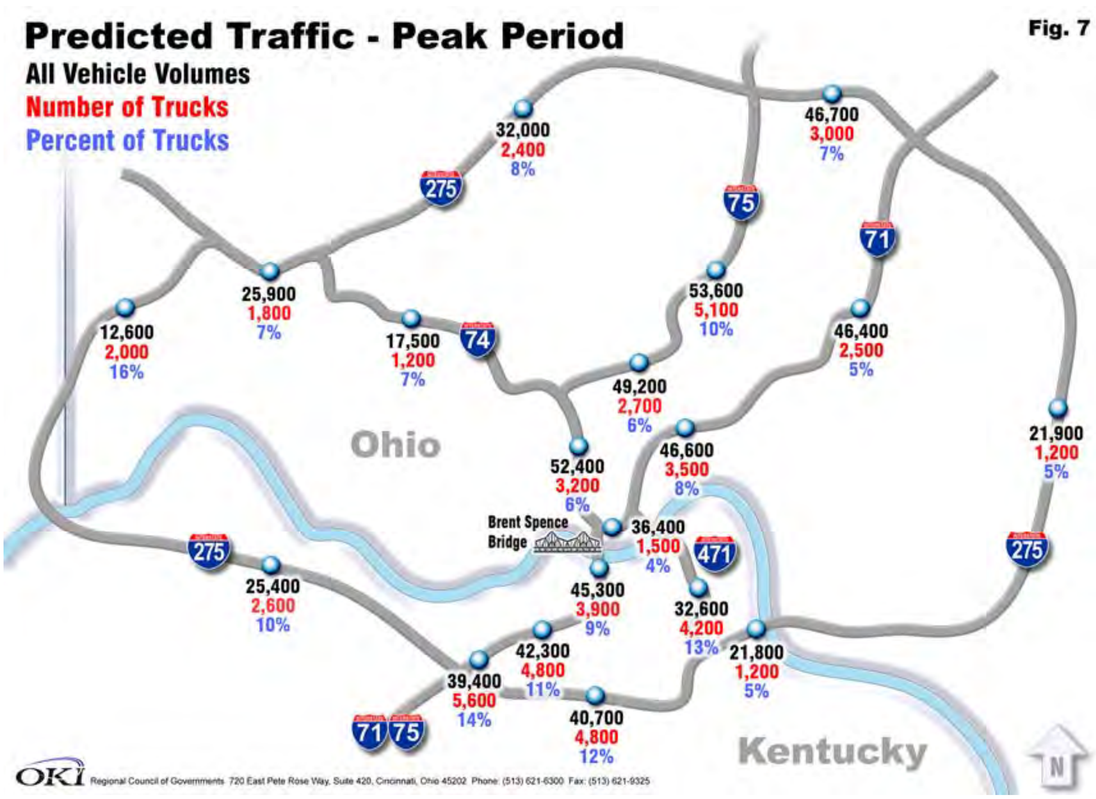
Predicted Traffic - Peak Period
Fig. 7
All Vehicle Volumes
Number of Trucks
Percent of Trucks
32,000
2,400
8%
46,700
3,000
7%
275
75
71
12,600
2,000
16%
25,900
1,800
7%
17,500
1,200
7%
74
53,600
5,100
10%
49,200
2,700
6%
46,400
2,500
5%
Ohio
52,400
3,200
6%
46,600
3,500
8%
21,900
1,200
5%
Brent Spence
Bridge
36,400
1,500
4%
471
275
275
25,400
2,600
10%
45,300
3,900
9%
32,600
4,200
13%
42,300
4,800
11%
21,800
1,200
5%
39,400
5,600
14%
40,700
4,800
12%
71
75
Kentucky
N
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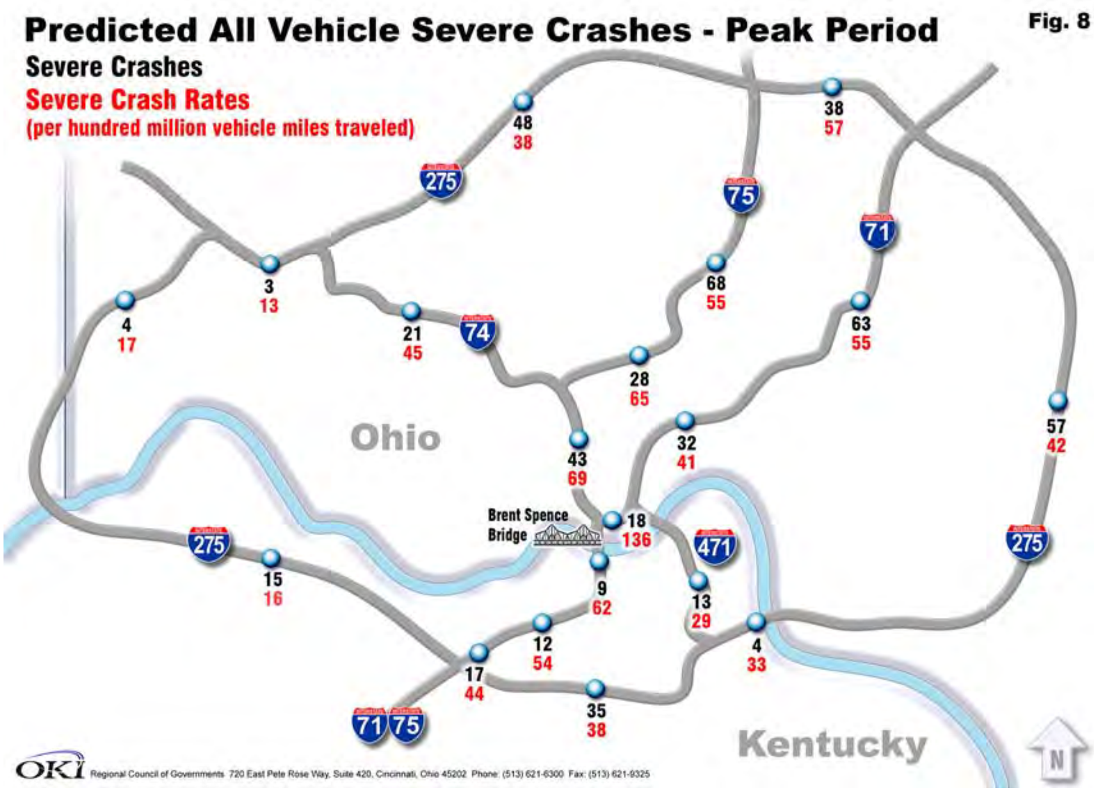
Crashes
As noted above, crash data was collected from the state departments of transportation and processed to calculate a peak period crash rate. The number of peak period crashes for each segment with the truck ban in place was estimated by applying the existing crash rates to the predicted volumes. The number of crashes and crash rates are presented in Figure 8.



Results

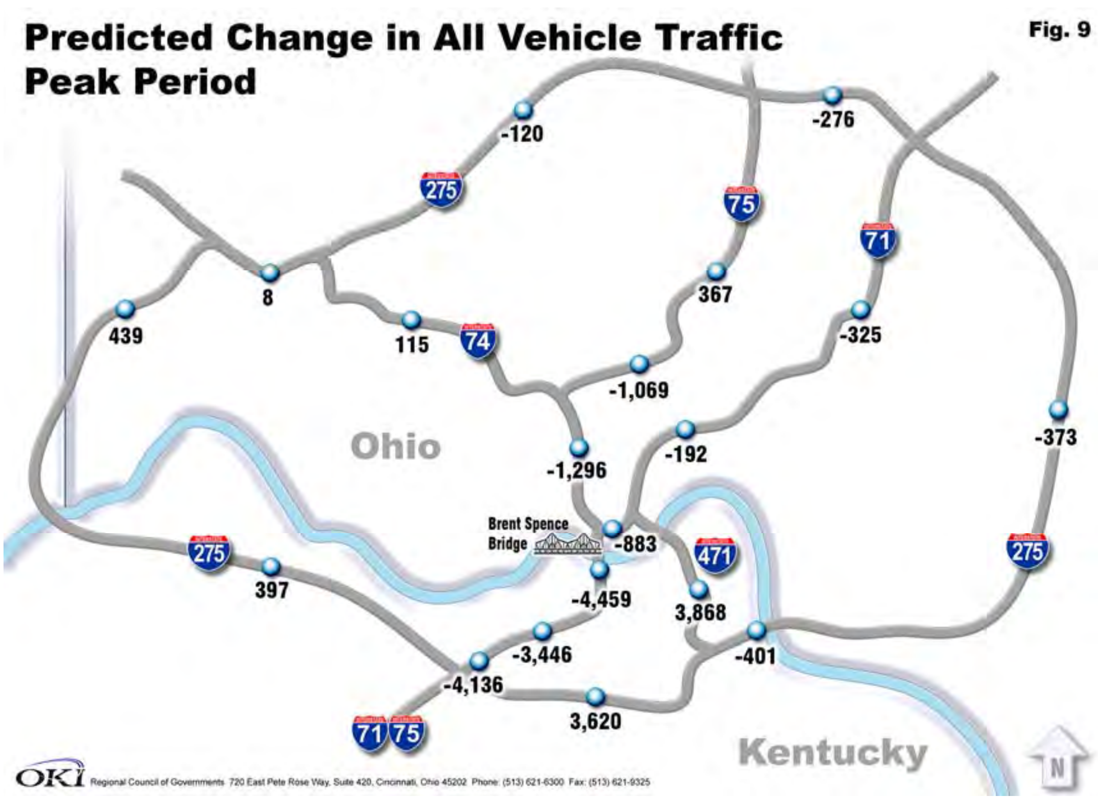
The impact of banning trucks without a stop (through trucks) from using I-71/75 within the I-275 beltway were estimated by comparing the peak period travel volumes and crashes in the baseline condition to those with the truck ban in place. Figure 9 presents the predicted change in peak period volumes. Figure 10 presents the predicted change in the number of peak period crashes.

As expected, the truck ban caused a diversion of traffic to various routes in the region. Most segments experienced modest changes. The most substantial impact was expected on three portions of interstate highways: I-71/75, I-275 from I-71/75 to I-471 and I-471. The largest reduction in traffic was predicted for segments on I-71/75 within the northern Kentucky portion of the beltway. While the through truck volumes declined by approximately 5,000 per day, this reduction induced traffic to shift from other routes, yielding a net decline of about 3,800 vehicles per day. The through truck traffic was diverted primarily to I-275 and I-471 in northern Kentucky.

Because the volumes of diverted traffic were relatively small compared to the overall volume, the impact on severe crashes within the system was minor. The change in the expected severe crashes (personal injury or fatality) on a regional basis was a reduction of two crashes per year. The number of crashes along the three I-75 segments between I-275 and the Brent Spence Bridge in northern Kentucky combined were reduced by three. The number of crashes on I-275 and I-471 in northern Kentucky combined were increased by four. In essence, the crashes were shifted from one segment group to another.

Though the crash rate for the I-75 segment group was higher than the I-275/I471 segment group the travel distance along the I-275/I-471 segment group was approximately seven miles longer. The extra travel distance accounts for the slight net increase in crashes for I-275 and I-471 segments.

This extra travel distance has other impacts on the vehicles using the diverted segments in the form of an additional travel time of approximately 5.5 minutes per vehicle. The resulting economic and emissions impacts are tabulated in the table below. For trucks this means additional operating costs in driver time, fuel, and maintenance. It is estimated that the total additional costs to the trucking industry would be $5 million per year. The emissions resulting from the additional vehicle miles of travel are estimated to be 313,000 pounds per year for VOC, NOx, CO and PM2.5. However, these diverted truck emissions are offset by a reduction in emissions by vehicles whose movement was now expedited.



Predicted Change in All Vehicle Severe Crashes

Peak Period

Fig. 10

Truck Ban Impact

Table 1

Estimated Impacts to the Trucking Industry	Per Day	Per Year
Additonal truck miles of travel	30,000	7,800,000
Additional hours of truck operation	600	156,000
Additional operating costs	$3,750	$975,000
Additional wage costs	$15,600	$4,056,000
Total additional costs	$19,350	$5,031,000
Estimated Impact on Emissions (lbs.)		
Additional volatile organic compounds (VOC)	2.65	702
Additional oxides of nitrogen (NOx)	-.14	-26
Additional carbon monoxide (CO)	-2.14	-60
Additional fine particulate matter (PM 2.5)	0.01	3

Conclusion

A ban of through trucks on the northern Kentucky portion of I-71/75 has no substantial benefits. Reduction in severe crashes is expected to be very modest. Operating costs to the trucking industry and additional emissions negatively impact the region. The practical difficulties in the enforcement of a truck ban must also to be considered in the deployment of such a ban.

Appendix 1: Daily and Peak Hour Truck Volume

Location	Peak Hours	Total Truck	Total Vehicles
1	Peak Hours	Total Truck	Total Vehicles
	6:00am-9:00am	3,748	24,514
	3:00pm-6:00pm	5,338	24,530
	Total Peak	9,086	49,044
	Avg Daily	30,323	140,824
2	Peak Hours	Total Truck	Total Vehicles
	6:00am-9:00am	703	6,292
	3:00pm-6:00pm	851	6,013
	Total Peak	1,554	12,305
	Avg Daily	4,552	36,532
3	Peak Hours	Total Truck	Total Vehicles
	6:00am-9:00am	928	13,193
	3:00pm-6:00pm	848	12,614
	Total Peak	1,775	25,807
	Avg Daily	5,094	69,270
4	Peak Hours	Total Truck	Total Vehicles
	6:00am-9:00am	1,129	16,460
	3:00pm-6:00pm	1,294	15,333
	Total Peak	2,422	31,792
	Avg Daily	6,287	86,768
5	Peak Hours	Total Truck	Total Vehicles
	6:00am-9:00am	1,527	23,132
	3:00pm-6:00pm	1,548	23,857
	Total Peak	3,075	46,989
	Avg Daily	9,070	112,480
6,7	Peak Hours	Total Truck	Total Vehicles
	6:00am-9:00am	571	11,272
	3:00pm-6:00pm	579	10,820
	Total Peak	1,150	22,092
	Avg Daily	2,736	57,052
8	Peak Hours	Total Truck	Total Vehicles
	6:00am-9:00am	807	18,739
	3:00pm-6:00pm	995	18,562
	Total Peak	1,802	37,301
	Avg Daily	5436	101014
9	Peak Hours	Total Truck	Total Vehicles
	6:00am-9:00am	1,047	12,818
	3:00pm-6:00pm	1,433	12,391
	Total Peak	2,480	25,209
	Avg Daily	7677	74929
10	Peak Hours	Total Truck	Total Vehicles
	6:00am-9:00am	4,639	20,188
	3:00pm-6:00pm	7,722	22,088
	Total Peak	12,361	42,276
	Avg Daily	40,352	162,918

Appendix 1: Daily and Peak Hour Truck Volume (continued)

Location			
11	**Peak Hours**	**Total Truck**	**Total Vehicles**
	6:00am-9:00am	2,435	26,902
	3:00pm-6:00pm	1,735	26,565
	Total Peak	4,170	53,467
	Avg Daily	15,965	139,645
12	**Peak Hours**	**Total Truck**	**Total Vehicles**
	6:00am-9:00am	882	9,012
	3:00pm-6:00pm	467	8,465
	Total Peak	1,349	17,477
	Avg Daily	2,834	43,803
13	**Peak Hours**	**Total Truck**	**Total Vehicles**
	6:00am-9:00am	1,735	24,909
	3:00pm-6:00pm	1,705	25,339
	Total Peak	3,440	50,249
	Avg Daily	11,416	135,034
14	**Peak Hours**	**Total Truck**	**Total Vehicles**
	6:00am-9:00am	2,412	26,884
	3:00pm-6:00pm	2,768	26,630
	Total Peak	5,181	53,514
	Avg Daily	17,696	144,680
15	**Peak Hours**	**Total Truck**	**Total Vehicles**
	6:00am-9:00am	584	15,361
	3:00pm-6:00pm	600	14,220
	Total Peak	1,183	29,581
	Avg Daily	2,912	75,568
16	**Peak Hours**	**Total Truck**	**Total Vehicles**
	6:00am-9:00am	1,251	22,385
	3:00pm-6:00pm	1,988	24,138
	Total Peak	3,239	46,523
	Avg Daily	9,176	119,038
17	**Peak Hours**	**Total Truck**	**Total Vehicles**
	6:00am-9:00am	1,155	22,771
	3:00pm-6:00pm	1,307	23,674
	Total Peak	2,462	46,445
	Avg Daily	7,368	106,714
18	**Peak Hours**	**Total Truck**	**Total Vehicles**
	6:00am-9:00am	823	18,383
	3:00pm-6:00pm	885	18,743
	Total Peak	1,709	37,126
	Avg Daily	5146	100333
19*	**Peak Hours**	**Total Truck**	**Total Vehicles**
	6:00am-9:00am	4,194	22,351
	3:00pm-6:00pm	6,530	23,309
	Total Peak	10,724	45,660
	Avg Daily	35,338	151,871

* Observed data not available. Data for location 19 is the mean of observed data for locations 1 and 10.

Appendix 2: AM and PM Peak All Vehicle and Truck Crashes by Type

All Vehicle Crash Counts by Location (2005 + 2006)

		AM Peak			PM Peak		
Location	Segment Length (ft.)	All Crashes	Injury Crashes	Fatality Crashes	All Crashes	Injury Crashes	Fatality Crashes
1	6,628	52	8	0	72	12	0
2	39,349	12	3	1	13	4	0
3	18,564	21	2	0	17	4	0
4	79,899	224	49	0	237	47	0
5	28,933	98	19	0	236	57	0
6	126,650	329	57	0	244	59	0
7	11,134	21	5	0	20	3	0
8	46,343	153	27	0	214	37	0
9	72,921	62	19	0	65	10	0
10	20,279	127	21	0	92	15	1
11	24,099	137	24	1	348	62	0
12	52,786	163	28	0	71	13	0
13	17,644	99	26	0	228	31	0
14	47,231	291	56	0	461	79	1
15	28,697	122	10	0	101	13	1
16	33,443	97	26	0	228	36	1
17	50,125	245	57	0	304	70	0
18	7,247	33	8	0	128	28	0
19	10,223	56	14	0	65	11	0

Truck Crash Counts by Location (2005 + 2006)

		AM Peak			PM Peak		
Location	Segment Length (ft.)	All Crashes	Injury Crashes	Fatality Crashes	All Crashes	Injury Crashes	Fatality Crashes
1	6,628	10	2	0	23	2	0
2	39,349	0	0	0	2	1	0
3	18,564	2	0	0	3	0	0
4	79,899	23	6	0	32	6	0
5	28,933	19	4	0	39	6	0
6	126,650	23	5	0	21	0	0
7	11,134	2	1	0	0	0	0
8	46,343	8	4	0	12	4	0
9	72,921	8	2	0	11	5	0
10	20,279	27	5	0	12	4	0
11	24,099	26	5	0	76	11	0
12	52,786	12	0	0	4	1	0
13	17,644	17	5	0	40	8	0
14	47,231	58	8	0	83	13	1
15	28,697	6	0	0	1	0	0
16	33,443	5	1	0	22	4	0
17	50,125	23	5	0	30	6	0
18	7,247	6	1	0	6	1	0
19	10,223	10	2	0	11	3	0

Reference Map