

December 22, 2017

**Introduction:** Traffic along Martin Luther King, Jr. Boulevard, 2<sup>nd</sup> Street, Adams Street, and Jackson Street was modeled and analyzed as part of the Rehabilitation of I-95 from I-495 to North of Brandywine River Bridge (a.k.a., “Wilmington Viaduct”) project. It was determined that Phase 2A of construction represents a “worst-case” scenario for traffic on the aforementioned streets, partially due to contraflow operation on Martin Luther King, Jr. Boulevard via the I-95 southbound “fly-under” ramp. To determine the benefits of opening the Christina River Bridge to traffic prior to the Wilmington Viaduct project, *Synchro* models were created for the AM and PM peak hours for the existing condition, a condition during Phase 2A, and a condition during Phase 2A with the proposed Christina River Bridge open. Traffic volumes in the construction scenarios were based on the most recent traffic counts and assigned traffic diversions due to the Phase 2A I-95 ramp closures.

**Delay Results:** Intersection delay (seconds per vehicle) and intersection level of service (LOS) were determined for each intersection in the network. **Table 1** shows the results for the most negatively-affected intersections in the network as a result of the Phase 2A ramp closures. Intersection delay and the corresponding change in intersection delay from the existing condition are reported.

**Table 1: Delay and Alternative Analysis for Critical Intersections**

LOS Key:	A	B	C	D	E	F
Intersection	AM Peak Hour			PM Peak Hour		
	Existing	Phase 2A without CRB	Phase 2A with CRB	Existing	Phase 2A without CRB	Phase 2A with CRB
MLK Blvd at Washington/Justison St	82.3	110.3 (+28.0)	64.8 (-17.5)	78.5	41.6 (-36.9)	36.3 (-42.2)
MLK Blvd at West St	7.0	47.2 (+40.2)	36.2 (+29.2)	19.5	143.6 (+124.1)	36.9 (+17.4)
MLK Blvd at Orange St	19.5	84.1 (+64.6)	91.4 (+71.9)	8.6	100.0 (+91.4)	85.7 (+77.1)
MLK Blvd at Market St	15.5	21.9 (+6.4)	18.8 (+3.3)	77.9	86.9 (+9.0)	96.9 (+19.0)
Front St at Walnut St	50.0	50.6 (+0.6)	29.9 (-20.1)	28.0	20.8 (-7.2)	19.7 (-8.3)
Walnut St at 2 <sup>nd</sup> Street	69.7	16.0 (-53.7)	14.9 (-54.8)	17.0	12.1 (-4.9)	12.1 (-4.9)
MLK Blvd at Madison St/Maryland Ave	30.3	20.2 (-10.1)	18.5 (-11.8)	25.4	21.2 (-4.2)	22.0 (-3.4)
Adams St at 2 <sup>nd</sup> Street	15.1	14.8 (-0.3)	14.9 (-0.2)	19.4	17.6 (-1.8)	15.7 (-3.7)
MLK Blvd at Jackson St	54.4	54.4 (0.0)	52.1 (-2.3)	26.9	26.8 (-0.1)	26.3 (-0.6)
Jackson St at 4 <sup>th</sup> St	66.8	66.7 (-0.1)	67.4 (+0.6)	40.4	40.7 (+0.3)	34.5 (-5.9)
Adams St at 9 <sup>th</sup> St	79.2	42.1 (-37.1)	42.1 (-37.1)	44.5	90.5 (+46.0)	55.1 (+10.6)
Adams St at 10 <sup>th</sup> St	5.7	65.5 (+59.8)	65.5 (+59.8)	13.6	221.2 (+207.6)	134.1 (+120.5)



**Road User Cost Analysis for Christina River Bridge  
in Conjunction with  
Rehabilitation of I-95 from I-495 to North of Brandywine River Bridge**

**Road User Cost:** The critical intersection delays and the modeled network were analyzed to obtain a road user cost for vehicles that would be most impacted by the Christina River Bridge, in accordance with DelDOT's *Design Guidance Memorandum on Road User Cost Analysis*. Two categories were considered – motorists who would use the bridge instead of city streets (e.g., Riverfront traffic) and motorists benefiting from the reduced demand at the critical intersections as a result of the bridge traffic diversion. **Table 2** summarizes the road user cost savings associated with traffic coming from or heading towards the south using the Christina River Bridge to access the Riverfront. These motorists are the most likely users to experience a benefit from the bridge. The two peak hour impacts were extrapolated to a daily cost by typical K-factors and diurnal traffic distributions. Because the relationship between demand and delay is not linear, especially in a complex traffic network including both uninterrupted and interrupted flow facilities, a range is provided for the daily road user cost based on a constructive assessment of several diurnal curves within the traffic network.

**Table 2: Delay Cost Savings for Traffic to/from South of Wilmington**

Direction	Peak Hour	Delay Cost Savings	Operating Cost Savings	Total User Cost Savings
Inbound	AM	\$677	\$145	\$822
	PM	\$296	\$57	\$353
Outbound	AM	\$58	\$10	\$68
	PM	\$90	\$14	\$104
<b>Total Savings – Two Peak Hours</b>				<b>\$1,347</b>
<b>Total Estimated Savings – Daily Range</b>				<b>\$5,388 – \$8,082</b>

Traffic coming from or heading towards the north was analyzed as well. Particularly during Stage 2A, some of this traffic is likely to utilize the bridge to avoid expected delays on I-95, Martin Luther King, Jr. Boulevard, and Adams Street. However, because the distance to travel along US 13/I-495 to reach the bridge is longer than the distance to travel through downtown Wilmington, in a road user cost analysis, the delay savings may outweigh the operating cost increases.

As significantly more motorists divert to the Christina River Bridge to avoid downtown Wilmington, the existing network of streets will have reduced demand and lower delays at various critical intersections. The road user cost savings for those motorists that continue to use the downtown intersections was calculated and the results are shown in **Table 3**.

**Table 3: Delay Cost Savings for Traffic in Downtown Wilmington**

Intersection	Phase 2A with CRB		AM Delay Cost Savings	PM Delay Cost Savings
	AM Volume	PM Volume		
MLK Blvd at Washington/Justison St	2,776	1,876	\$718	\$57
MLK Blvd at West St	2,632	2,061	\$165	\$1,250
MLK Blvd at Orange St	2,287	1,766	-\$95	\$144
MLK Blvd at Market St	2,466	2,759	\$43	-\$157
Front St at Walnut St	4,009	2,361	\$472	\$15
Walnut St at 2 <sup>nd</sup> Street	3,876	2,537	\$24	\$0
MLK Blvd at Madison St/Maryland Ave	1,683	1,283	\$16	-\$6
Adams St at 2 <sup>nd</sup> Street	1,476	2,236	-\$1	\$24
MLK Blvd at Jackson St	2,692	2,211	\$35	\$6
Jackson St at 4 <sup>th</sup> St	2,553	2,196	-\$10	\$77
Adams St at 9 <sup>th</sup> St	1,890	1,965	\$0	\$396
Adams St at 10 <sup>th</sup> St	2,144	2,529	\$0	\$1,253
<b>Total Savings – Peak Hour</b>			<b>\$1,367</b>	<b>\$3,059</b>
<b>Total Estimated Savings – Daily Range</b>			<b>\$17,704 – \$26,556</b>	

During Phase 2A of construction, if the Christina River Bridge is open to traffic, there is an anticipated road user cost savings of **approximately \$23,000 to \$35,000 per day** based on traffic using the new bridge as well as circulating downtown Wilmington traffic.

The preceding construction phases for the Wilmington Viaduct project prior to Phase 2A commencing – 1A, 1B, and 1C – were also analyzed for road user cost savings. The road user cost savings for these phases was estimated based on the proportion of vehicles diverted from the I-95 on- and off-ramps relative to those diverted from the I-95 on- and off-ramps during Phase 2A. **Table 4** presents the estimated road user cost savings for each phase over a typical weekday and as an estimated total for the construction phase.

**Table 4: Delay Cost Savings Ranges for Phases 1A to 2A with Corresponding Timeline**

	Phase 1A	Phase 1B	Phase 1C	Phase 2A
<b>Total Estimated Savings – Daily</b>	\$6,000 – \$9,000	\$16,000 – \$24,000	\$4,000 – \$6,000	\$23,000 – \$35,000
<b>Estimated Phase Duration (days)</b>	75	45	30	234
<b>Total Estimated Savings – Phase</b>	\$450,000 – \$675,000	\$720,000 – \$1,080,000	\$120,000 – \$180,000	\$5,400,000 – \$8,200,000

