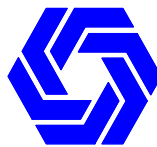


Boston Street and Ponca Street

Freight-Related Intersection Evaluation

August 2005

Prepared for



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EXECUTIVE SUMMARY

This report contains the data, analysis, findings and conclusions of an intersection evaluation of Boston Street at Ponca Street, in the Canton area of Baltimore City. The objective of this study was to conduct a full intersection assessment to identify deficiencies related to freight movement and determine if safety and operational improvements are necessary. Based on the data collection, field observations and analysis, there are a number of findings that may impact safety and operations as summarized below:

- There are several industrial complexes in the vicinity of the intersection that generate a high amount of truck traffic.
- Trucks destined for Seagirt and Dundalk Marine Terminals might be traveling through the intersection based on observations of container and flatbed tractor-trailer trucks.
- Boston Street, west of Ponca Street, is a two-lane section. This narrow cross section impacts traffic operations since the short (assumed three-lane) eastbound approach cannot process vehicles efficiently.
- There are no pavement markings indicating the westbound lane drop.
- There are three railroad crossings west of the intersection (two at-grade and one grade-separated). Trains were observed at the five-track crossing, approximately 1,400 feet west of the intersection. During the day of the count, the gates at this crossing were down for 20 minutes continuously. Westbound vehicle queues extended to a location just west of the intersection. Once the queue extends to this point, drivers often divert to Ponca Street or Newkirk Street.
- Trucks are overriding the curb in the southwest corner of the intersection.
- Pavement markings in the vicinity of the intersection are faded.
- Guide signing to I-95 is not present on all of the approaches. There are no signs directing motorists to I-895.
- Two large developments, proposed west of the intersection, will nearly double the traffic in the area.
- There are no near-term programmed improvements on either Baltimore City's or MdTA's Capital Improvement Plan. Baltimore City has a long-term Master Plan improvement to viaduct Boston Street over all three railroad crossings and tie directly into I-95.
- There is a high percentage of trucks in all three peak hours. The predominant truck movements are northbound right turns and westbound left turns.
- Most of the trucks at the intersection were tractor-trailer trucks.
- Peak period observations indicated the following:
 - Eastbound queues were long throughout the day. There were also moderate queues along northbound Ponca Street.
 - Westbound queues often developed when trucks or other vehicles were turning left at Newkirk Street, west of the intersection. These queues often temporarily blocked the intersection.
 - The presence of trucks often impeded visibility of other motorists and required left turns to be completed only on the exclusive portion of the traffic signal phase.
 - On more than one occasion, motorists in the westbound left-turn lane often continued straight.
- The LOS determined via the CLV methodology as well as Synchro/SimTraffic indicate traffic operations are acceptable during all three peaks when a train is not present. Based on field observations, the intersection operates at LOS F when vehicle queues extend west into and through the intersection when a train is present.
- There are two difficult truck turning movements as observed in the field and analyzed with AutoTurn: eastbound to southbound right turns and westbound to southbound left turns. The lack of two departure lanes contributes to truck turning difficulty in the southbound direction on Ponca Street.
- There were 52 crashes in the vicinity of the intersection based on data from Baltimore City. The data indicate there were no fatal crashes and the majority of incidents were property-damage-only left-turn and rear end crashes. There were two pedestrian and one bicyclist crashes at the intersection.

Based on the data collection, field observations and analysis of existing conditions, several alternatives were evaluated to improve safety and operations at each location. These include:

- Implement Spot Safety, Signing and Other Improvements
- Provide a Traffic Signal System Along Boston Street
- Widen Boston Street: Between Newkirk and Ponca Streets
- Widen Boston Street: Between Conkling and Ponca Streets
- Widen Ponca Street, South of Boston Street
- Implement Master Planned Roadway Improvement

I. Introduction

This report contains the data, analysis, findings and conclusions of a freight-related intersection evaluation of Boston Street at Ponca Street, in the Canton area of Baltimore City.

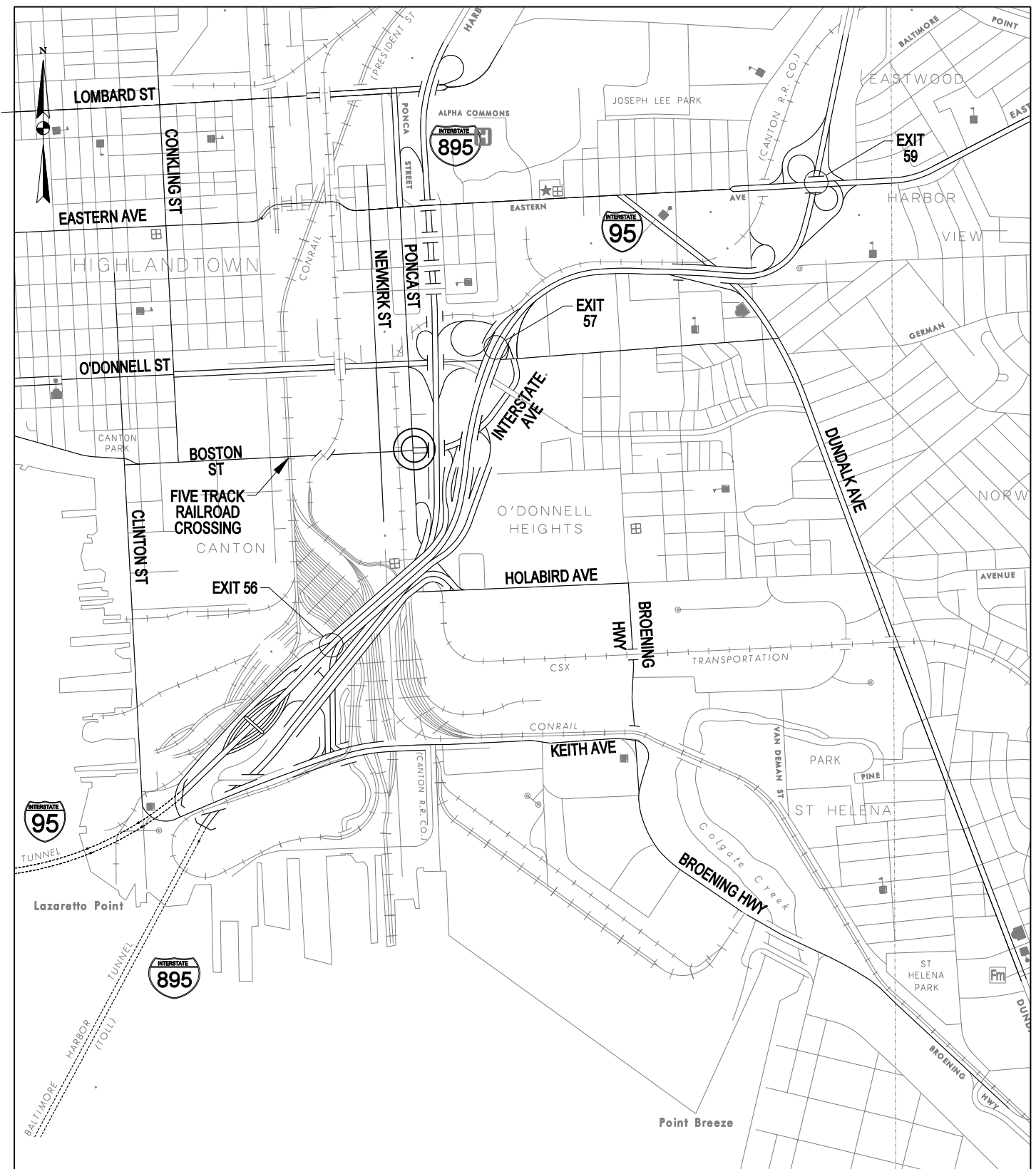
The objective of this study was to conduct a full intersection assessment to identify deficiencies related to freight movement and determine if safety and operational improvements are necessary. Traffic data were collected, including turning movement, crash records, and sight distance. Peak period field observations were also conducted and analyzed. The analysis included a study of peak hour volumes, intersection level of service (LOS) analysis via the Critical Lane Volume (CLV) approach, crash history, pedestrian movements, sight distances, geometrics, simulating truck movements with Autoturn and the evaluation of existing traffic control devices. The LOS was also evaluated with Synchro and SimTraffic to understand the effect of individual delays and the presence of trucks in the vehicle stream.

This study was performed in accordance with the 2003 *Manual of Uniform Traffic Control Devices*, the Institute of Transportation Engineer's (ITE) *Manual of Transportation Engineering Studies*, the American Association of State Highway and Transportation Officials (AASHTO) *A Policy on Geometric Design of Highways and Streets*, as well as all applicable Maryland State Highway Administration (SHA) supplements to these documents.

II. Intersection Location and Characteristics

The study intersection is located in the Canton area of Baltimore City, as shown in Figure 1. This area of Baltimore City is bounded by I-95 and I-895 to the east and the northwest branch of the Patapsco River to the south and west. Figure 2 shows a more detailed study area map. Boston Street is a primary arterial highway that generally runs in an east-west direction and provides access into downtown Baltimore from I-95. Interstate Avenue is the continuation of Boston Street, east of Ponca Street, that ends at O'Donnell Street. Ponca Street is a collector street that generally runs in a north-south direction between Holabird Avenue and Lombard Street.

There are numerous industrial land uses in the vicinity of the intersection that generate truck traffic. Figure 2 illustrates several larger industrial parks and marine terminals, including Seagirt and Dundalk, located within two miles of the study intersection. Many container and flat bed trucks were observed traveling through the intersection. A proportion of these trucks are likely destined for or traveling from the Port of Baltimore. Currently, trucks accessing the Port of Baltimore (north or south of Baltimore City) are signed via I-95. Trucks destined for the Seagirt or Dundalk Marine Terminal are signed to exit at Keith Avenue (Exit 56).



STUDY INTERSECTION

**MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION - DISTRICT 7
TRAFFIC ENGINEERING**

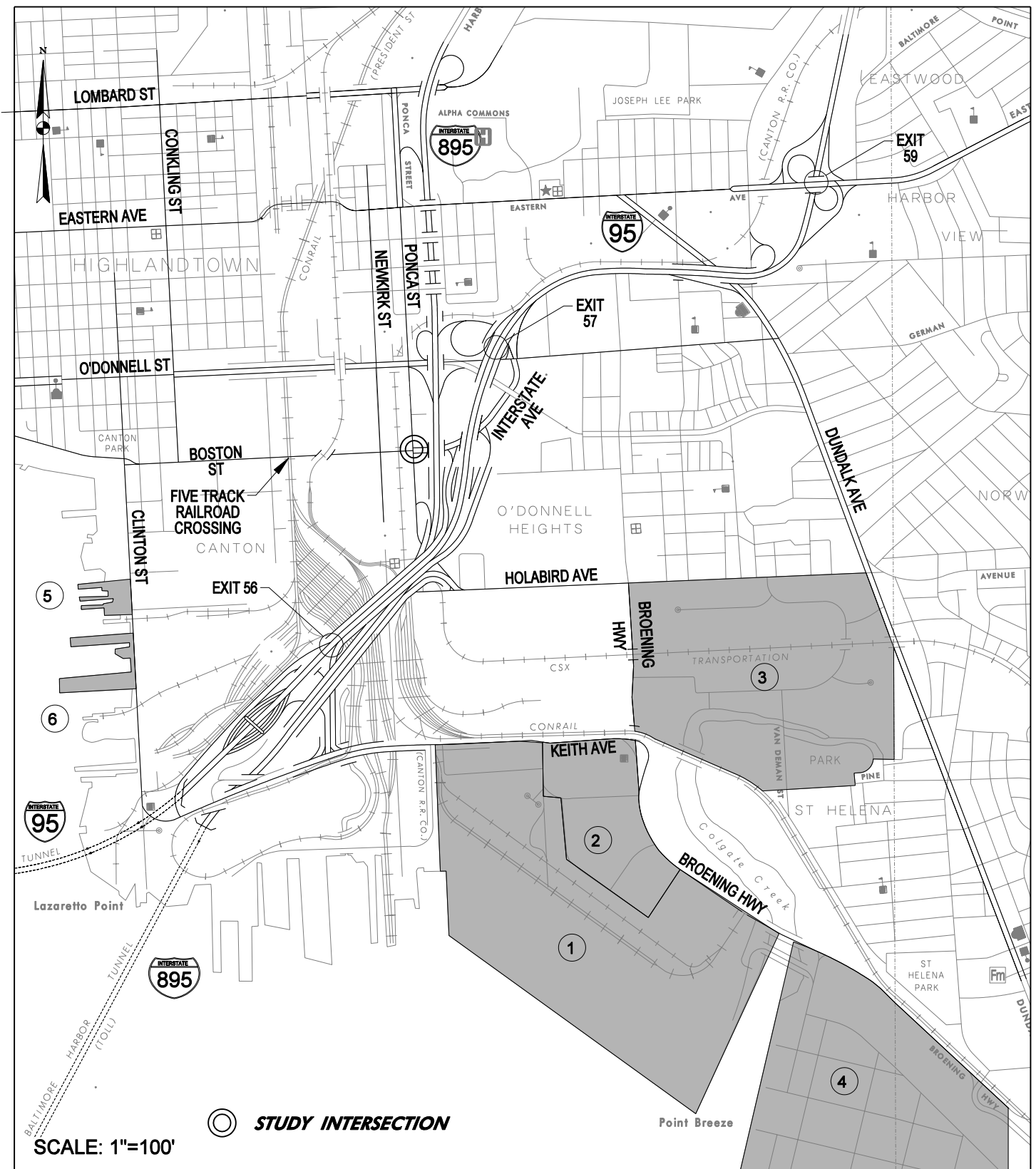
FIGURE 1

**BOSTON STREET AND PONCA STREET
LOCATION MAP**

**DATE
AUGUST 2005**

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**CONTRACT NO.
BCS 2004-04-E**



1. SEAGIRT MARINE TERMINAL
2. POINT BREEZE INDUSTRIAL PARK
3. FORT HOLABIRD INDUSTRIAL PARK
4. DUNDALK MARINE TERMINAL
5. CLINTON STREET MARINE TERMINAL
6. EXXON MARINE TERMINAL

**MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION - DISTRICT 7
TRAFFIC ENGINEERING**

FIGURE 2

BOSTON STREET AND PONCA STREET

DETAILED STUDY AREA

DATE
AUGUST 2005

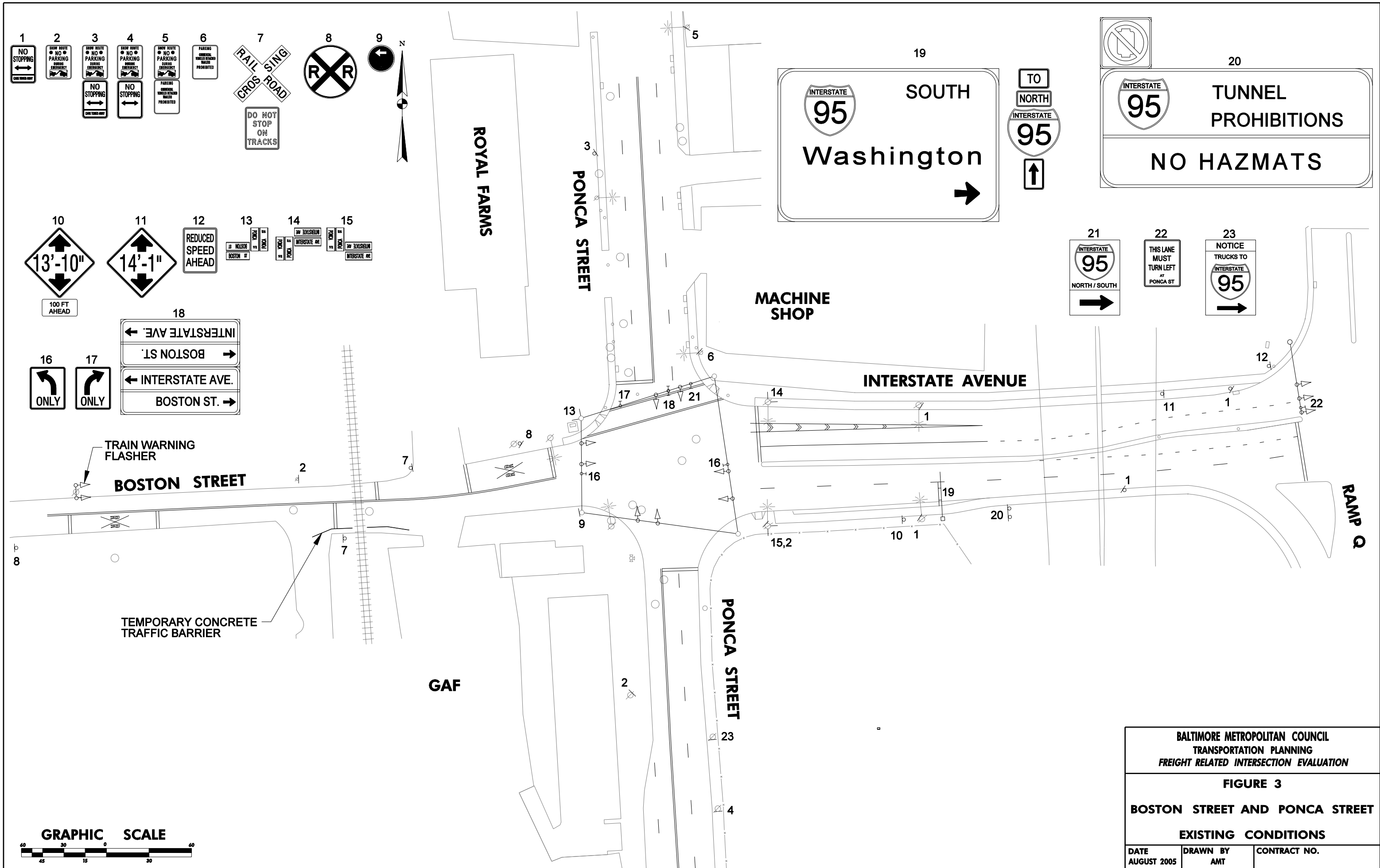
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Baltimore City recently implemented truck restrictions on Dundalk Avenue because trucks destined for Seagirt and Dundalk Marine Terminals were short-cutting via Exit 59. It is possible that trucks are continuing to short cut to the Seagirt and Dundalk Marine Terminals via Exit 57, and consequently, must travel through the intersection of Boston Street and Ponca Street.

Specific characteristics of the intersection include the following:

- Existing conditions of the study intersection are shown in Figure 3. Topographic information contained on this figure is based on data received from Baltimore City's Geographic Information System.
- The intersection has four legs and is controlled by an isolated actuated traffic signal. South- and westbound left turns operate with exclusive/permissive left-turn traffic signal phasing. All other movements operate with permissive traffic signal phasing. There are no pedestrian signal heads at the intersection.
- Boston Street has a narrow two-lane cross section, immediately west of Ponca Street, as shown in Figure 3. The narrower two-lane section exists from Ponca Street to a point just east of Conkling Street. West of Conkling Street, Boston Street is a divided highway with two travel lanes in each direction and dedicated left-turn lanes.
- There are no lane lines designating the lane use in the eastbound direction. Based on field observations, it appeared the lane use consists of a left-turn lane, through lane, and shared through/right-turn lane. Since this wider section is short, only six vehicles can queue in each lane.
- There is a sign mounted on the traffic signal structure at Ramp Q that indicates the left-most lane in the westbound direction drops at Ponca Street. There is one other sign at Ponca Street indicating this lane drop. There were no visible pavement markings indicating this lane drop in the westbound direction.
- There is a sidewalk on the north and south sides of Interstate Avenue and on the east and west sides of Ponca Street, north of the intersection. There is a faded crosswalk to cross the north leg and handicap ramps located on Figure 3. There is temporary concrete traffic barrier that appears to provide protection for pedestrians in the southwest quadrant.
- There is a single track at-grade railroad crossing immediately to the west of the intersection. This crossing is controlled by crossbuck signs only. No trains were observed during any of the data collection or field investigations.
- There is a grade-separated railroad crossing approximately 800 feet west of the intersection.
- There is another at-grade railroad crossing approximately 1,400 feet west of the intersection. This crossing is five tracks wide and is controlled by flashing signals and gates. Multiple trains were observed during the data collection and field investigations. A more detailed discussion of the impact of train movements on the intersection is provided later.
- The south leg of the intersection is three lanes wide. Approximately 200 feet south of the intersection, Ponca Street is four lanes wide. Within this section of roadway, there are parked vehicles and trucks.



- There are two adjacent signalized intersections, east on Interstate Avenue, that are closely spaced with the study intersection. There are no signalized intersections within 1,000 feet to the north, south or west of the study intersection.
- Street lights exist on all four corners of the intersection.
- Trucks are overriding the curb in the southwest corner of the intersection. A more detailed discussion of truck turning movements is presented later.
- There were no speed limit signs in the vicinity of the intersection. Nearer to Conkling Street, the speed limit is 30 mph along Boston Street. There is an R2-5a “Reduced Speed Ahead” sign along westbound Interstate Avenue approaching Boston Street. The speed limit on Ponca Street is assumed to be 30 mph. It did not appear that vehicles exceeded the assumed speed limits due to traffic conditions.
- Ponca Street, north of the intersection, is constructed of rigid concrete pavement. Ponca Street (south of the intersection), Interstate Avenue and Boston Street are constructed of flexible bituminous pavement. The condition of the bituminous pavements was satisfactory; however, the pavement condition at the at-grade railroad crossing is poor.
- Lane line pavement markings are beginning to fade. The STOP lines and crosswalk pavement markings were almost completely faded. The eastbound STOP is completely faded.
- There is an overhead guide sign directing traffic to southbound I-95, east of the intersection. There is also a guide sign on the traffic signal structure directing motorists traveling on northbound Ponca Street to I-95. There is no corresponding sign for motorists traveling on southbound Ponca Street to access I-95. There are no signs at the intersection directing motorists to I-895.
- There are yellow traffic signal head sections mounted on utility poles in the vicinity of the intersection. Field observations determined the signal heads flash when a train is present at the five-track crossing, west of the intersection. There are no signs, however, communicating to motorists the meaning of the flashing signals. Figure 2 shows the locations of the flashing signals.
- Visibility of the intersection from all four approaches was adequate. Intersection and stopping sight distance were adequate approaching the intersection.
- Appendix A contains photographs of each intersection approach.
- Appendix B contains other intersection photographs.

III. Intersection Operations and Capacity Analyses

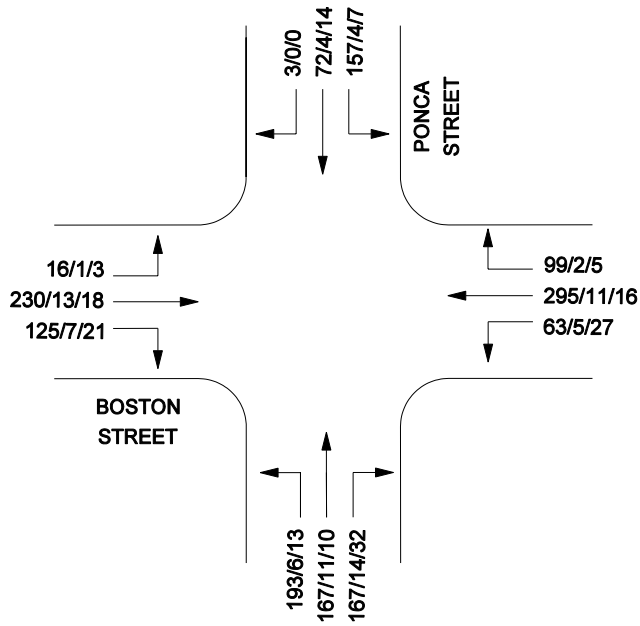
A peak period classified turning movement count was collected at the intersection on Wednesday, May 4, 2005, and included the peak hours of 7:00 to 9:00 AM, 11:00 AM to 1:00 PM and 4:00 to 6:00 PM. The classification breakout included passenger vehicles, single unit trucks and tractor-trailer trucks. The AM peak hour was from 7:30 to 8:30 AM, the midday peak hour was from 12:00 to 1:00 PM, and the PM peak hour was from 5:00 to 6:00 PM. Peak hour traffic volumes are summarized in Table 1 and shown on Figure 4. Figure 4 also contains the corresponding truck volumes (both single unit and tractor-trailer trucks) during the highest peak hour. The turning movement count data are provided in Appendix C.

Table 1: Peak Hour Classification Count Summary

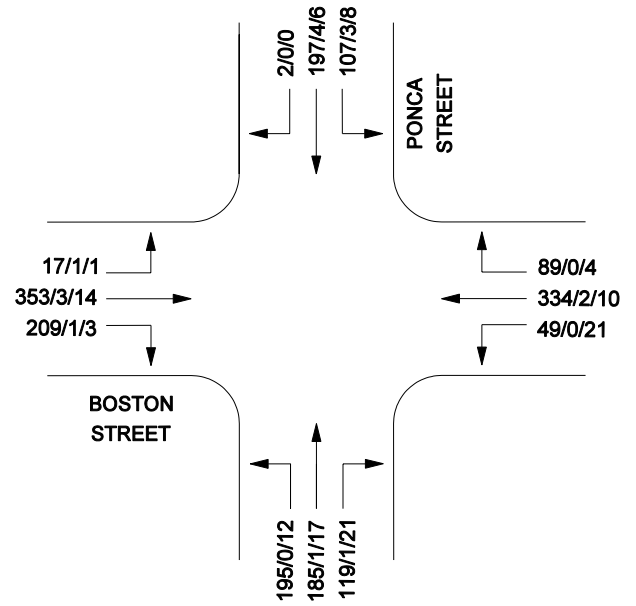
	From the North			From the South			From the East			From the West		
	Ponca Street			Ponca Street			Interstate Avenue			Boston Street		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
AM Peak												
7:30 - 8:30												
All Vehicles	157	72	3	193	167	167	63	295	99	16	230	125
Single Unit	4	4	0	6	11	14	5	11	2	1	13	7
Tractor Trailer	7	14	0	13	10	32	27	16	5	3	18	21
All Trucks	11	18	0	19	21	46	32	27	7	4	31	28
Movement %	7.0%	25.0%	0.0%	9.8%	12.6%	27.5%	50.8%	9.2%	7.1%	25.0%	13.5%	22.4%
Approach %	12.5%			16.3%			14.4%			17.0%		
Midday Peak												
12:00 - 1:00												
All Vehicles	72	81	3	175	123	98	58	233	58	21	239	133
Single Unit	0	4	0	2	3	6	4	15	3	2	16	6
Tractor Trailer	13	7	0	29	10	29	34	33	8	3	26	18
All Trucks	13	11	0	31	13	35	38	48	11	5	42	24
Movement %	18.1%	13.6%	0.0%	17.7%	10.6%	35.7%	65.5%	20.6%	19.0%	23.8%	17.6%	18.0%
Approach %	15.4%			19.9%			27.8%			18.1%		
PM Peak												
5:00 - 6:00												
All Vehicles	107	197	2	195	185	119	49	334	89	17	353	209
Single Unit	3	4	0	0	1	1	0	2	0	1	3	1
Tractor Trailer	8	6	0	12	17	21	21	10	4	1	14	3
All Trucks	11	10	0	12	18	22	21	12	4	2	17	4
Movement %	10.3%	5.1%	0.0%	6.2%	9.7%	18.5%	42.9%	3.6%	4.5%	11.8%	4.8%	1.9%
Approach %	6.9%			10.4%			7.8%			4.0%		



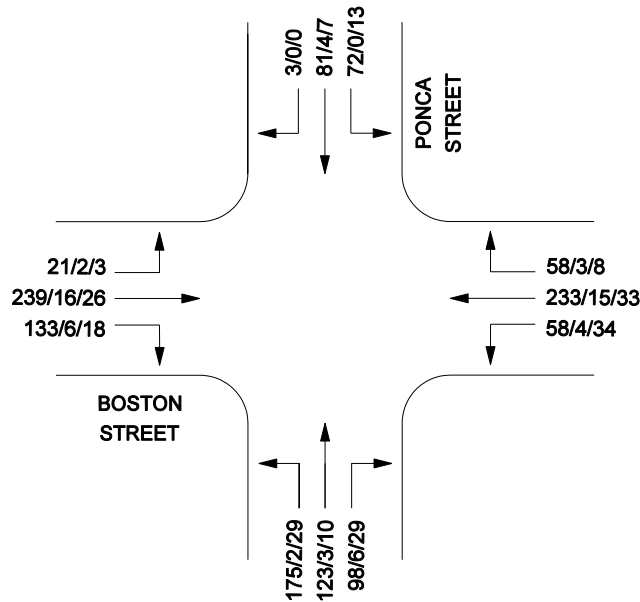
AM PEAK HOUR



PM PEAK HOUR



MIDDAY PEAK HOUR



LEGEND

ALL VEHICLES /SINGLE UNIT TRUCKS /TRACTOR-TRAILER TRUCKS

BALTIMORE METROPOLITAN COUNCIL
TRANSPORTATION PLANNING
FREIGHT RELATED INTERSECTION STUDY

FIGURE 4

BOSTON STREET AND PONCA STREET

EXISTING PEAK HOUR VOLUMES

DATE
AUGUST 2005

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It can be seen from the table above that single unit and tractor-trailer trucks comprised a high proportion of the traffic volume for all of the approaches during the AM peak hour. Though the highest percentage of trucks (in the AM peak) were observed coming from the west (17 percent), the highest volume of trucks was observed from the south (86 trucks). The highest percentage and volume of trucks (in the midday peak) was from the east (28 percent of the approach volume corresponding to 97 trucks). Truck approach percentages were somewhat lower during the PM peak hour. The highest percentage and volume of trucks (in the PM peak) was from the south (10 percent of the approach volume corresponding to 52 trucks). Tractor trailer trucks comprised the majority of the truck volume counted in all of the peaks.

Figure 4 also shows that the majority of the trucks are traveling on Boston Street, Interstate Avenue and the south leg of Ponca Street. The predominant tractor trailer truck maneuvers are westbound left turns and corresponding northbound right turns. A number of trucks traveling north on Ponca Street continue through, presumably to access I-895 at O'Donnell Street, during the PM peak.

Automatic machine counts were also collected at the intersection for 48 hours. Counts were collected over multiple days between May 2-6, 2005 and May 9-13, 2005. Due to the proximity of adjacent intersections and potential for vehicle queues approaching the intersection, counts were collected on the intersection departures. Table 2 summarizes the count data over the two-day period.

Table 2: 48-Hour Classification Summary

Class	Type	Northbound		Southbound		Eastbound		Westbound	
		5/3/2005	5/4/2005	5/11/2005	5/12/2005	5/11/2005	5/12/2005	5/3/2005	5/4/2005
1	Cycle	29	21	117	105	307	156	89	89
2	P	5,400	5,569	4,822	4,808	1,339	855	1,621	1,545
3	RV	849	786	1,072	1,058	3,095	2,060	927	954
4	BUS	44	30	116	112	256	125	93	95
5	SU (2)*	109	118	317	309	846	462	180	185
6	SU (3)*	116	122	147	141	141	78	142	117
7	SU (4)*	4	6	56	49	35	1	24	20
8	WB (4)*	140	132	210	213	67	35	54	53
9	WB (5)*	450	460	646	624	288	104	111	84
10	WB (6)*	52	52	67	76	43	11	35	25
11	WB (5)(2)**	3	3	4	3	0	0	0	1
12	WB (6)(2)**	17	16	23	31	3	2	0	1
13	WB (7)(2)**	53	52	102	119	24	3	23	19
Total		7,266	7,367	7,699	7,648	6,444	3,892	3,299	3,188
Truck Volume		944	961	1,572	1,565	1,447	696	569	505
Truck Percent		13.0%	13.0%	20.4%	20.5%	22.5%	17.9%	17.2%	15.8%

* (2) = Number of Axles

** (5) (2) = Number of Axles / Multi-Trailer

Table 2 also shows a high percentage of trucks leaving the intersection on each approach. As was the case with the peak hour classified turning movement count, the highest percentages of trucks were found traveling south- and eastbound departing the intersection. The majority of trucks for the two-day period were four- and five-axle tractor trailer trucks. The next highest volume of trucks were two- and three-axle single unit trucks. Appendix C contains the classification breakdown. A discussion of truck turning movements is presented later.

Level of Service (LOS) calculations were conducted using both the Critical Lane Volume (CLV) approach and Synchro along with the traffic animator SimTraffic. Synchro models operations at signalized and unsignalized intersections using the methodology from the 2003 *Highway Capacity Manual (HCM)*. SimTraffic is a microscopic traffic simulator that models traffic conditions defined in Synchro and records a variety of measures of effectiveness (MOEs). The selected MOEs utilized as part of this evaluation included LOS, stopped delay, volume-to-capacity, and queues.

The CLV technique determines the overall operational LOS for an entire intersection. The procedure examines the combination of conflicting movements during a peak period. This maximum number of conflicts is the critical lane volume or CLV. This CLV is then compared to a range of values to determine the LOS at an intersection. The CLV methodology also predicts the volume to capacity or v/c ratio. The v/c ratio is the degree of saturation of an intersection. When the v/c ratio is greater than 1.00, the demand exceeds the capacity, and an improvement may be required.

The Level of Service (LOS) is defined in the Transportation Research Board *HCM* as a “qualitative measure describing operational conditions within a traffic stream, and their perceptions by motorists and/or passengers.” Six levels of service, ranging from A to F, with A representing the optimum operating conditions and F representing congestion.

There are currently no existing Synchro networks maintained by Baltimore City. Consequently, a model had to be created for this intersection. The model included the adjacent traffic signals to the east at Ramps Q and R as well as the intersections of Boston Street and Conkling as well as O'Donnell Street and Ponca Street. Lane configurations, turn lane lengths, traffic signal timing and phasing, along with peak hour volumes for each location were input into Synchro. The traffic signal timings, provided by Baltimore City, are included in Appendix D. The Synchro model was animated in SimTraffic and the resultant queues were compared with actual field-observed conditions. The calibration process included adjusting link and turning speeds and re-running the model until the results closely matched field-observed queues and delays based on field observations identified below. The calibration was completed to predict with a high degree of confidence, changes in delays and queuing resulting from timing or other improvements.

Field observations were performed on May 4, 2005 (the day of the turning movement count) and May 19, 2005. The following operational characteristics were observed at the intersection:

- On the day of the turning movement count, a train was observed crossing the five-track gated crossing to the west during the AM peak period. The operation of the train required the gates to be down for 20 minutes continuously. From what could be observed from the intersection, vehicles initially began to queue back from the crossing. Once this queue extended back towards Ponca Street, some vehicles A) diverted to Newkirk Street, B) turned around and turned onto Ponca Street or C) turned onto Ponca Street to bypass the queue. The queue never extended through the intersection. During this time, the yellow signal heads were flashing.
- Throughout the day, eastbound queues often extended toward the grade-separated railroad crossing. The eastbound queues were higher during the PM peak, sometimes extending back beyond the five-track crossing. A single lane through queue often blocked the ability for motorists to maneuver into the assumed left-turn lane as well as the through/right-turn lane that develops east of the railroad crossing.
- Queues were also high on northbound Ponca Street, often extending to 15 to 20 vehicles in each lane.
- Westbound queues often developed when trucks or other vehicles were turning left at Newkirk Street, west of the intersection. These queues often temporarily blocked the intersection.
- On more than one occasion, there were near misses between southbound vehicles turning left and northbound vehicles traveling through. The southbound vehicles were not able to see the on-coming traffic due to trucks making northbound left turns.
- Right-turning trucks from all directions were not able to make right turns on red due to the volume of traffic coming from the left.
- Trucks completing westbound left turns primarily completed the turn on the exclusive portion of the phase. The limited gaps in opposing traffic and inability of the trucks to quickly accelerate required trucks to wait during the permissive portion of the phase.
- On more than one occasion, motorists in the westbound left-turn lane often continued straight.

Table 3 below contains the existing capacity analyses.

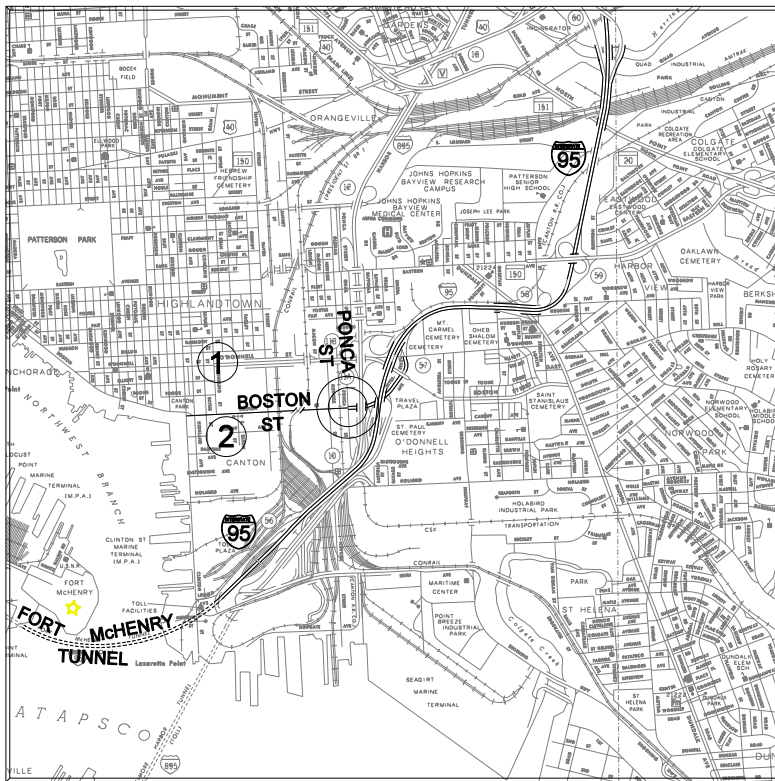
Table 3: Existing Intersection Capacity Analysis

	AM Peak Hour				Midday Peak Hour				PM Peak Hour			
	Delay (sec)	v/c	Queue (feet)	LOS	Delay (sec)	v/c	Queue (feet)	LOS	Delay (sec)	v/c	Queue (feet)	LOS
CLV Analysis												
Boston Street at Ponca Street	-	0.50	-	A	-	0.41	-	A	-	0.48	-	A
	CLV = 802				CLV = 653				CLV = 769			
Highway Capacity Manual Analysis												
Boston Street at Ponca Street	30.0	0.54	-	C	40.3	0.35	-	D	29.5	0.55	-	C
Eastbound Left	20.2	0.03	518	C	40.5	0.06	72	D	19.4	0.04	1,535	B
Eastbound Through	22.5	0.23	531	C	44.8	0.32	504	D	23.5	0.36	1,550	C
Westbound Left	14.8	0.13	398	B	33.6	0.18	137	C	14.8	0.13	390	B
Westbound Through	17.4	0.31	403	B	36.6	0.33	353	D	17.3	0.35	396	B
Northbound Left	35.8	0.58	200	D	49.4	0.345	265	D	45.9	0.74	226	D
Northbound Through	32.8	0.52	182	C	46.2	0.38	331	D	32.0	0.47	370	C
Southbound Through/Left	60.4	0.86	198	E	22.3	0.22	149	C	48.8	0.81	175	D
Southbound Right	25.5	0.00	83	C	19.2	0.00	16	B	25.6	0.00	61	C

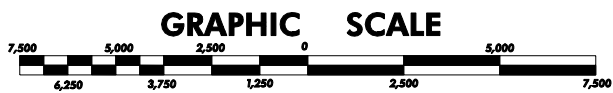
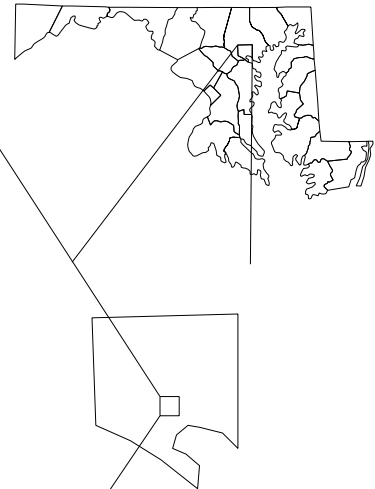
The results of the CLV analysis indicate that the intersection operates at an acceptable LOS in all peak periods. The results of Synchro/SimTraffic also report acceptable LOS for all movements during all peak hours. However, long queues are reported in the eastbound direction during all peak hours (as shown in **bold**). As mentioned previously, the presence of a train to the west can have a substantial impact on the traffic operations at the intersection when the gates are down for a long period of time. It would be difficult to perform a traffic analysis of the impacts of a full roadway closure for a 20 minute period (as was the case during the AM peak hour when the turning movement count was collected) because motorists (as seen from the field observations) will likely divert and use other routes. For the purposes of this analysis, it can be assumed that the intersection operates at LOS F when a train is present and vehicle queues extend 1,400 feet to the intersection. The capacity analysis worksheets are located in Appendix E.

It should be noted the CLV results should only be used as an analytical tool, as the results do not always provide a good picture of individual delays experienced at an intersection because the methodology does not take into account the percentage of heavy trucks, delays incurred from the railroad crossing, traffic signal phasing and timing as well as the effect of adjacent signalized intersections.

Baltimore City's Planning Department was contacted to obtain a detailed listing of approved developments anticipated to generate additional traffic that will impact the study intersection. Table 4 below summarizes the approved, but not yet constructed development activity in the vicinity of the study intersections. The location of these developments is shown in Figure 5.



KEY MAP



LEGEND

- ① BREWER'S HILL
- ② CANTON CROSSING



MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION - DISTRICT 7
TRAFFIC ENGINEERING

FIGURE 5

BOSTON STREET AND PONCA STREET

APPROVED DEVELOPMENTS

DATE
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Table 4: Proximate Approved Developments

Location	Development Name	Land Use Type	Size
1	Brewer's Hill	Office	335,500 SF
		Warehouse	225,000 SF
		Mini-Storage	115,000 SF
		Residential	21 Units
		Retail	28,500 SF
2	Canton Crossing	Office	1,500,000 SF
		Residential	100 Units
		Hotel	360 Rooms
		Retail	250,000 SF

SF – Square Feet

Recent traffic impact studies were reviewed to understand the impact of this development on the study intersection. Table 5 summarizes the vehicle trip generation and corresponding new trips at the intersection of Boston Street and Ponca Street.

Table 5: Approved Development Trip Generation Summary

Development Name	ITE Vehicle Trips (1)		Total New Trips (2)		Total Intersection Trips (3)	
	AM	PM	AM	PM	AM	PM
Canton Crossing	2,843	3,444	2,124	2,439	1,258	1,375
Brewers Hill	680	762	530	586	168	136
Total	3,523	4,206	2,654	3,025	1,426	1,511

1. Total raw vehicle trips generated based on the Institute of Transportation Engineers (ITE) *Trip Generation*.
2. Total new vehicle trips resulting from adjustment for mode (transit and pedestrian) based on “Journey to Work” data provided by the Baltimore Metropolitan Council
3. Total trips assigned to the intersection of Boston Street and Ponca Street.

Table 5 illustrates that the two approved developments will have a substantial impact on the intersection. Of the two developments, Brewer's Hill will also increase truck traffic due to the proposed warehouse use. When these two developments are fully built, it is likely that traffic at the intersection will double.

The Capital Improvement Program for the Maryland Transportation Authority (MdTA) and Baltimore City were reviewed to determine if there are any programmed improvements in the vicinity of the intersection. According to MdTA, only rehabilitation of I-95, including ramps, is proposed in the near future. Baltimore City has a long-term project to construct a viaduct that would carry Boston Street over all three railroad crossings and connect directly with I-95. Some right-of-way has been purchased, but there has been no funding allocated for design or construction.

IV. Truck Turning Movements

Field visits indicated a high volume of trucks turning in all possible directions. Only trucks destined to travel south on Ponca Street were observed having difficulty making certain turning movements. Autoturn was used to determine whether the existing geometrics were sufficient for the large turning volume of trucks at the intersection. Predominant turning movements were examined for a WB-50 Design Vehicle.

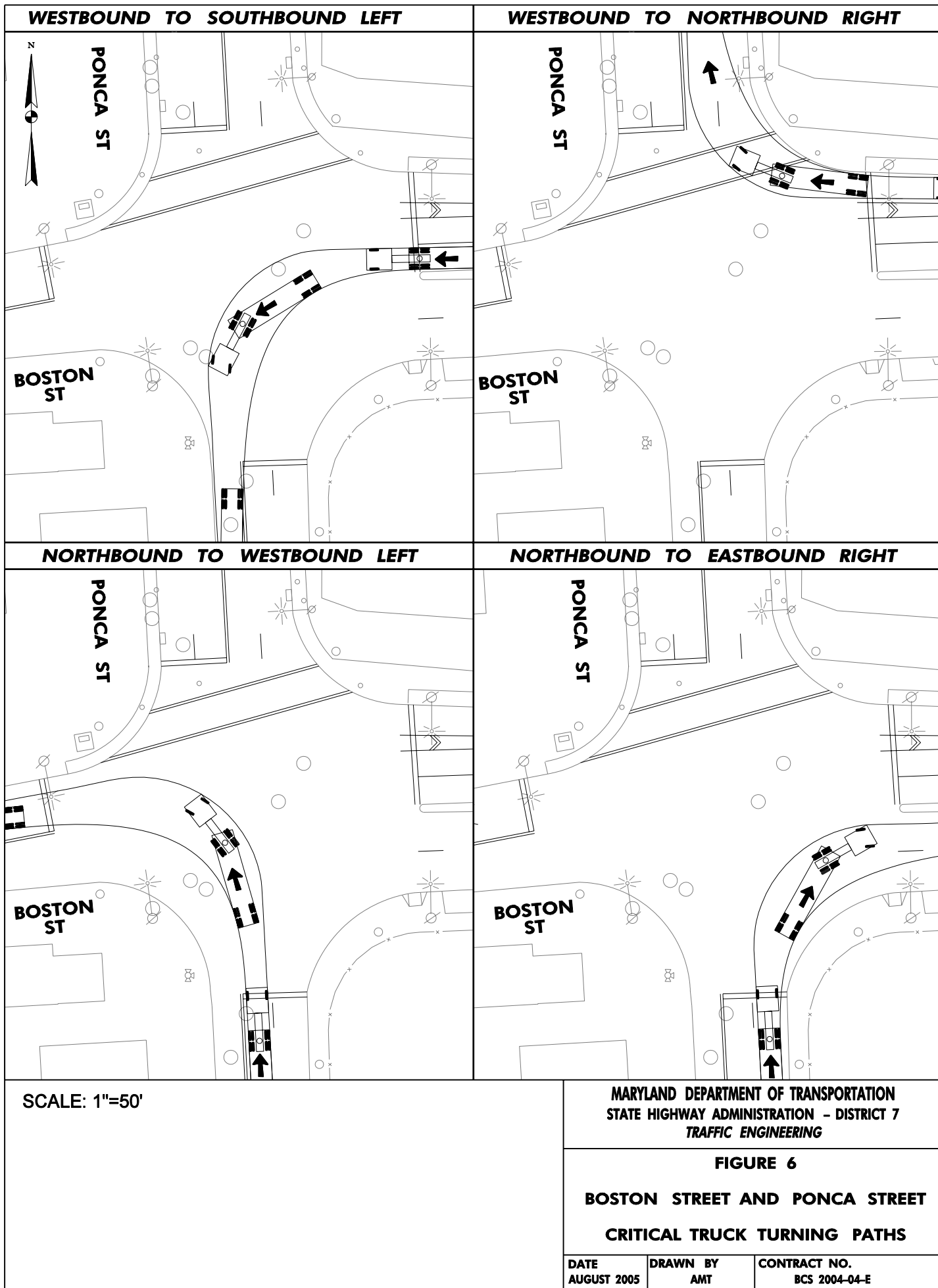
Eight truck turning maneuvers were evaluated as shown on Figures 6 and 7, including:

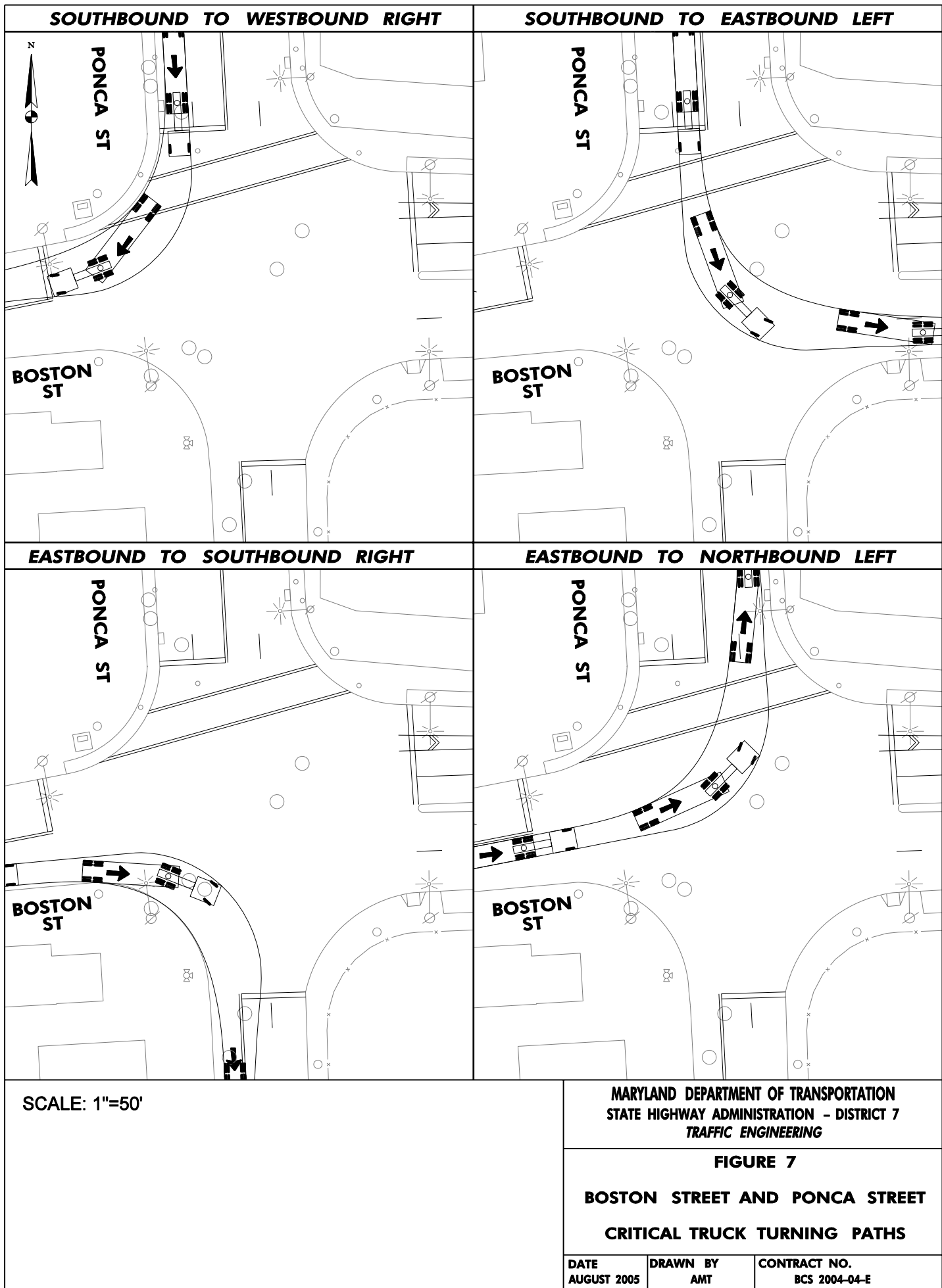
- Left turns from westbound Interstate Avenue to southbound Ponca Street;
- Right turns from westbound Interstate Avenue to northbound Ponca Street;
- Left turns from northbound Ponca Street to westbound Boston Street;
- Right turns from northbound Ponca Street to eastbound Interstate Avenue;
- Right turns from southbound Ponca Street to westbound Boston Street;
- Left turns from southbound Ponca Street to eastbound Interstate Avenue;
- Right turns from eastbound Boston Street to southbound Ponca Street; and
- Left turns from eastbound Boston Street to northbound Ponca Street.

According to Autoturn, truck turning paths are adequate for **six** of the **eight** trucking turning paths. The two turning paths Autoturn indicated trucks would have difficulty maneuvering include:

- Traveling west from Interstate Avenue to southbound Ponca Street - The trailer wheel path will cross the STOP line (Figure 6).
- Traveling east from Boston Street to southbound Ponca Street - The truck tractor must encroach into the opposing lane so that the trailer wheel path does not override the curb in the southwest corner of the intersection (Figure 7).

The lack of two departure lanes contributes to truck turning difficulties in the southbound direction on Ponca Street. The other intersection departures are the width of two lanes. Trucks completing right-turning movements in the north-, south- and westbound directions must swing into both departure lanes to complete their turns. Consequently, it is likely that trucks would not be able to turn right on red.





V. Safety Analysis

Baltimore City's Office of Transportation provided crash data for the study intersection for the period from January 1, 1999 through September 30, 2003. The crash table provided by the City is located in Appendix F. A review of the crash data at the location indicated the following:

- During the four-year and nine-month period there were a total of 52 reported crashes at the intersection.
- Of the 52 reported crashes, the predominant collision types were left turn, rear end and other.
- **No intersection-related crash resulted in a fatality.** A total of eight (8) crashes resulted in personal injury and 44 resulted in property damage only. The total number of crashes between 1998 and 2002 has remained relatively constant. Only three crashes were reported in the first nine months of 2003.
- Half (26) of the crashes occurred at night.
- The data from the City indicates only three (3) of the crashes were intersection-related. The other collisions were near the intersection.
- Of the 52 reported crashes, two (2) involved pedestrians and one (1) involved a bicyclist.

VI. Summary of Findings

Based on the data collection, field observations and analysis, there are a number of findings that may impact safety and operations as summarized below:

- There are several industrial complexes in the vicinity of the intersection that generate a high amount of truck traffic.
- Trucks destined for Seagirt and Dundalk Marine Terminals might be traveling through the intersection based on observations of container and flatbed tractor-trailer trucks.
- Boston Street, west of Ponca Street, is a two-lane section. This narrow cross section impacts traffic operations since the short (assumed three-lane) eastbound approach cannot process vehicles efficiently.
- There are no pavement markings indicating the westbound lane drop.
- There are three railroad crossings west of the intersection (two at-grade and one grade-separated). Trains were observed at the five-track crossing, approximately 1,400 feet west of the intersection. During the day of the count, the gates at this crossing were down for 20 minutes continuously. Westbound vehicle queues extended to a location just west of the intersection. Once the queue extends to this point, drivers often divert to Ponca Street or Newkirk Street.
- There is temporary concrete traffic barrier in the southwest corner protecting pedestrians in this area. There are other pedestrian facilities in the vicinity of the intersection.
- Trucks are overriding the curb in the southwest corner of the intersection.
- Pavement markings in the vicinity of the intersection are faded.
- Guide signing to I-95 is not present on all of the approaches. There are no signs directing motorists to I-895.
- Two large developments, proposed west of the intersection, will nearly double the traffic in the area.
- There are no near-term programmed improvements on either Baltimore City's or MdTA's Capital Improvement Plan. Baltimore City has a long-term Master Plan improvement to viaduct Boston Street over all three railroad crossings and tie directly into I-95.
- There is a high percentage of trucks in all three peak hours. The predominant truck movements are northbound right turns and westbound left turns.
- Most of the trucks at the intersection were tractor-trailer trucks.
- Peak period observations indicated the following:
 - Eastbound queues were long throughout the day. There were also moderate queues along northbound Ponca Street.
 - Westbound queues often developed when trucks or other vehicles were turning left at Newkirk Street, west of the intersection. These queues often temporarily blocked the intersection. (This is not reflected in the operational analysis.)
 - The presence of trucks often impeded visibility of other motorists and required left turns to be completed only on the exclusive portion of the traffic signal phase.
 - On more than one occasion, motorists in the westbound left-turn lane often continued straight.

- The LOS determined via the CLV methodology as well as Synchro/SimTraffic indicate traffic operations are acceptable during all three peaks when a train is not present. Based on field observations, the intersection operates at LOS F when vehicle queues extend west into and through the intersection when a train is present.
- There are two difficult truck turning movements as observed in the field and analyzed with AutoTurn: eastbound to southbound right turns and westbound to southbound left turns. The lack of two departure lanes contributes to truck turning difficulty in the southbound direction on Ponca Street.
- There were 52 crashes in the vicinity of the intersection based on data from Baltimore City. The data indicate there were no fatal crashes and the majority of incidents were property-damage-only left-turn and rear end crashes. There were two pedestrian and one bicyclist crashes at the intersection.

VII. Potential Alternatives

Based on the data collection, field observations and analysis of existing conditions, there are some alternatives that could be considered to improve safety and operations for truck and other traffic. The alternatives that could be considered are summarized below:

1. **IMPLEMENT SPOT SAFETY, SIGNING AND OTHER IMPROVEMENTS**

This alternative contains a variety of low-cost improvements that can be quickly implemented to correct existing deficiencies. Specific improvements could include the following:

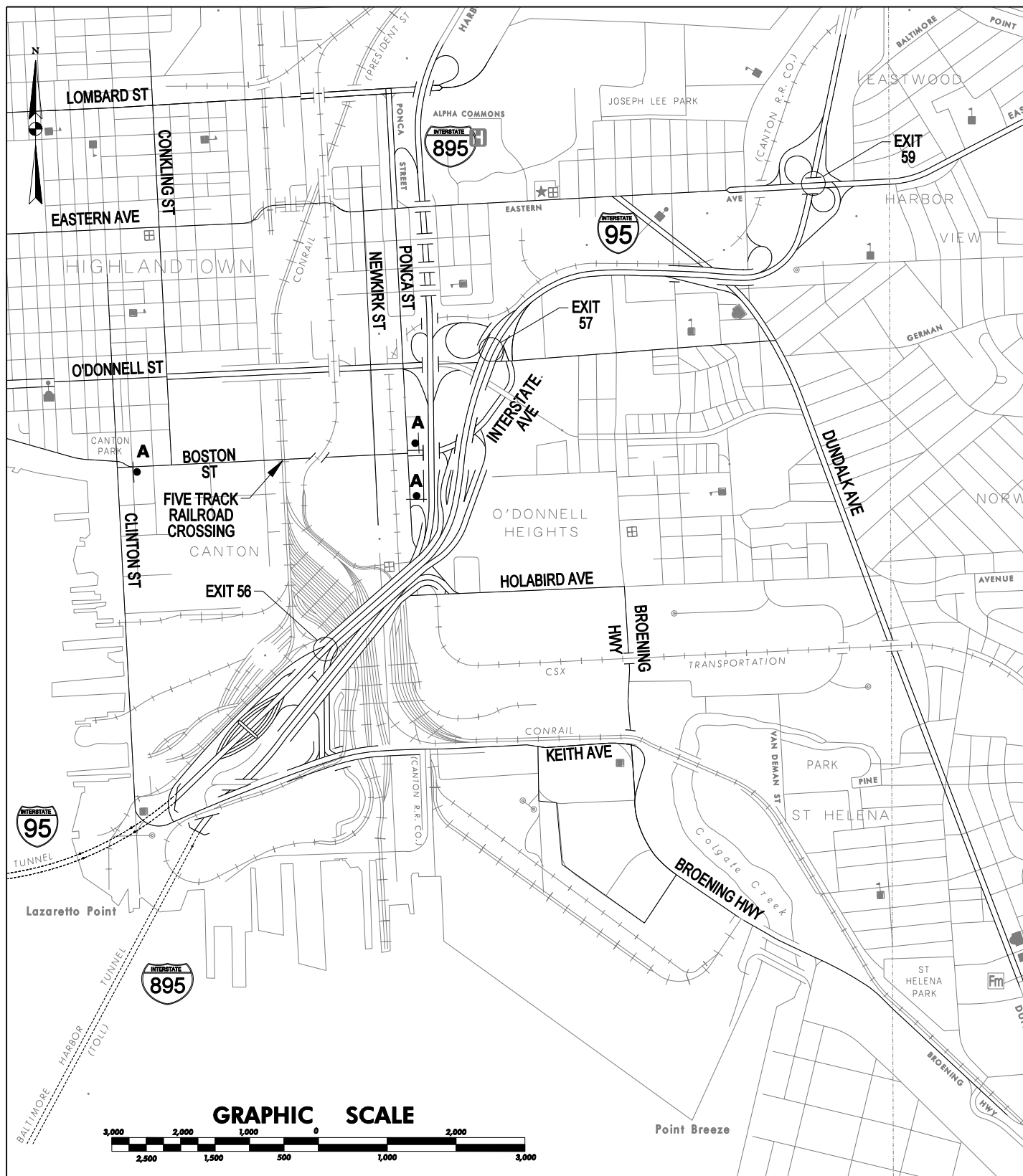
- Upgrade westbound lane drop pavement markings;
- Consider exclusive-permissive left-turn traffic signal phasing in the northbound direction.
- Re-mark STOP lines for all approaches, crosswalks and all lane lines;
- Upgrade STOP line pavement markings A) in their current location or B) set them back to improve truck turning movements;
- Install pedestrian signal heads to support the existing crossing on the north leg;
- Consider installation of crosswalk markings and pedestrian signal heads to cross the east leg (there are existing handicap ramps);
- Consider re-marking the southbound approach to include a left-turn lane and a shared through/right-turn lane;
- Consider re-marking the southbound approach to include a left-turn lane, through lane and shared through/right-turn lane) to offset the left-turn lanes to improve visibility (this would require removal of one northbound departure lane);
- Construct sidewalk in the vicinity of GAF in the southwest corner of the intersection;
- Install speed limit signs near the intersection;
- Install guide signs directing motorists to I-95 along southbound Ponca Street and eastbound Boston Street;
- Consider installing guide signs to direct motorists to I-895;
- Install supplemental warning signs on existing train warning flashing signal; **OR**
- Install active warning signs that inform motorists of trains at the five-track crossing. The signs should be installed at strategic points to provide motorists ample warning of trains so that they can divert to other routes. The signs would be activated when a train calls the flashing signs and gates. Figure 8 includes a detail of the proposed sign as well as potential placement locations.

Advantages:

- Low cost improvements
- Could improve safety and operations
- Could provide motorists information to divert to adjacent roadways when trains are present

Disadvantages:

- Does not correct eastbound queuing deficiencies



PROPOSED SIGN A



12" YELLOW
TRAFFIC SIGNAL
HEAD SECTION

12" YELLOW
TRAFFIC SIGNAL
HEAD SECTION

**MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION - DISTRICT 7
TRAFFIC ENGINEERING**

FIGURE 8

BOSTON STREET AND PONCA STREET TRAIN WARNING SIGN DETAIL AND PROPOSED PLACEMENT

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2. *PROVIDE A TRAFFIC SIGNAL SYSTEM ALONG BOSTON STREET*

This alternative is another low-cost improvement that can be quickly implemented to improve traffic operations along the corridor. This improvement considers interconnecting all of the traffic signals along Boston Street and Interstate Avenue to improve coordination, platooning, and vehicle progression. Synchro/SimTraffic were used to coordinate all of the coded traffic signals on Boston Street and to find the optimal timing plan at each location, including offsets. Table 6 below contains the capacity analyses for this alternative. Appendix G contains the capacity analyses worksheets.

Table 6: Alternative No. 2 Intersection Capacity Analysis

	AM Peak Hour				Midday Peak Hour				PM Peak Hour			
	Delay (sec)	v/c	Queue (feet)	LOS	Delay (sec)	v/c	Queue (feet)	LOS	Delay (sec)	v/c	Queue (feet)	LOS
Existing CLV Analysis												
Boston Street at Ponca Street	-	0.50	-	A	-	0.41	-	A	-	0.48	-	A
	CLV = 802				CLV = 653				CLV = 769			
Existing Highway Capacity Manual Analysis												
Boston Street at Ponca Street	30.0	0.54	-	C	40.3	0.35	-	D	29.5	0.55	-	C
Proposed CLV Analysis												
Boston Street at Ponca Street	-	0.50	-	A	-	0.41	-	A	-	0.48	-	A
	CLV = 802				CLV = 653				CLV = 769			
Proposed Highway Capacity Manual Analysis												
Boston Street at Ponca Street	28.6	0.43	-	C	30.2	0.34	-	C	35.4	0.56	-	D
Eastbound Left	46.1	0.13	66	D	46.0	0.13	70	D	19.1	0.04	70	B
Eastbound Through	52.5	0.64	1,021	D	53.5	0.68	467	D	23.3	0.34	866	C
Westbound Left	37.9	0.34	93	D	38.1	0.33	118	D	15.1	0.13	112	B
Westbound Through	45.6	0.67	372	D	41.5	0.53	217	D	17.7	0.34	414	B
Northbound Left	8.9	0.28	222	A	8.1	0.23	159	A	59.6	0.80	314	E
Northbound Through	8.8	0.30	328	A	7.7	0.20	159	A	38.0	0.49	372	D
Southbound Through/Left	8.7	0.35	199	A	7.2	0.17	113	A	69.6	0.90	331	E
Southbound Right	6.5	0.01	27	A	6.3	0.01	16	A	30.7	0.01	30	C

Advantages:

- Low cost improvement
- Could improve safety and operations along the corridor
- Overall LOS improves during AM and midday peak hours
- Eastbound queues reduce during midday and PM peak hours

Disadvantages:

- Does not correct any of the issues related to truck turning movements
- The north- and southbound left-turn movement LOS degrades during PM peak
- Does not correct any of the operational deficiencies introduced by trains

3. **WIDEN BOSTON STREET: BETWEEN NEWKIRK AND PONCA STREETS**

This alternative could be implemented in a reasonable timeframe to improve traffic operations along the corridor. Boston Street would be widened so that the existing approach lanes could be extended to Newkirk Street. This improvement also assumes implementation of Alternative 2. Figure 9 illustrates two options to implement this proposed improvement. Table 7 below contains the capacity analyses for this alternative. Appendix H contains the capacity analyses worksheets.

Table 7: Alternative No. 3 Intersection Capacity Analysis

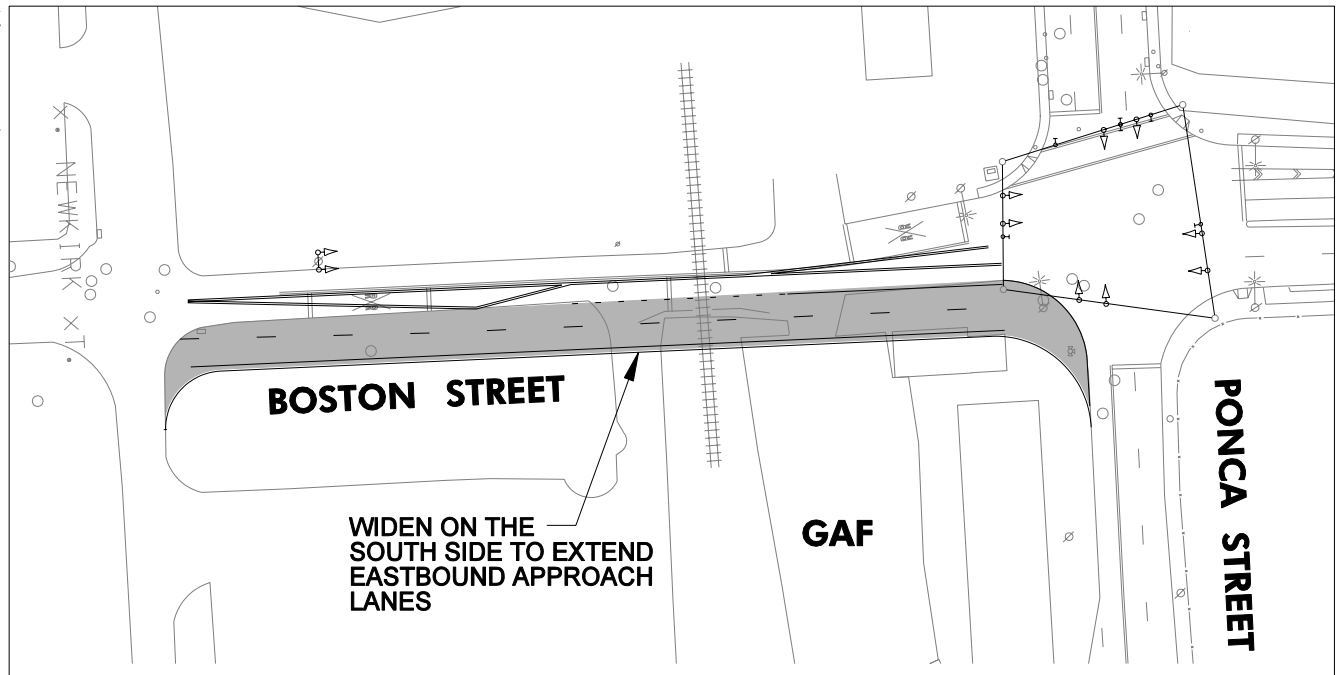
	AM Peak Hour				Midday Peak Hour				PM Peak Hour			
	Delay (sec)	v/c	Queue (feet)	LOS	Delay (sec)	v/c	Queue (feet)	LOS	Delay (sec)	v/c	Queue (feet)	LOS
Existing CLV Analysis												
Boston Street at Ponca Street	-	0.50	-	A	-	0.41	-	A	-	0.48	-	A
	CLV = 802				CLV = 653				CLV = 769			
Existing Highway Capacity Manual Analysis												
Boston Street at Ponca Street	30.0	0.54	-	C	40.3	0.35	-	D	29.5	0.55	-	C
Proposed CLV Analysis												
Boston Street at Ponca Street	-	0.50	-	A	-	0.41	-	A	-	0.48	-	A
	CLV = 802				CLV = 653				CLV = 769			
Proposed Highway Capacity Manual Analysis												
Boston Street at Ponca Street	28.6	0.43	-	C	30.2	0.34	-	C	35.4	0.56	-	D
Eastbound Left	46.1	0.13	45	D	46.0	0.13	105	D	19.1	0.04	103	B
Eastbound Through	52.5	0.64	513	D	53.5	0.68	211	D	23.3	0.34	365	C
Westbound Left	37.9	0.34	93	D	38.1	0.33	93	D	15.1	0.13	112	B
Westbound Through	45.6	0.67	330	D	41.5	0.53	217	D	17.7	0.34	414	B
Northbound Left	8.9	0.28	198	A	8.1	0.23	178	A	59.6	0.80	314	E
Northbound Through	8.8	0.30	249	A	7.7	0.20	220	A	38.0	0.49	372	D
Southbound Through/Left	8.7	0.35	220	A	7.2	0.17	155	A	69.6	0.90	331	E
Southbound Right	6.5	0.01	0	A	6.3	0.01	22	A	30.7	0.01	30	C

Advantages:

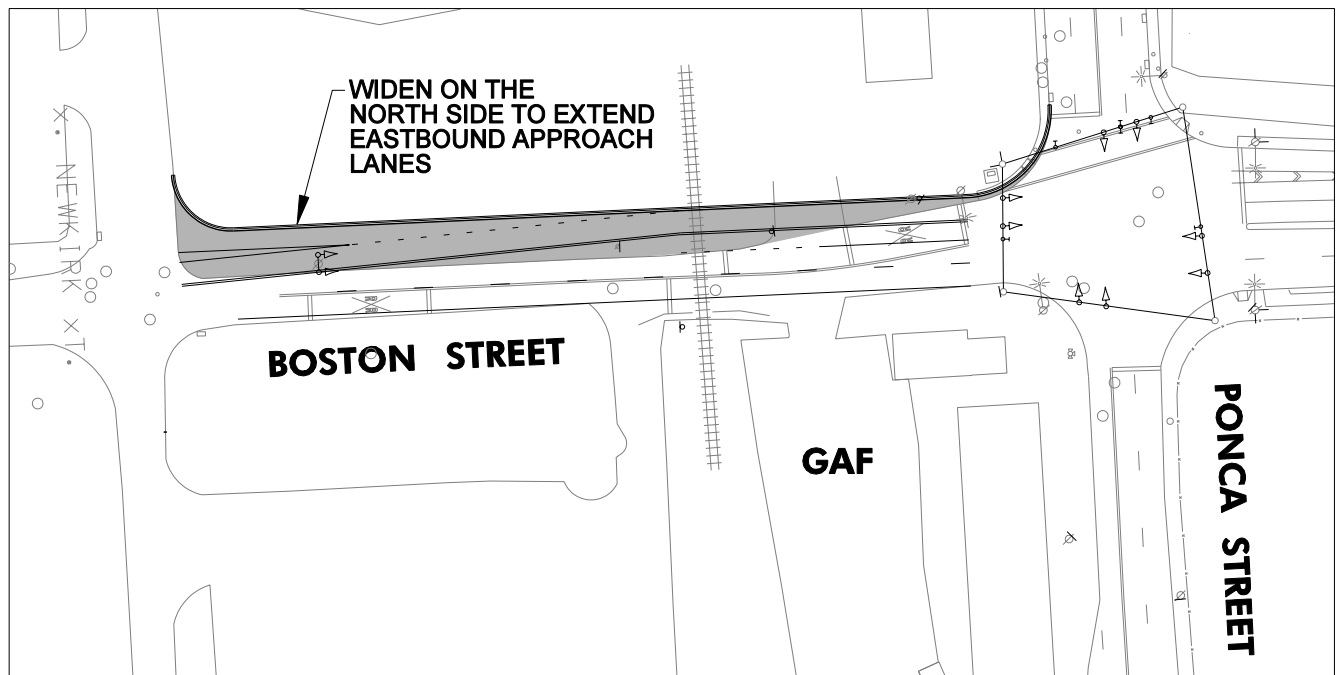
- Overall LOS improves during AM and midday peak hours
- Could improve safety and operations at the intersection
- Eastbound queues reduce during all peak hours

Disadvantages:

- Does not correct any of the issues related to truck turning movements
- Construction costs
- Either option is likely to require right-of-way
- The north- and southbound left-turn movement LOS degrades during PM peak
- Does not correct any of the operational deficiencies introduced by trains



OPTION A



OPTION B

LEGEND



FULL DEPTH PAVEMENT

**MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION - DISTRICT 7
TRAFFIC ENGINEERING**

FIGURE 9

**BOSTON STREET AND PONCA STREET
ALTERNATIVE NO. 3**

**DATE
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4. **WIDEN BOSTON STREET: BETWEEN CONKLING AND PONCA STREETS**

This alternative would be a long term improvement to improve traffic operations. Boston Street would be widened so that the existing wider cross section (nearer to Conkling Street) would extend to Ponca Street. This improvement also assumes implementation of Alternative 2 and includes a revised westbound lane use to include a left-turn lane, through lane and shared through/right-turn lane. Table 8 below contains the capacity analyses for this alternative. Appendix I contains the capacity analyses worksheets.

Table 8: Alternative No. 4 Intersection Capacity Analysis

	AM Peak Hour				Midday Peak Hour				PM Peak Hour			
	Delay (sec)	v/c	Queue (feet)	LOS	Delay (sec)	v/c	Queue (feet)	LOS	Delay (sec)	v/c	Queue (feet)	LOS
Existing CLV Analysis												
Boston Street at Ponca Street	-	0.50	-	A	-	0.41	-	A	-	0.48	-	A
	CLV = 802				CLV = 653				CLV = 769			
Existing Highway Capacity Manual Analysis												
Boston Street at Ponca Street	30.0	0.54	-	C	40.3	0.35	-	D	29.5	0.55	-	C
Proposed CLV Analysis												
Boston Street at Ponca Street	-	0.52	-	A	-	0.41	-	A	-	0.60	-	A
	CLV = 837				CLV = 663				CLV = 964			
Proposed Highway Capacity Manual Analysis												
Boston Street at Ponca Street	28.0	0.41	-	C	30.0	0.32	-	C	35.2	0.56	-	D
Eastbound Left	46.4	0.12	105	D	46.4	0.14	105	D	19.4	0.04	103	B
Eastbound Through	53.5	0.67	399	D	54.3	0.69	168	D	23.3	0.34	282	C
Westbound Left	38.3	0.35	132	D	38.3	0.34	179	D	15.1	0.13	70	B
Westbound Through	40.1	0.47	264	D	38.6	0.35	178	D	15.9	0.23	289	B
Northbound Left	8.6	0.28	218	A	8.0	0.23	140	A	59.6	0.80	261	E
Northbound Through	8.5	0.30	269	A	7.5	0.20	178	A	38.0	0.49	373	D
Southbound Through/Left	8.4	0.34	158	A	7.1	0.17	136	A	69.6	0.90	421	E
Southbound Right	6.2	0.01	32	A	6.2	0.01	31	A	30.7	0.01	50	C

Advantages:

- Would improve safety and operations along the corridor
- Overall LOS improves during AM and midday peak hours
- Improves eastbound queues during all peak hours

Disadvantages:

- Implementation of improvements is long term
- Does not correct any of the issues related to truck turning movements
- Construction costs
- Likely requires additional right-of-way
- Grade separated railroad crossing would have to be reconstructed
- The north- and southbound left-turn movement LOS degrades during PM peak
- Does not correct any of the operational deficiencies introduced by trains

5. *WIDEN PONCA STREET, SOUTH OF BOSTON STREET*

This alternative considers minor widening on Ponca Street to extend the wider cross section south of the intersection, north to Boston Street. This is a medium-cost improvement that could be implemented in a reasonable timeframe to correct existing deficiencies related to truck turning movements. Figure 10 illustrates this proposed improvement. The existing lane use would remain, consequently, there are no capacity analyses for this alternative.

Advantages:

- Could improve safety and operations
- Would improve truck turning movements toward southbound Ponca Street

Disadvantages:

- Construction cost
- Likely requires right-of-way
- Would require vehicles currently parking along Ponca Street to relocate

6. *IMPLEMENT MASTER PLANNED ROADWAY IMPROVEMENT*

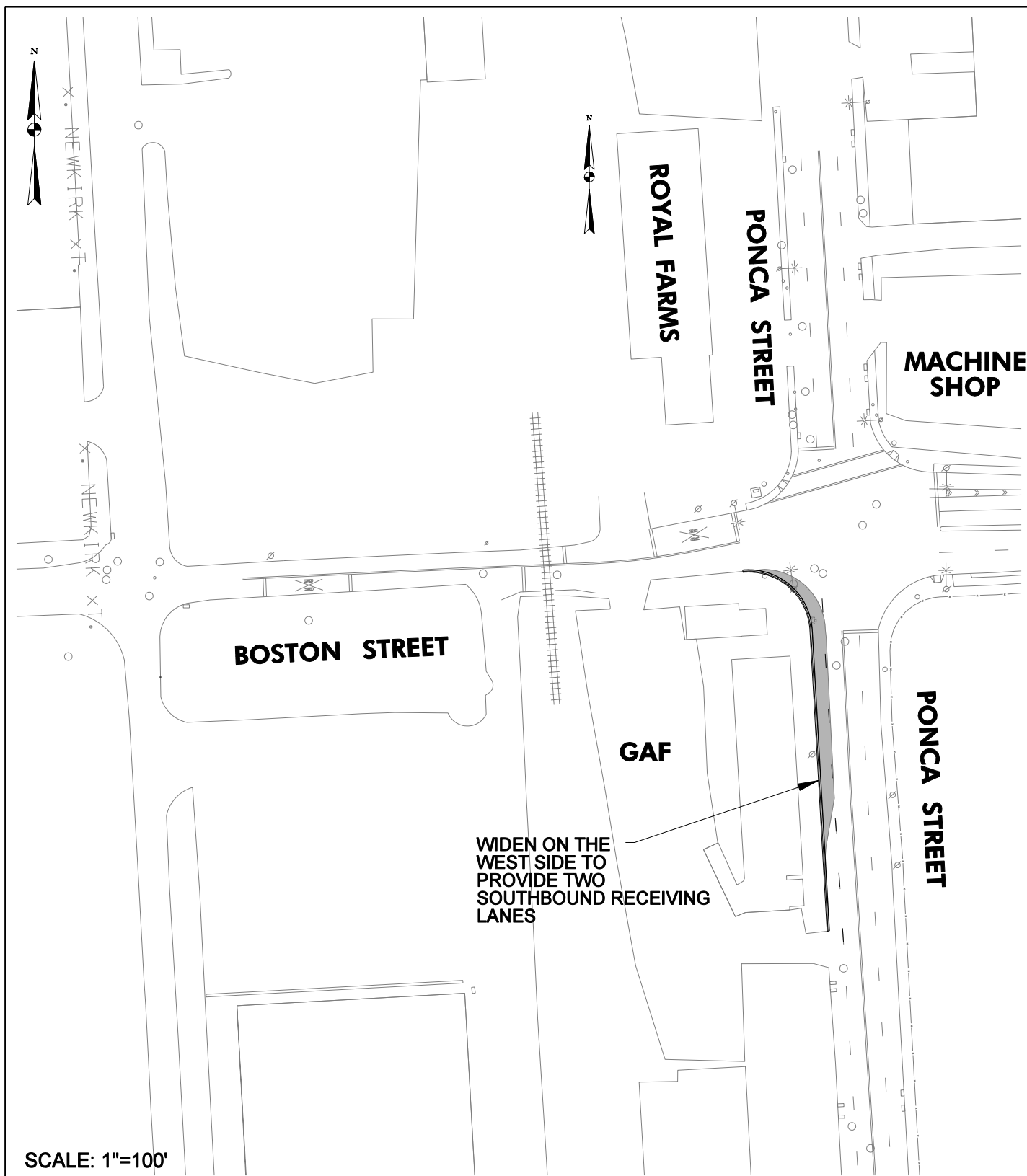
This alternative considers constructing the viaduct that would carry Boston Street over all of the railroad tracks and tie into I-95 directly. This new connection would divert all through traffic from the existing intersection. Only local traffic would remain at the intersection.

Advantages:

- Would improve safety and operations along the corridor
- A decrease in traffic is expected at the intersection of Boston Street and Ponca Street

Disadvantages:

- Implementation of improvements is long term
- Likely requires right-of-way
- Construction cost



LEGEND



FULL DEPTH PAVEMENT

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION - DISTRICT 7
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FIGURE 10

BOSTON STREET AND PONCA STREET
ALTERNATIVE NO. 5

DATE
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