NORTHEAST OHIO AREAWIDE COORDINATING AGENCY

NOACA: Planning For Greater Cleveland

IR-71 CORRIDOR STUDY
BOSTON RD PARTIAL INTERCHANGE

November 2017

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Executive Summary

Interstate 71 (IR-71) is a regionally significant highway that connects Cleveland to Columbus, Cincinnati and Louisville, Kentucky. Traffic flow and congestion along this highway corridor varies, but it generally operates near or at capacity level during the peak periods as it passes through urbanized areas such as Strongsville and Medina. The first phase of this study investigated traffic congestion along IR-71 from the State Route (SR) 82 (Royalton Rd) interchange to United States Route (US)-224. The analysis identified adding a partial interchange at Boston Road and IR-71 as the alternative with the highest return.

This Report summarizes the second phase of the study conducted by The Northeast Ohio Areawide Coordinating Agency (NOACA), which analyzes alternatives for a partial interchange design at Boston Road and IR-71. Similar to the first phase of the IR-71 corridor study, the backbone of the second phase is a comparative analysis for a set of selected construction design alternatives based on the future morning and afternoon peak period scenarios of the NOACA travel forecasting model.

The study considered five alternatives for the partial interchange at Boston Road and IR-71. Each alternative includes a pair of scenarios for the Boston Road lane configuration. A median lane along Boston Road distinguishes each pair of scenarios. Combining the partial interchange alternatives and Boston Road median alternatives generated ten individual alternatives. Additionally, the "No Build" and "Full Interchange" alternatives played the benchmark roles for the conducted comparative analysis.

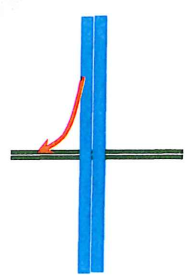
A benefit value was calculated for each alternative by comparing its total cost to that of the "No Build" alternative. The total cost is comprised of congestion, preliminary engineering, right of way acquisition, construction, construction engineering, maintenance, safety, and emissions costs. These costs were then decreased by estimated reduction in congestion costs, and the savings magnitude is the overall comparison indicator. Aggregating all these costs for each alternative and comparing them with the specified benchmark quantified the positive or negative return of each alternative. The highest positive return justifies the construction design alternative in terms of cost, however, traffic congestion is also important in selecting the best candidate.

Boston Road Interchange Alternative Evaluations

Considering the residential neighborhoods in the west of the intersection of Boston Road and IR-71 as the major trip generators, and the employment centers in the north and south, five possible partial interchange alternatives were designed. This alternative was assumed as alternate 1, or the base alternate and alternatives 2, 3, 4 and 5 add supplemental ramps.

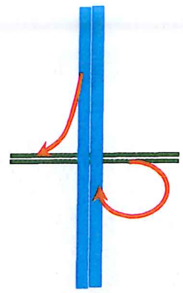
1. Exit-ramp from SB IR-71 to Boston Road in City of Strongsville.

Alternative 1 (Base)



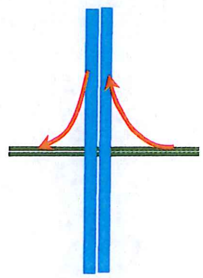
2. On-ramp from Boston Road to NB IR-71 in City of Brunswick.

Alternative 2



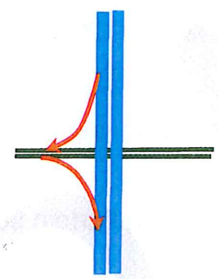
3. On-ramp from Boston Road to NB IR-71 in City of Strongsville.

Alternative 3



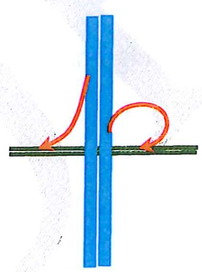
4. On-ramp from Boston Road to SB IR-71 in City of Brunswick.

Alternative 4



5. Exit-ramp from NB IR-71 to Boston Road in City of Strongsville.

Alternative 5



The “No Build” and a full interchange were considered as the benchmark alternatives.

Findings

- Alternative 4 without a Boston Road median provides the highest potential benefit.

- Congestion impacts are between 0% to +/- 20% for most alternatives.
- Alternative 2 and 3 offer the highest traffic improvements on Howe Road and SR-82.
- Traffic congestion will slightly increase on certain segments of IR-71 regardless of the alternatives.
- All alternatives make Boston Road and Carpenter Road more congested.
- All alternatives do not have any noticeable impacts on SR 303 congestion.

Background

The Northeast Ohio Areawide Coordinating Agency (NOACA) and the Ohio Department of Transportation (ODOT) have partnered on a study to investigate improvements on the operations of the Interstate 71 (IR-71) corridor by reducing congestion and improving safety. Specifically examining the high-level need for one or more interchanges in the corridor to provide the most relief in terms of congestion.

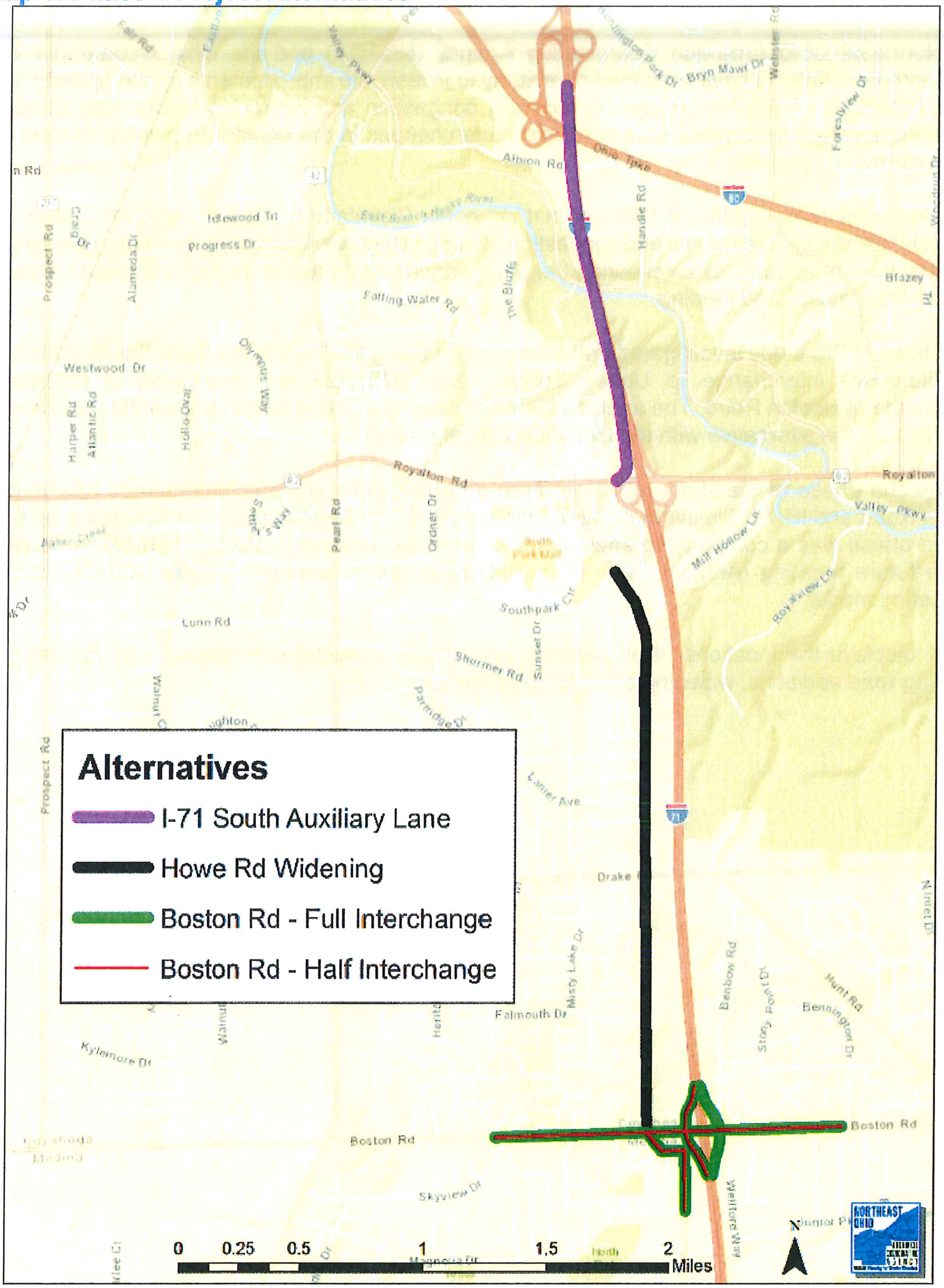
IR-71 is a regionally significant highway that connects Cleveland to Columbus, Cincinnati and Louisville, Kentucky. Traffic flow and congestion along this highway corridor varies, but it generally operates near or at capacity level during the peak periods as it passes through urbanized areas such as Strongsville and Medina.

First phase of this study investigated traffic congestion along IR-71 from the State Route (SR) 82 (Royalton Rd) interchange to United States Route (US)-224 and evaluating a potential interchange at Boston Road. The analysis identified adding a partial interchange at Boston Road and IR-71 as the alternative with the highest potential return.

The second phase of the study was to analyze alternatives for a partial interchange design at Boston Road and IR-71. Similar to the first phase of the IR-71 corridor study, the backbone of the second phase was a comparative analysis for a set of selected construction alternatives based on the future morning (AM) and afternoon (PM) peak period scenarios of the NOACA travel forecasting model.

Map 1 displays the locations of alternatives which were considered in phase 1 of this study including road additions, widening and new interchanges.

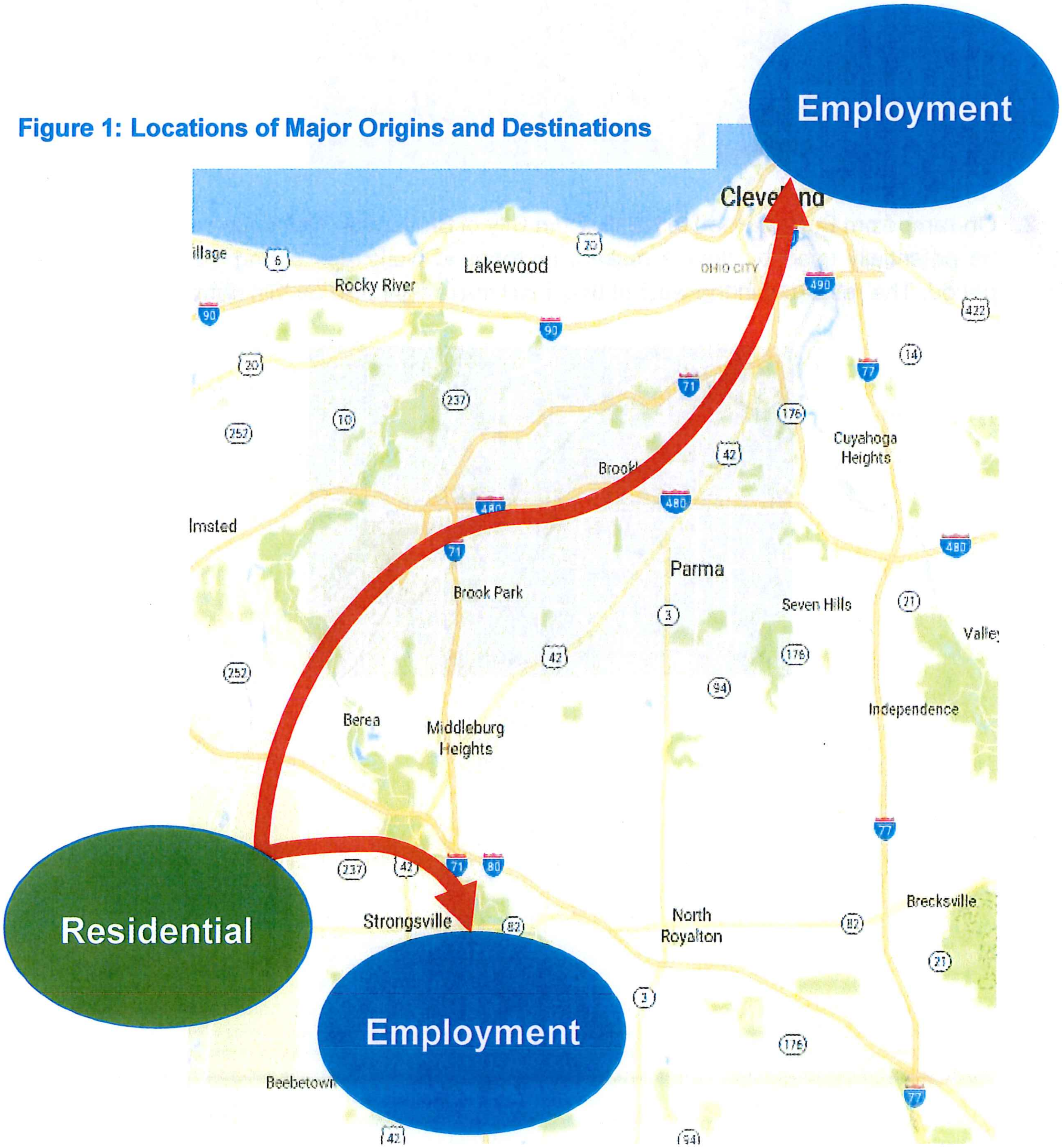
Map 1: Phase 1 Project Alternatives



Boston Road Interchange Alternative Evaluation

The second phase considered five alternatives for the partial interchange at Boston Road and IR-71. Each alternative includes a pair of scenarios for the Boston Road lane configuration. A median lane along Boston Road distinguishes each pair of scenarios. Combining the partial interchange evaluation and Boston Road median alternatives generated ten individual alternatives. Considering the residential neighborhoods in the west of the intersection of Boston Road and IR-71 as the major trip generators and the employment centers in the north and south, five possible partial interchange alternatives were evaluated. Figure 1 schematically depicts the locations of these origins and destinations.

Figure 1: Locations of Major Origins and Destinations



1. Exit-ramp from SB IR-71 to Boston Road in City of Strongsville. This alternative was assumed as alternate 1, or the base alternate and targeted users will be those making southbound return work trips during the afternoon peak period.
   Alternatives 2, 3, 4 and 5 add supplemental ramps.

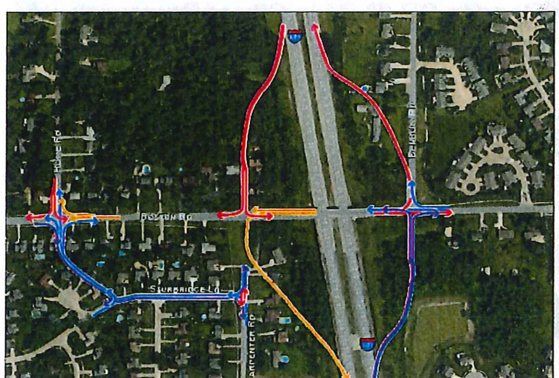
2. On-ramp from Boston Road to NB IR-71 in City of Brunswick. This supplemental ramp will be potentially used by drivers making northbound work trips during the morning peak period. The residents in the west of IR-71 will make right turn on this ramp.

3. On-ramp from Boston Road to NB IR-71 in City of Strongsville. This supplemental ramp will be potentially used by drivers making northbound work trips during the morning peak period. The residents in the west of IR-71 will make left turn on this ramp.

4. On-ramp from Boston Road to SB IR-71 in City of Brunswick, which includes a realignment of Carpenter Road. This ramp will serve drivers traveling southbound for their morning work trips.

5. Exit-ramp from NB IR-71 to Boston Road in City of Strongsville. Drivers traveling northbound on IR-71 from work locations in the south will exit using this ramp to reach their residences during the afternoon peak period.

The "No Build" and a full interchange were considered as the benchmark alternatives.



Comparative Analyses

A future year modeling scenario was developed for each specified alternative, and the NOACA travel forecasting model runs were executed. A comparative analysis was conducted based on the following cost items:

- Congestion Cost
- Preliminary Engineering Cost
- Right-of-Way acquisition Cost
- Construction Cost
- Construction Engineering Cost
- Maintenance Cost
- Safety Cost
- Emissions Cost

The next sections document a short description for each cost estimation procedure.

Congestion Cost

As demand approaches the capacity of a road (or of the intersection along the road), extreme traffic congestion sets in. Traffic congestion causes longer trip times, slower speed and increased delay. Traffic engineering and financial indicators of travel delay and wasted fuel due to congestion were combined as a performance measure of congestion cost. This combined measure was calculated based on the following assumptions and procedure.

Assumptions

Average Fuel Cost = $2.5 per Gallon

Average miles a vehicle can travel on one gallon of fuel = 25.73 miles per gallon. According to several sources, in 2015, the average Ohio gasoline consumption per day per capita was about 1.059 gallons, and therefore the calculated daily fuel consumption for the NOACA region is 2,145,911 gallons. The 2015 total Vehicle Mile Traveled (VMT) was about 55,224,583 vehicle miles and therefore the average miles per gallon is the quotient of VMT divided by total daily gasoline consumption.

Median Value of time per hour = $12.27

The 2015 median annual income in the NOACA region was about $51,049 which results in $24.54 per hour. The US Department of Transportation and other sources indicate a range of 30 to 60 percent of average earnings for value of travel time.

Auto occupancy varies during the peak and off-peak periods of a day.

The NOACA travel forecasting model estimates a range of 1.21 to 1.485 for average auto occupancy during the five periods of AM peak, midday, PM peak, night time, and early morning modeling scenarios.

Procedure

The congestion cost procedure utilizes the NOACA travel forecasting model, and a set of assumptions to calculate the additional times that are required to travel a road segment due to traffic congestion conditions. The following steps were implemented to calculate the total congestion costs:

- The ***average road segment delay*** is the difference between the estimated travel time under actual (often congested) conditions and under uncongested conditions.

$$Average\ Road\ Segment\ Delay\ (hr) = \frac{Length\ of\ the\ road\ Segment\ (miles)}{Modeled\ Road\ Segment\ speed\ (mph)} - \frac{Length\ of\ the\ road\ Segment\ (miles)}{Free\ Flow\ Speed\ (mph)}$$

- The ***total delay on a road segment*** is product of the average delay and total vehicles traveling this segment.

$$Road\ Segment\ Delay\ (hr) = Average\ Road\ Segment\ Delay\ \times Total\ Traffic\ Volume$$

- The ***road segment delay cost*** is calculated by multiplying the estimated road segment delay by average passenger car occupancy and the occupants' average value of time.

$$Road\ Segment\ Delay\ Cost\ (\$) = Road\ Segment\ Delay\ \times Average\ auto\ occupancy\ \times Average\ Value\ of\ time$$

- Vehicles waste additional fuel when they are under congested conditions. The ***additional consumed fuel cost*** can be estimated using the below calculated delay and auto operating cost.

$$Road\ Segment\ Fuel\ Cost\ (\$) = Road\ Segment\ Delay\ \times Modeled\ Road\ Segment\ Speed\ \times\ auto\ Operating\ cost$$

- The ***average auto operating cost*** is estimated by dividing the fuel cost per gallon by the average miles a vehicle can travel on one gallon of fuel.

$$Average\ Auto\ Operating\ Cost\ (\$) = \frac{Fuel\ Cost\ per\ gallon}{Average\ miles\ a\ vehicle\ can\ travel\ on\ one\ gallon\ of\ fuel}$$

- Finally, the ***total road segment congestion cost*** comprises of two elements; delay cost and fuel cost.

$$Road\ Segment\ Congestion\ Cost\ (\$) = Road\ Segment\ Delay\ Cost + Road\ Segment\ Fuel\ Cost$$

Construction Cost Items

The preliminary engineering, right of way acquisition, construction, construction engineering, maintenance costs were estimated based on the assumed unit costs, which are illustrated in table 1.

Table 1: Unit Costs

Cost Item/ Parameter	Unit Cost
Project Period	20 Years
Area of a Lane-Mile (Sq. Ft)	12 x 5,280 = 63,360
On or Off-Ramp Construction Cost per Sq. Ft	$30
Construction Cost of a Lane-Mile of Ramp	$1,900,800
Construction Cost of a Four-Legged Signalized Intersection	$425,000
Width of a Median Lane (Ft)	11
Two-Way Left-Turn Lane (TWLTL) Construction Cost per Sq. Ft	$22
Construction Cost of a Mile of TWLTL	$1,277,760
TWLTL Cost for Boston Rd, from SR42 to W 130th St (2.04 miles)	$2,606,630
Right of Way (R/W) Cost per Sq. Ft	$15
R/W width of a Ramp Lane (Ft)	40
Average Cost of Demolishing a House ($)	$350,000
Maintenance Cost Per Sq. Ft	$4
Number of Maintenance Cycles in the Project Period	3
Maintenance Cost of a Lane-Mile	$253,440
Preliminary Engineering Cost for a Ramp only (Scenario 1)	10% of Construction Cost
Preliminary Engineering Cost for a Half Interchange (Scenarios 2-5)	18% of Construction Cost
Construction Engineering Cost for a Ramp only (Scenario 1)	5% of Construction Cost
Construction Engineering Cost for a Half Interchange (Scenarios 2-5)	10% of Construction Cost

Safety Cost

The crash risk in congested areas within the study area was considered and corresponding costs were calculated. The reported crashes referenced to a specific location were used to identify crash patterns and more specifically, severity, and frequency of crashes. A crash severity scale known as the KABCO scale shown in Table 2, provided by the Federal Highway Administration, was considered to calculate the potential costs as a measure of safety analysis. The KABCO injury scale was developed by the National Safety Council (NSC) and frequently used by law enforcement for classifying injuries.

K: Fatal

A: Incapacitating injury

B: Non incapacitating injury

C: possible injury

O: No injury (property damage only)

Table 2: Typical Crash Costs

Injury/ Severity Level	Estimated Crash Cost ($)
Fatality (K)	$4,008,900
Disabling Injury (A)	$216,000
Evident Injury (B)	$79,000
Possible Injury (C)	$44,900
Property Damage only (O)	$7,400

Emission Cost

The emission costs were calculated using the most recent version of the US Environmental Protection Agency's (US EPA) mobile emissions modeling software, named MOVES2014a. Emissions factors for all vehicle class types (e.g. passenger vehicles, buses, heavy-duty trucks) were developed for nitrogen oxides (NOx), volatile organic compounds (VOCs), and fine particulate matter (PM2.5) that are the main mobile emissions of concern in Northeast Ohio. These emissions factors estimate the grams of each pollutant released per mile (g/mi) for each vehicle class, under various parameters. Emissions factors were selected for vehicles traveling 27.5-32.5 miles per hour (mph), which is approximately the average travel speed for vehicles in the US, according to the US Department of Transportation (US DOT) Department of Transportation Statistics. Emission factors were also selected for buses traveling 12.5-17.5 mph, which is the average travel speed for buses in the NOACA region.

The selected emission factors (in g/mi) were then multiplied by the total Vehicle Miles Traveled (VMT) associated with each scenario alternative. It is worth mentioning that the VMT is an indicator of the travel levels on the roadway system by motor vehicles, and varies by subarea and scenario alternative. These VMT values are calculated using the NOACA travel demand model and are broken down into vehicle classes. This step also provided estimates of total grams of each pollutant per day, for each scenario alternative.

In order to calculate the mobile emission costs, first the estimated grams per day for each scenario were converted into total metric tons per year and then multiplied by the most recent costs per ton for NOx, VOCs, and PM2.5 from the Federal Highway Administration. Table 3 shows the estimated mobile emission costs.

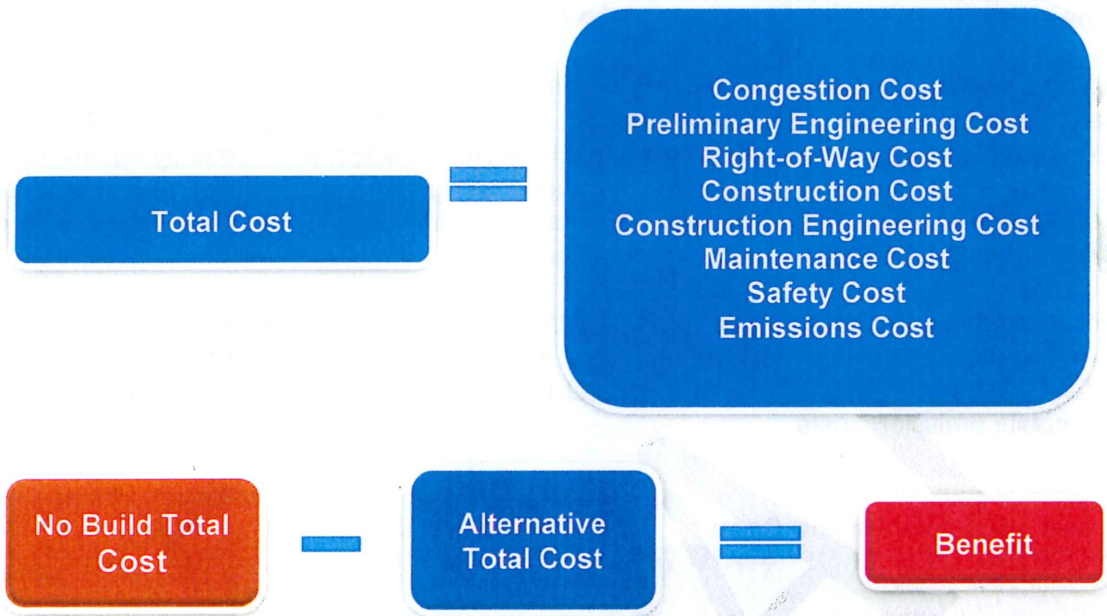
Table 3: Main Mobile Emission Costs

Main Mobile Emission	Emission Cost per ton (2017 $)
VOCs	2,032
NOx	8,010
PM2.5	366,414

Total Cost Comparison

A comparative analysis was conducted based on the total of all the cost items of each alternative. These total costs were compared with that of the "No Build" scenario as the benchmark.
The comparative analyses illustrate that if the estimated total construction costs are justified by the reduction in congestion costs, then the savings magnitude as a benefit is the overall comparison indicator. Figure 2 displays the total cost items and calculating equation.

Figure 2: Benefit Calculations



Tables 4 and 5 show the estimated cost items for each alternative with, and without a median lane for Boston Road, and the last column presents the benefit as the alternative selection indicator. Also, Figure 3 illustrates alternative cost chart for comparison.

Table 4: Cost Items for Alternatives with a Boston Road Median

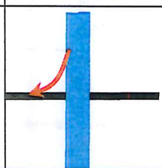
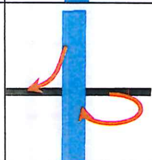
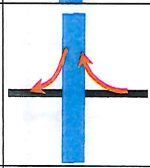
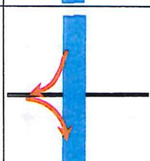
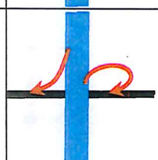
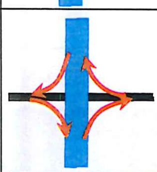
Alternative		Cost Item (2017$)								
		Congestion	Preliminary Engineering	Right-of-Way	Construction	Construction Engineering	Maintenance	Safety	Emission	Benefit
	No Build	463,217,800	0	0	0	0	0	6,079,174	40,411,256	0
1 (Base)		430,993,250	433,977	5,865,360	4,339,770	216,989	608,865	5,814,857	40,688,650	20,746,512
2		442,077,250	1,045,838	10,255,920	5,810,210	581,021	1,027,459	5,859,095	40,998,202	2,083,235
3		445,028,050	1,028,731	9,574,960	5,715,170	571,517	989,405	5,847,485	40,916,963	35,948
4		416,333,500	1,047,505	12,696,320	5,819,470	581,947	837,189	5,835,412	40,832,481	25,724,405
5		432,377,450	1,114,267	11,079,760	6,190,370	619,037	1,179,676	5,799,817	40,583,408	10,764,446
Full Interch-ange		437,122,600	2,295,365	39,713,520	12,752,030	1,275,203	3,272,649	5,875,474	40,747,768	-33,346,379

Table 5: Cost Items for Alternatives without a Boston Road Median

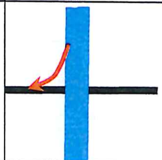
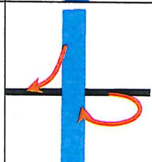
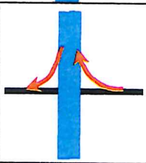
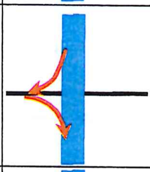
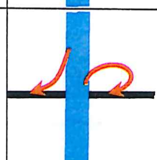
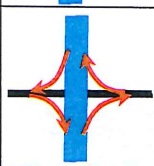
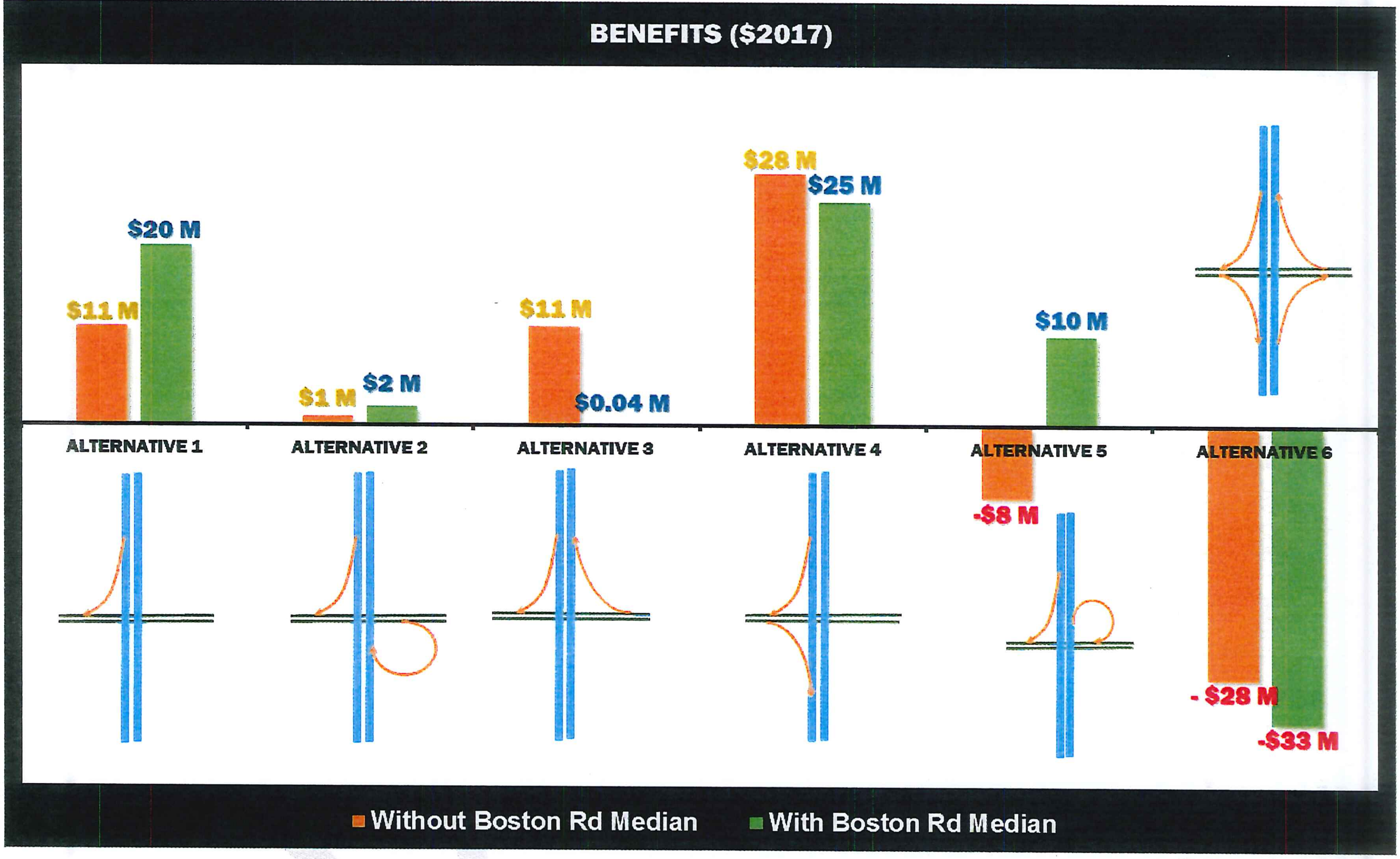
Alternative		Cost Item (2017$)								
		Congestion	Preliminary Engineering	Right-of-Way	Construction	Construction Engineering	Maintenance	Safety	Emission	Benefit
	No Build	463,217,800	0	0	0	0	0	6,079,174	40,411,256	0
1 (Base)		443,317,900	173,314	5,168,400	1,733,140	86,657	608,865	6,115,381	40,651,952	11,852,621
2		444,743,350	576,644	9,049,800	3,203,580	320,358	1,027,459	6,172,968	43,601,658	1,012,413
3		437,444,100	559,537	8,442,400	3,108,540	310,854	989,405	6,143,417	40,838,320	11,871,656
4		417,870,200	578,311	11,738,000	3,212,840	321,284	837,189	6,138,338	40,804,556	28,207,512
5		456,135,250	645,073	9,729,400	3,583,740	358,374	1,179,676	6,117,601	40,666,705	-8,707,588
Full Interch-ange		438,899,550	1,826,172	35,706,000	10,145,400	1,014,540	3,272,649	6,188,329	40,916,963	-28,261,373

Figure 3: Alternative Benefits Comparison Chart



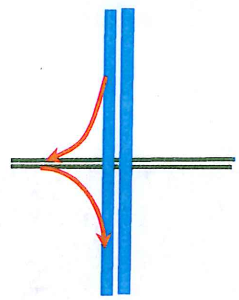
This analysis led to conducting a traffic engineering evaluation based on the congestion measure of "Volume over Capacity Ratio" (V/C) for segments of eight roads and highways in the study area during the morning and afternoon peak periods. These roads and highways are: SR 82, SR 303, IR-71, Boston Road, Howe Road, Carpenter Road, SR 82 -IR-71 ramps, SR303- IR-71 ramps and Boston Road- IR-71 ramps. In total, 1,600 V/C segment ratios were analyzed.

Appendix 1 depicts several examples of the V/C ratios comparison for the congested segments of SR 82 and Howe Road during the morning and afternoon peak Periods.

Conclusion

As discussed, ten partial interchange alternatives were considered and alternative 1 was assumed as the base alternative, and the other alternatives included an additional ramp. The total cost of these alternatives were compared with that of the "No Build" scenario as the benchmark of study.

As illustrated in the last column of Table 4, Table 5, and also in Appendix 1, alternative 4 without the Boston Road median has the highest potential benefit. More than one third of this benefit is due to alternative 1, or base alternative of the construction.



Alternative 4 with the Boston Road median has the second highest potential benefit. Alternative 1 occupies the third position in the ranking of potential benefits.
Additional ramps of other alternatives are not cost effective, and, in fact, alternatives 2, 3, and 5 lose the benefits gained from alternative 1.

As analyzed in the phase 1 of the IR-71 corridor study, the full interchange alternative, as shown in tables 4 and 5, has the lowest potential benefit.

A traffic congestion analysis followed the cost comparative analysis using the "Volume over Capacity Ratio" (V/C) as the performance measure. This analysis considered about ten segments of eight roads and highways for the ten alternatives in the study area during the morning and afternoon peak periods. In total, about 1,600 peak period V/C segment ratios were calculated and compared with those of the 'No Build" scenario.

The traffic congestion analysis indicated that:

- For any alternative, the congestion impacts are in the range 0% to 20%.
- The impact of adding a Boston Road median is negligible on other roads in the study area.
- All alternatives generally make SR 82, Howe Road, SR82- IR-71 ramps and SR303-IR71 ramps less congested depending on the morning or afternoon peak periods.
- All alternatives make Boston Road and Carpenter Road more congested.
- All alternatives do not have any noticeable impacts on SR 303 traffic congestion.
- Alternative 1 moderately improves the congestion on SR 82 and Howe Road.

- Alternatives 2 and 3 take the congestion improvements of the phase 1 of construction to a higher level on SR 82 and Howe Road and decrease the V/C values up to 25%.
- The congestion on IR-71 will slightly increase on certain segments for all the alternatives.

Tables 6 and 7 summarize the cost and traffic analyses results for the phase 1 and phase 2 of the alternatives evaluation.

Table 6: Cost and Traffic Analyses Results for Alternative 1

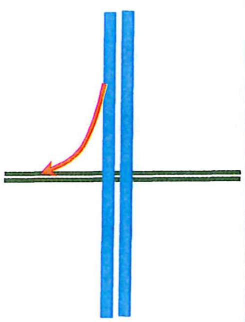
Alternative 1 (Base) 	Selection Criterion	Benefit	Adding Boston Road median
	Total Cost	High	Added Benefit
	Selection Criterion	Congestion	Boston Road median preference
	Howe Road	Moderate improvements	YES
	SR 82	Moderate improvements	NO
	IR-71	Slight increase on certain segments	NO
	Boston Road	Moderately increase	YES
	SR 303	No improvements	NO

Table 7: Cost and Traffic Analyses Results for Alternative 2

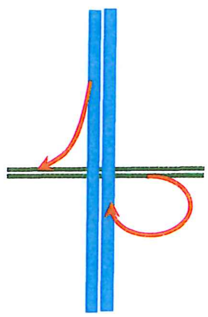
	Selection Criterion	Second Ramp Benefit	Adding Boston Road median
	Total Cost	All benefit lost	Insignificant
Alternative 2	Selection Criterion	Congestion	Boston Road median preference
	Howe Road	Significant high improvements	NO
	SR 82	Significant high improvements	NO
	IR-71	Slight increase on certain segments	NO
	Boston Road	Moderately increase	YES
	SR 303	No improvements	NO

Table 8: Cost and Traffic Analyses Results for Alternative 3

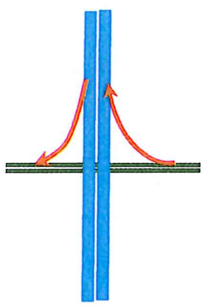
<table>
<tr><td rowspan="8">Alternative 3
</td><th>Selection Criterion</th><th>Second Ramp Benefit</th><th>Adding Boston Road median</th></tr>
<tr><td>Total Cost</td><td>None</td><td>All benefit lost</td></tr>
<tr><th>Selection Criterion</th><th>Congestion</th><th>Boston Road median preference</th></tr>
<tr><td>Howe Road</td><td>Significant high improvements</td><td>NO</td></tr>
<tr><td>SR 82</td><td>Significant high improvements</td><td>NO</td></tr>
<tr><td>IR-71</td><td>Slight increase on certain segments</td><td>NO</td></tr>
<tr><td>Boston Road</td><td>Moderately increase</td><td>YES</td></tr>
<tr><td>SR 303</td><td>No improvements</td><td>NO</td></tr>
</table>

Table 9: Cost and Traffic Analyses Results for Alternative 4

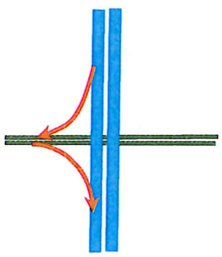
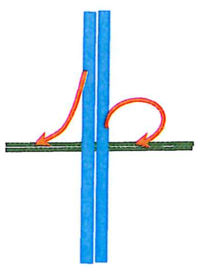
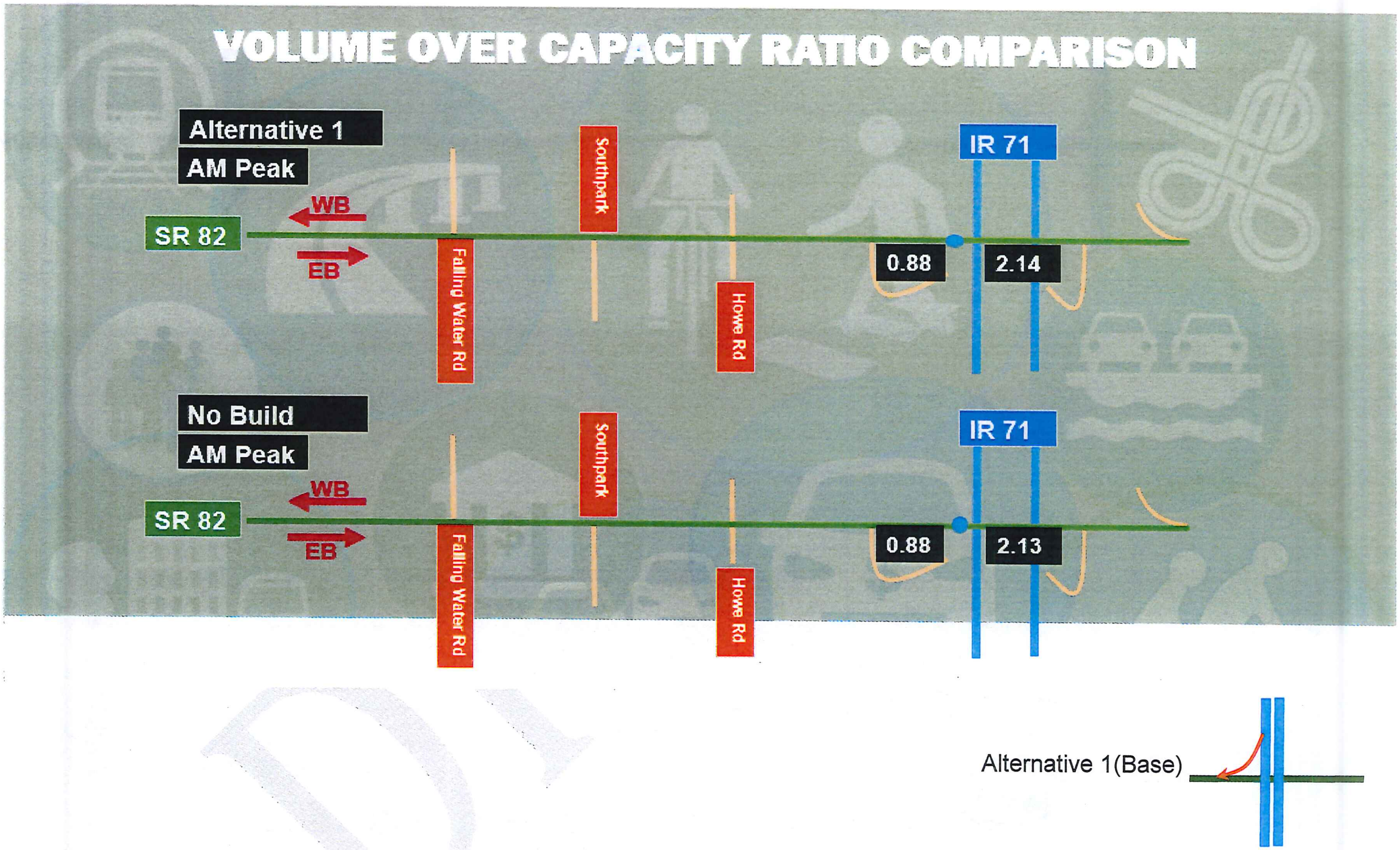
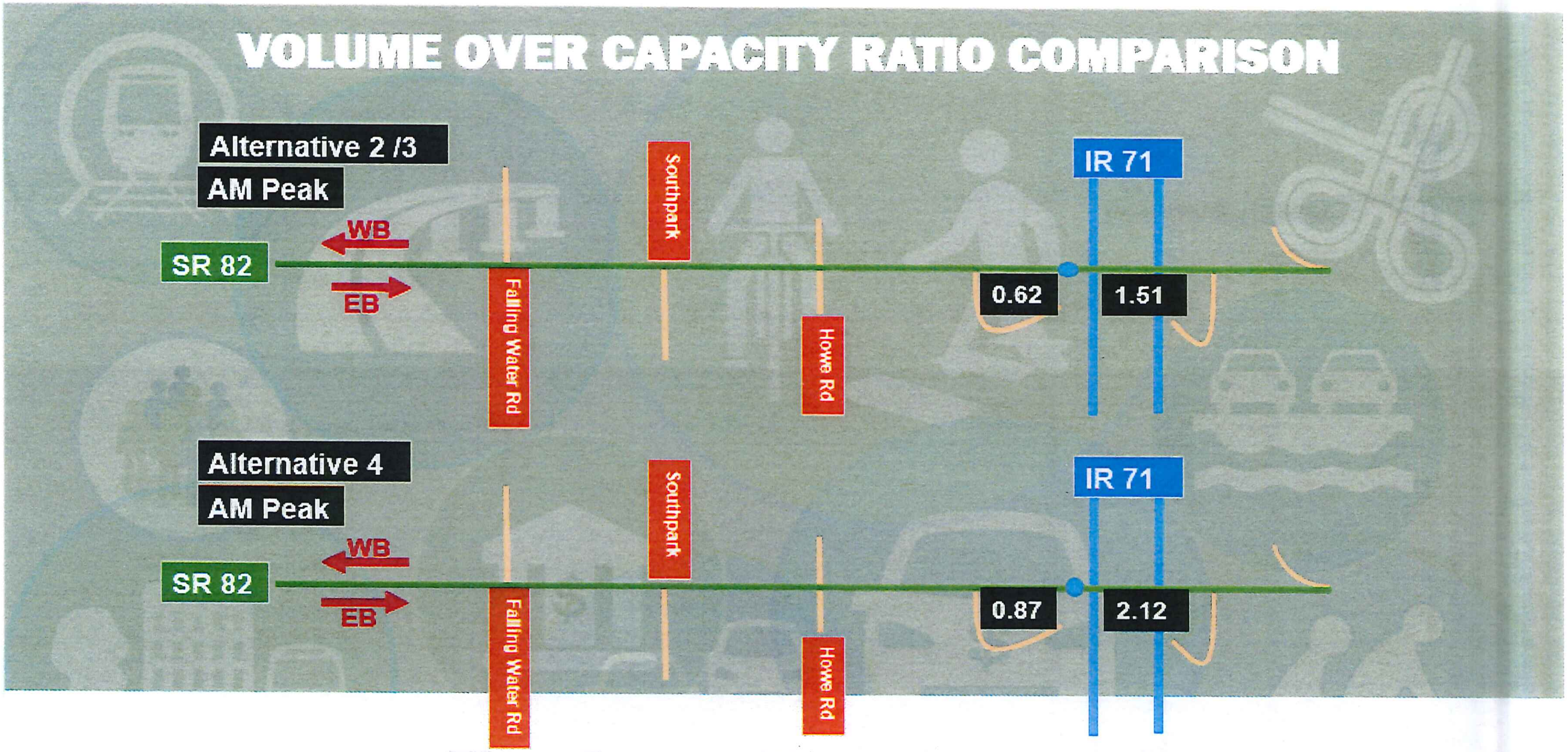
	Selection Criterion	Second Ramp Benefit	Adding Boston Road median
	Total Cost	High	Insignificant
Alternative 4	**Selection Criterion**	**Congestion**	**Boston Road median preference**
	Howe Road	High improvements	NO
	SR 82	High improvements	NO
	IR-71	Slight increase on certain segments	NO
	Boston Road	Moderately increase	YES
	SR 303	No improvements	NO

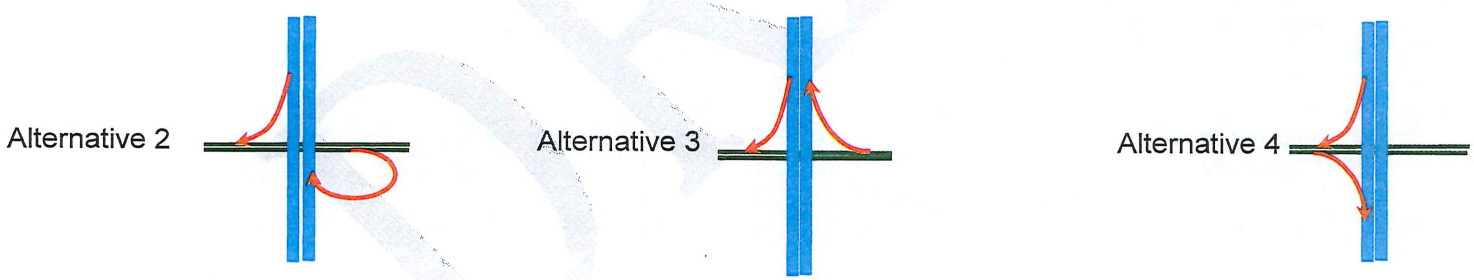
Table 10: Cost and Traffic Analyses Results for Alternative 5

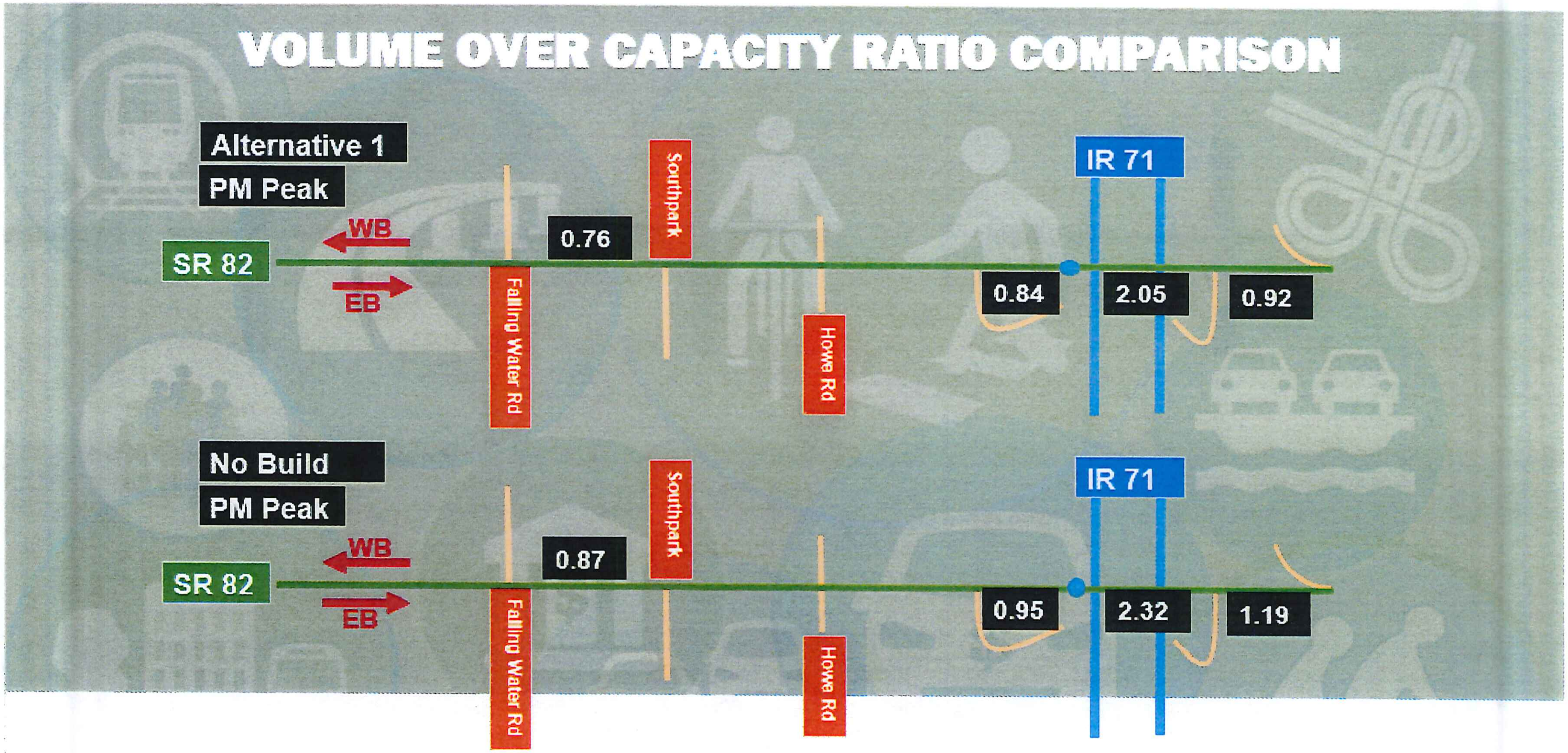
	Selection Criterion	Second Ramp Benefit	Adding Boston Road median
	Total Cost	All benefit lost & additional cost	Restore benefit
Alternative 5	**Selection Criterion**	**Congestion**	**Boston Road median preference**
	Howe Road	High improvements	NO
	SR 82	High improvements	NO
	IR-71	Slight increase on certain segments	NO
	Boston Road	Moderately increase	YES
	SR 303	No improvements	NO

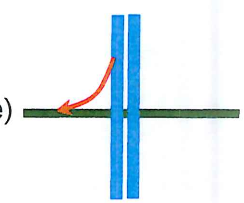
Appendix 1: Volume over Capacity Ratio Comparisons

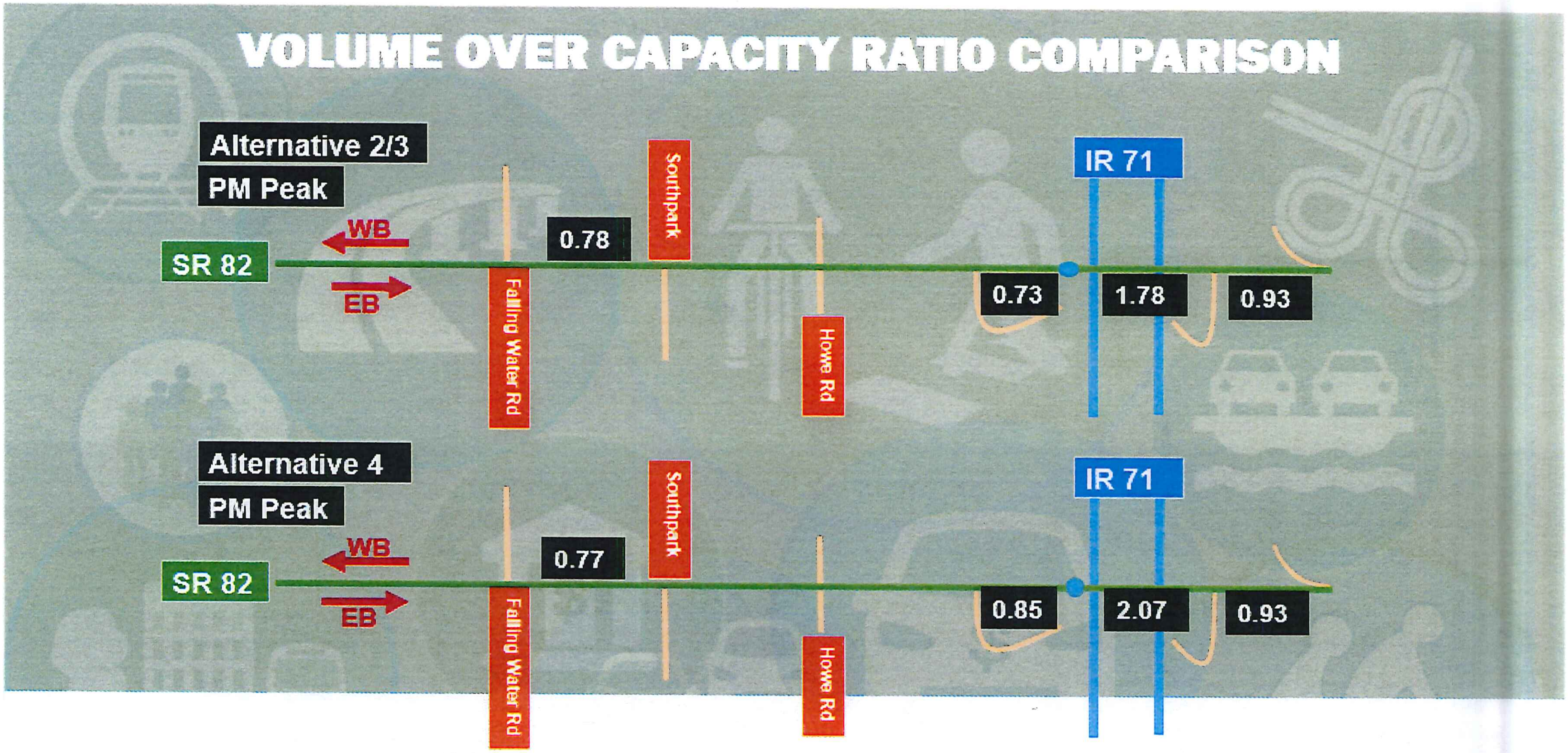


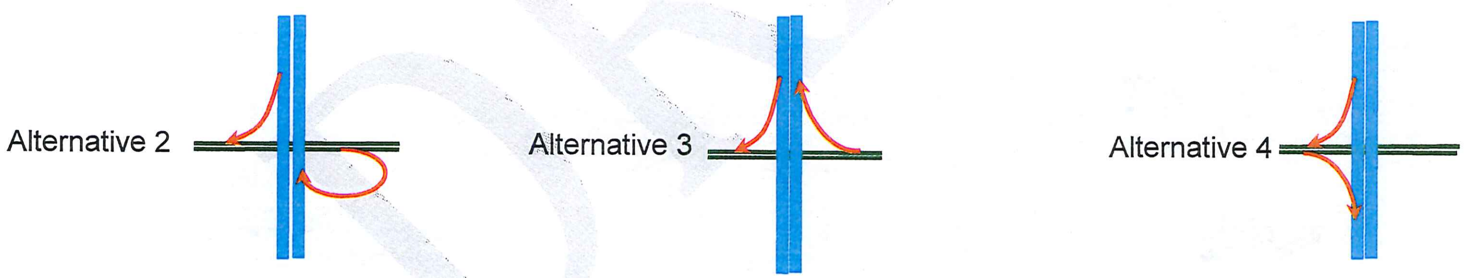

VOLUME OVER CAPACITY RATIO COMPARISON
Alternative 2 /3
AM Peak
SR 82
WB
EB
Falling Water Rd
Southpark
Howe Rd
IR 71
0.62
1.51
Alternative 4
AM Peak
SR 82
WB
EB
Falling Water Rd
Southpark
Howe Rd
IR 71
0.87
2.12

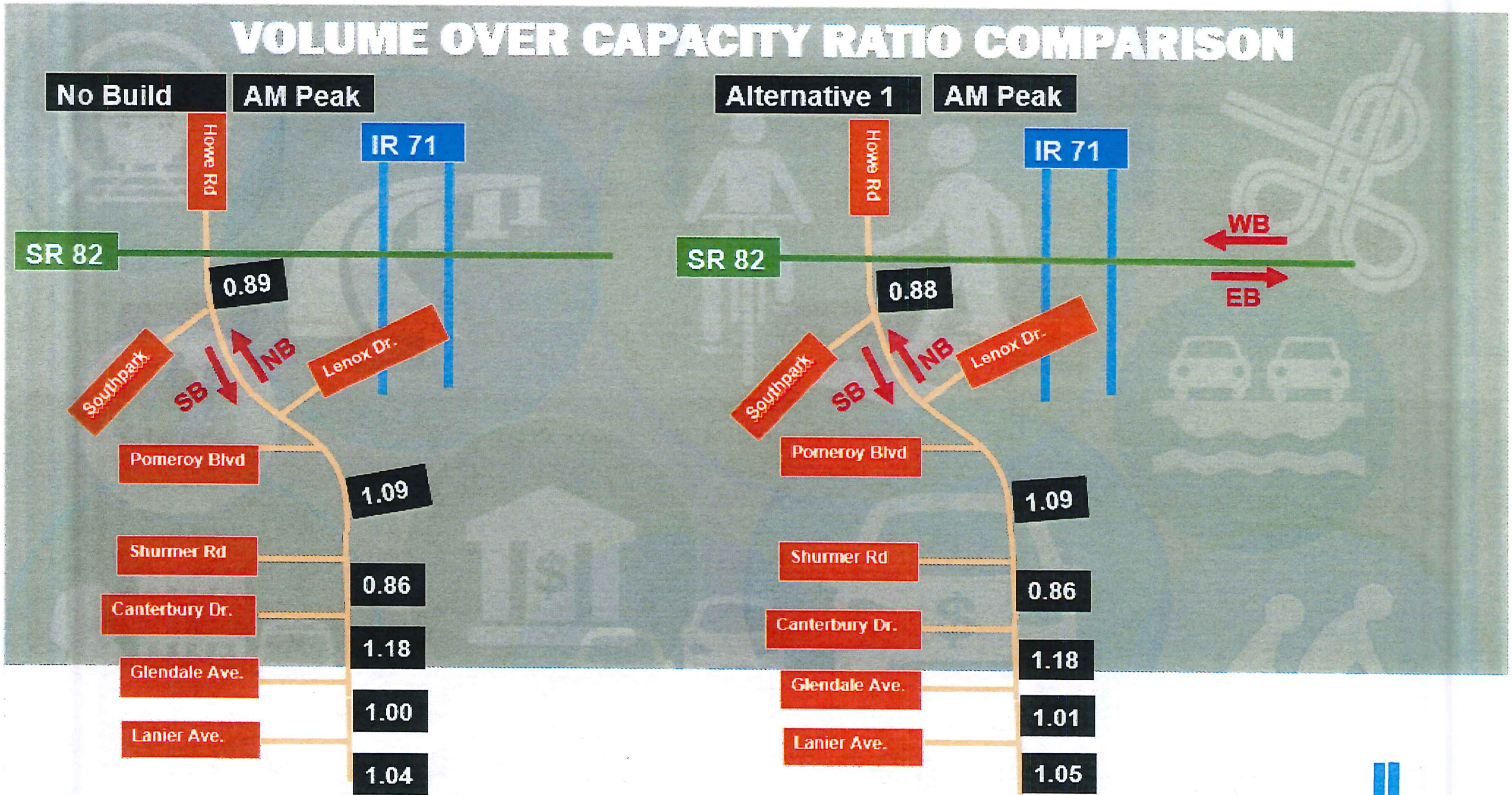

Alternative 2
Alternative 3
Alternative 4

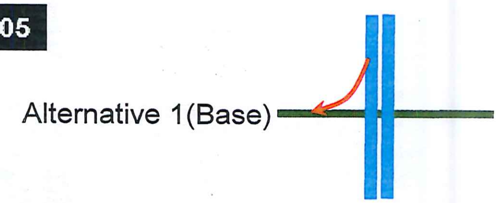

VOLUME OVER CAPACITY RATIO COMPARISON
Alternative 1
PM Peak
SR 82
WB
EB
Falling Water Rd
0.76
Southpark
Howe Rd
0.84
IR 71
2.05
0.92
No Build
PM Peak
SR 82
WB
EB
Falling Water Rd
0.87
Southpark
Howe Rd
0.95
IR 71
2.32
1.19

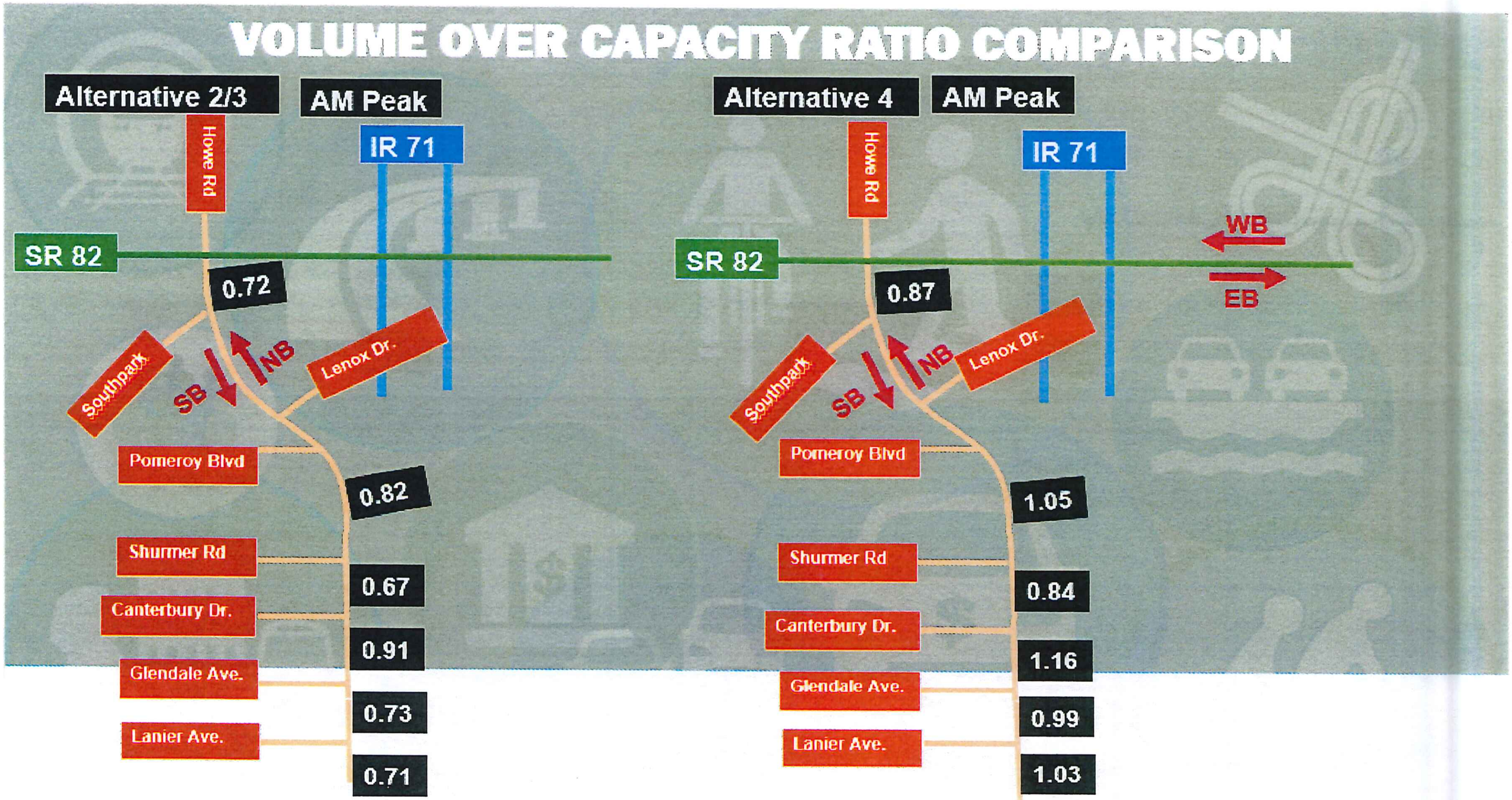

Alternative 1 (Base)

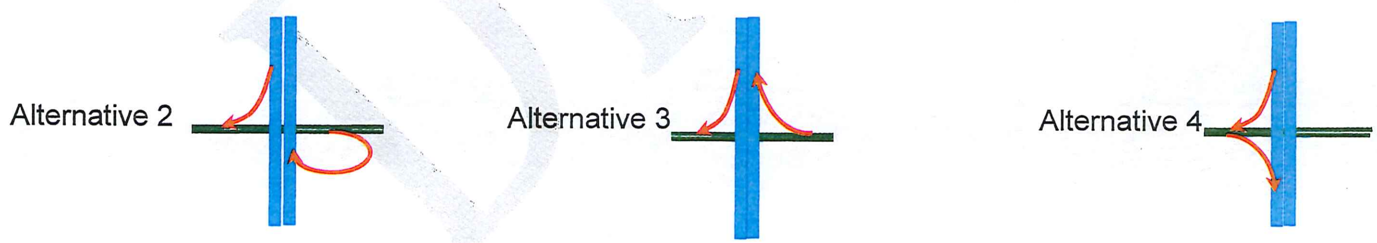

VOLUME OVER CAPACITY RATIO COMPARISON
Alternative 2/3
PM Peak
SR 82
WB
EB
Falling Water Rd
0.78
Southpark
Howe Rd
0.73
IR 71
1.78
0.93
Alternative 4
PM Peak
SR 82
WB
EB
Falling Water Rd
0.77
Southpark
Howe Rd
0.85
IR 71
2.07
0.93

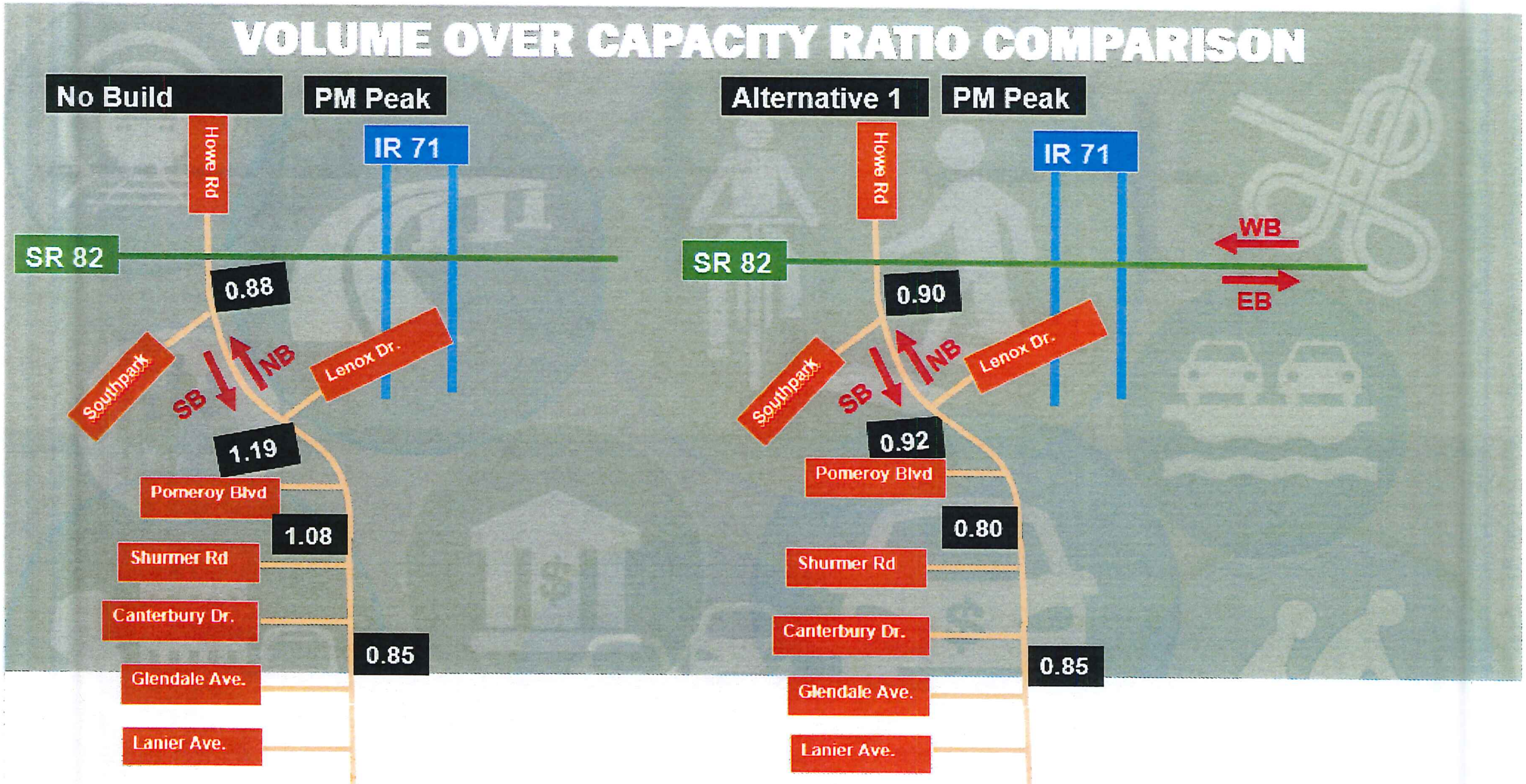

Alternative 2
Alternative 3
Alternative 4


VOLUME OVER CAPACITY RATIO COMPARISON
No Build
AM Peak
Howe Rd
IR 71
SR 82
0.89
Southpark
SB
NB
Lenox Dr.
Pomeroy Blvd
1.09
Shurmer Rd
0.86
Canterbury Dr.
1.18
Glendale Ave.
1.00
Lanier Ave.
1.04
Alternative 1
AM Peak
Howe Rd
IR 71
SR 82
WB
EB
0.88
Southpark
SB
NB
Lenox Dr.
Pomeroy Blvd
1.09
Shurmer Rd
0.86
Canterbury Dr.
1.18
Glendale Ave.
1.01
Lanier Ave.
1.05

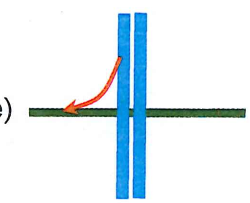

Alternative 1(Base)

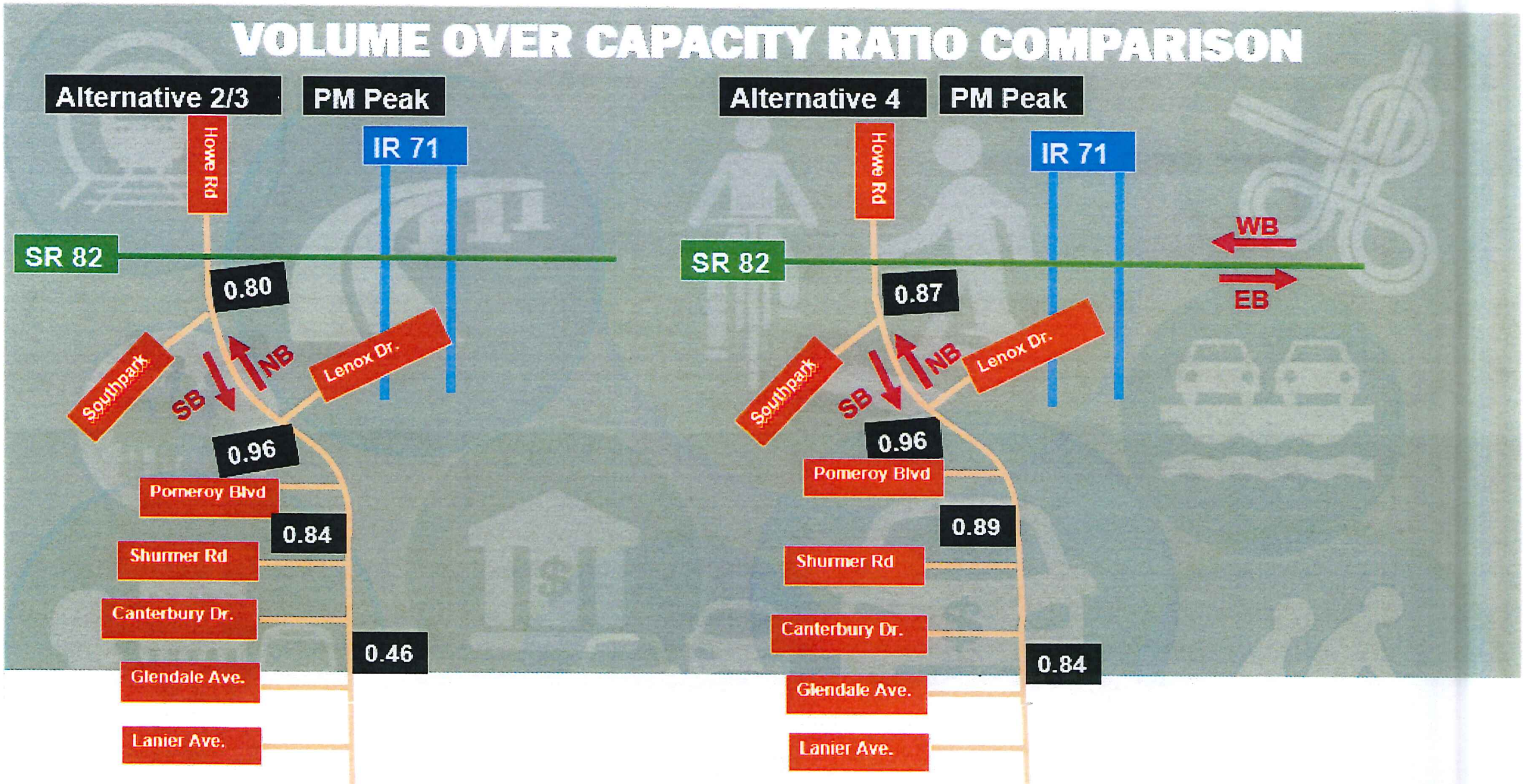

VOLUME OVER CAPACITY RATIO COMPARISON
Alternative 2/3
AM Peak
IR 71
Howe Rd
SR 82
0.72
Southpark
SB
NB
Lenox Dr.
Pomeroy Blvd
0.82
Shurmer Rd
0.67
Canterbury Dr.
0.91
Glendale Ave.
0.73
Lanier Ave.
0.71
Alternative 4
AM Peak
IR 71
Howe Rd
SR 82
WB
EB
0.87
Southpark
SB
NB
Lenox Dr.
Pomeroy Blvd
1.05
Shurmer Rd
0.84
Canterbury Dr.
1.16
Glendale Ave.
0.99
Lanier Ave.
1.03


Alternative 2
Alternative 3
Alternative 4

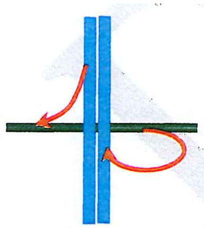


Alternative 1(Base)

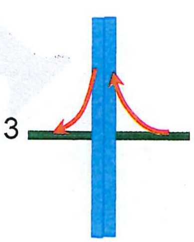




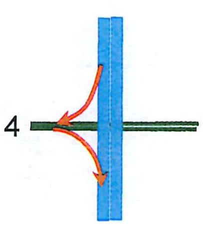
Alternative 2



Alternative 3



Alternative 4



IR-71 Corridor Study - Boston Rd. Partial Interchange

November 2017

Prepared by:
Northeast Ohio Areawide Coordinating Agency

1299 Superior Ave.
Cleveland, Ohio 44114
www.noaca.org