



Engineers, Surveyors, Planners, Scientists

TECHNICAL MEMO

Date: January 24, 2023
To: John Otis, PE
From: Abby Cueva, PE
Subject: **PID 114161 - Selection of the Preferred Alternative at the I-75 & WHV Interchange**

INTRODUCTION

The 2012 FONSI for the Brent Spence Bridge (BSB) corridor study identified a preferred alternative for the I-75 and Western Hills Viaduct interchange. The preferred alternative was a Tight Urban Diamond Interchange (TUDI), with local connections made via the existing upper deck of the Viaduct. Following completion of the BSB study, the City of Cincinnati advanced a stand-alone project to replace the Western Hills Viaduct (WHV) on a new alignment. This advancement impacted the previously preferred alternative at the interchange. The following memo serves to document the process followed to determine a revised preferred alternative at the interchange that accommodates the conditions of the proposed WHV.

Traffic plates from the previous study were available for Alternatives 1 and 2, but needed developed for all additional alternatives that were considered. During the development of traffic plates for the various alternatives, it was discovered that the traffic modeling for Alternative 3 had errantly allowed a northbound left turn from the Bank Street ramp, which should have been a through-only movement to northbound I-75. ODOT regenerated daily model assignments with the correct movement restrictions applied. Provided as percent-changes between the corrected model and the original model, vehicles were redistributed and balanced in new traffic plates. Once reassigned, volumes for Alternatives 3, 4, and 5 were produced. Traffic was assigned using a combination of strategies and references including:

- Reference to the Original Brent Spence Bridge Certified Traffic dated May 2010. These plates showed 2035 DHV for the local connection usage (via various routes) without the errant left at the northbound ramp.
- Reference to the Alternative 3 original traffic plates (2021) that included a permitted northbound left, providing reference for local westbound traffic demand.
- Traffic Counts obtained 1/12/2022 at the existing Spring Grove/Viaduct intersection, providing insight to current local traffic demand.

Once volumes were established, traffic at local intersections was modeled in Highway Capacity Software (HCS7) using existing timings and projected volumes. Both opening year (2028) and design year (2048) volumes were analyzed. Traffic for the WHV and I-75 interchange was modeled in TransModeler in accordance with the ODOT Analysis and Traffic Simulation Manual (OATS) for Alternatives 3, 4, and 5.

ALTERNATIVES

The alternatives considered in this memo were evaluated based on operations, geometrics, and in relation to the movements provided in the 2012 preferred alternative, as described below.

Preliminary schematic drawings of each alternative can be found attached to this memo to aide in the descriptions below.

2012 Preferred Alternative: Alt I-BSB – local connections from the *existing* upper deck

The 2012 preferred alternative removed an existing local access point at Spring Grove Avenue in order to facilitate the new interchange. As such, local traffic connections to and from Spring Grove Avenue were proposed to occur by direct (WB) and indirect (EB) connections to Spring Grove Avenue from the upper deck of the existing WHV. For reference, an exhibit of the original preferred alternative is included as an attachment to this memo.

Alternative 1: Alt I-BSB – local connections from the *proposed* upper deck

Alternative 1 reflects the 2012 preferred alternative, but modifies the local connections to accommodate the new location of the Viaduct's upper deck. The eastbound WHV to Harrison Avenue connector from the new location of the upper deck would have a downgrade in excess of 13% and is not viable from the more southerly location of the upper deck in Alternative 1. In addition, the local connection from Spring Grove to westbound WHV would travel under all lanes of I-75 before climbing to the upper deck. The connection has significant MOT impacts along I-75 with the need to build new mainline structures to accommodate the connection; and requires a wider westbound upper deck to accommodate the merge. For these reasons, **Alternative 1 was dismissed from further consideration and no operational analysis was completed.**

Alternative 2: Alt I-BSB – no local connections

Alternative 2 also reflects the previous preferred alternative, but *removes the local connections to and from the Viaduct's upper deck.* Although this alternative works from a design and operational perspective, it does not provide for local connections consistent with the previously preferred alternative. For this reason, **Alternative 2 is dismissed from further consideration.**

Alternative 3: Harrison Connection for Local Traffic

Suspecting that the local connections of Alternative 1 would be impacted geometrically by the change in location of the upper deck, this alternative provides a local connection to and from the west for local traffic, via a connection to Harrison Avenue, off the east end of the WHV interchange at the northbound ramp intersection.

Traffic from the west side of the Viaduct could use the connector road to reach the local street network and conversely for local traffic accessing the Viaduct. The connection can be made with a 25 mph curve and a downgrade of approximately 6.5% to Harrison Street. Operational analysis shows that the additional phase at the northbound ramp intersection needed to accommodate the Harrison Road connection, creates excessive queueing for the northbound exiting traffic, the southbound exiting traffic, and the Harrison connection. In order to obtain favorable results, triple southbound right turn lanes are needed at the southbound off-ramp, dual lefts at the northbound ramp intersection, and, most notably, an additional eastbound through lane is needed at the southbound and northbound ramp intersections to obtain favorable results. The additional widening needed on the bridge to accommodate the additional eastbound lane and the additional westbound lane needed to facilitate the southbound triple rights is also difficult to accommodate with the upper deck piers on either side of the interchange. Please note the exhibit shown for Alternative 3 shows an older preferred alternative for the upper decks of the WHV. They are now proposed to have one direction on each side of the interchange bridge. Since this alternative did not work operationally without the addition of lanes in each direction on the structure and west of the interchange, the exhibit was not updated. Based on the additional eastbound and westbound lanes needed on the lower deck, **Alternative 3 is dismissed from further consideration.**

Alternative 4: Local Connections within the Interchange

Alternative 4 provides local connections to and from the west, within the northbound and southbound ramp intersections. The ramp from Bank Street provides access to northbound I-75 in the TUDI design and, in this alternative, also provides the local to westbound WHV movement, by allowing local traffic to turn left at the northbound ramp intersection. The eastbound WHV to local movement is provided at the southbound ramp intersection with connection to the Western Avenue/Findlay Street intersection. The movement is accommodated by combining the WHV and Western Avenue/Findlay Street traffic that exits I-75 southbound, by bringing both movements to an at-grade intersection at the southbound ramp. The Western Avenue/Findlay traffic proceeds through the intersection to a ramp that connects them to the local street network. The previous preferred alternative braided the Western Avenue/Findlay Street traffic under the Viaduct/interchange and did not bring the Western Avenue/Findlay Street traffic through the intersection with WHV. Combining these movements at the southbound ramp intersection allows eastbound to local traffic to turn right at the signal and utilize the connection to Western Avenue/Findlay Street. The operational analysis (based on 2048 volumes), summarized in **Table 1** and **Table 2** below, shows acceptable results for both intersections. Additionally, no modifications to local intersections are required. Combining the southbound exiting traffic, and not braiding the Western/Findlay movement has constructability benefits as it avoids the construction of stacked MSE walls, needed in the braided southbound ramp alternatives.

Table 1: Operational Performance of WHV & Northbound Ramps (Alternative 4)

AM PEAK	LOS	Delay (sec/veh)	95th % Queue (FT)	PM PEAK	LOS	Delay (sec/veh)	95th % Queue (FT)
EB L	A	1.1	0.0	EB L	A	2.0	0.0
EB L	A	0.7	0.0	EB L	A	1.8	0.0
EB APPROACH	A	0.9		EB APPROACH	A	1.9	
NB L	C	25.1	148.6	NB L	D	39.7	364.7
NB L	C	21.8	96.0	NB L	C	30.5	214.8
NB T	C	24.7	194.8	NB T	C	33.9	370.0
NB APPROACH	C	24.2		NB APPROACH	D	35.1	
INTERSECTION	B	13.4		INTERSECTION	C	23.3	

Table 2: Operational Performance of WHV & Southbound Ramps (Alternative 4)

AM PEAK	LOS	Delay (sec/veh)	95th % Queue (FT)	PM PEAK	LOS	Delay (sec/veh)	95th % Queue (FT)
EB T	C	24.9	149.5	EB T	D	41.6	285.6
EB T	C	24.9	174.6	EB T	D	42.2	280.9
EB R	D	36.0	402.3	EB R	B	14.6	171.1
EB APPROACH	C	30.4		EB APPROACH	C	32.4	
SB R	A	9.6	85.6	SB R	C	25.2	210.2
SB TR	C	23.0	167.0	SB TR	D	38.1	314.6
SB T	C	21.1	181.1	SB T	D	40.0	336.5
SB APPROACH	B	18.3		SB APPROACH	C	33.8	
WB T	A	0.8	1.5	WB T	A	0.9	8.7
WB T	A	0.6	0.0	WB T	A	0.4	0.0
WB APPROACH	A	0.7		WB APPROACH	A	0.7	
INTERSECTION	C	20.9		INTERSECTION	C	25.1	

While this alternative works operationally with some potential savings in costs and constructability, it is not the preference of the City to bring I-75 southbound traffic, exiting to Western/Findlay, up

to and through a signalized intersection unless absolutely necessary. As such, Alternative 5 was considered for comparison to Alternative 4.

Alternative 5: Hybrid Local Connections

Alternative 5 is a hybrid of Alternative 3 and Alternative 4. The northbound ramp intersection is similar to Alternative 4 in that it provides a local connection from Bank Street by allowing local traffic to turn left at the intersection for local-to-westbound access to the Viaduct; and similar to Alternative 3 in that an eastbound-only connection is introduced off the east end of the bridge, at the northbound intersection, to facilitate the eastbound-to-local connection from the Viaduct. The connector will be one way eastbound, with right turns only at Harrison Avenue. The connection does require a reduced speed curve of 25mph (from 35mph on the Viaduct) with a downgrade of 6-6.5%. Minor modifications will be needed at Spring Grove Avenue to accommodate truck turning movements, but are not expected to have significant impacts. Similar to Alternative 3, the southbound ramp to Western Avenue/Findlay Street will go under the lower deck and bypass the interchange completely. Eliminating the through movement at the southbound intersection (shown in Alternative 4) removes the need for an eastbound right turn lane on the bridge approaching the southbound intersection and allows a free-flow design for eastbound vehicles destined for I-75 southbound. With the one-way connection off the east end, a two-phase signal can still be utilized (as shown in Alt 4) which contains both queuing and delay on the northbound approach. The operational analysis (based on 2048 volumes), summarized in **Table 3** and **Table 4** below, shows favorably for this alternative due to the efficient two-phase signals at both intersections.

Table 3: Operational Performance of WHV & Northbound Ramps (Alternative 5)

AM PEAK	LOS	Delay (sec/veh)	95th % Queue (FT)	PM PEAK	LOS	Delay (sec/veh)	95th % Queue (FT)
EB L	B	12.5	148.0	EB L	C	24.6	256.6
EB LT	B	12.3	126.6	EB LT	C	24.3	300.0
EB APPROACH	B	12.4		EB APPROACH	C	24.4	
NB L	B	19.7	131.5	NB L	C	23.3	262.0
NB L	B	17.4	91.3	NB L	B	19.8	167.8
NB T	C	20.8	177.4	NB T	C	25.8	363.4
NB APPROACH	B	19.6		NB APPROACH	C	23.4	
INTERSECTION	B	15.7		INTERSECTION	C	23.8	

Table 4: Operational Performance of WHV & Southbound Ramps (Alternative 5)

AM PEAK	LOS	Delay (sec/veh)	95th % Queue (FT)	PM PEAK	LOS	Delay (sec/veh)	95th % Queue (FT)
SB R	B	11.6	62.4	SB R	C	25.9	188.6
SB R	B	12.1	61.8	SB R	C	25.3	188.5
SB APPROACH	B	11.8		SB APPROACH	C	25.6	
WB T	A	0.1	0.0	WB T	A	0.1	0.0
WB T	A	0.2	0.0	WB T	A	0.2	0.0
WB APPROACH	A	0.1		WB APPROACH	A	0.1	
INTERSECTION	A	5.0		INTERSECTION	B	11.8	

CONCLUSION

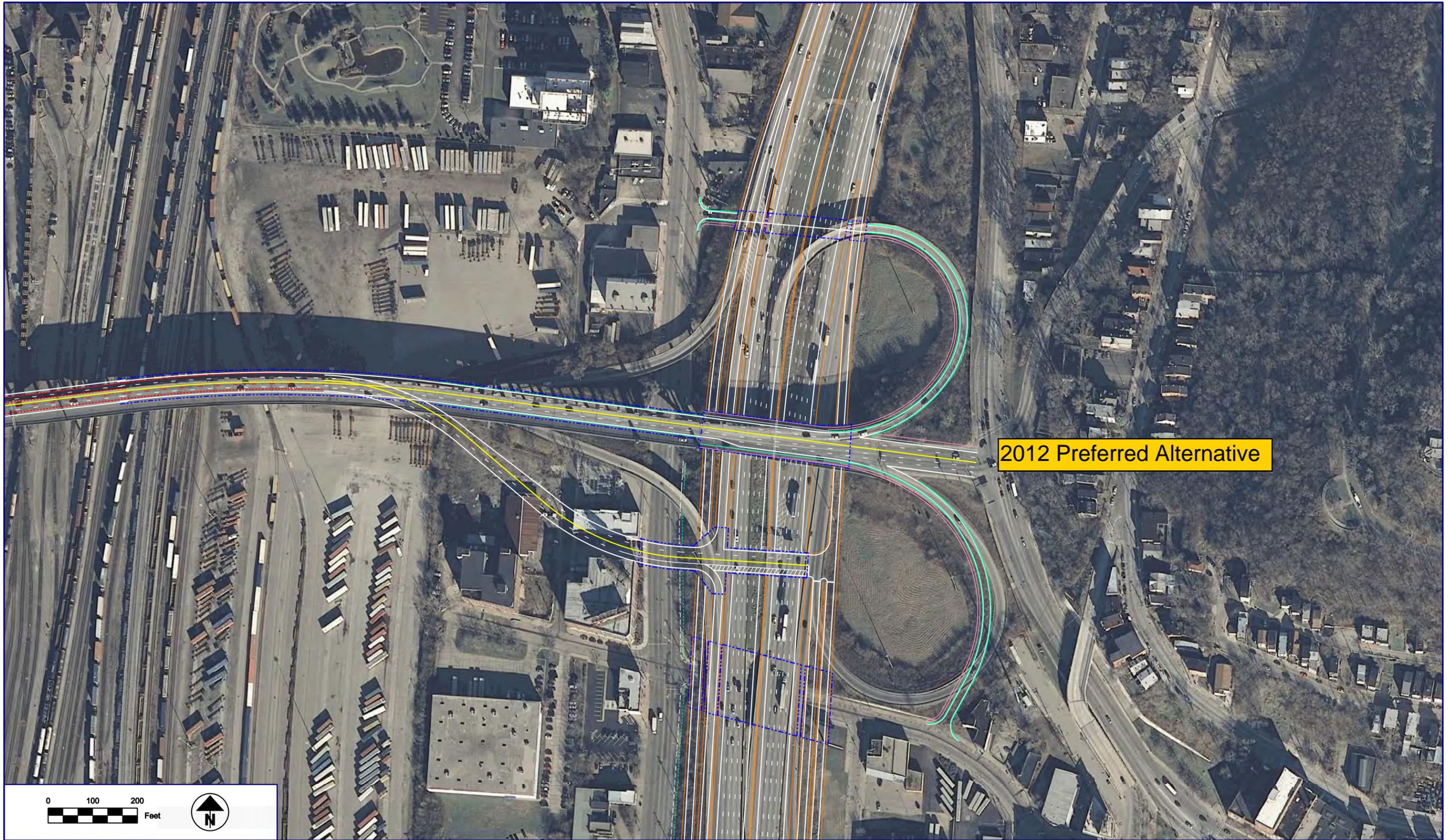
In coordination with ODOT District 8, ODOT Office of Roadway Engineering, and the City of Cincinnati, **Alternative 5 is being recommended as the preferred alternative** for the following reasons:

- Provides local access at the interchange without detriment to the operations of the interchange;
- Maintains a similar footprint of the original preferred interchange while also providing the local movements;
- Functions with the highest operational efficiency of the alternatives with local connections.

In summary, ODOT has updated and refined the WHV interchange to accommodate the City's proposed plans for the Viaduct while still providing for local connections that were a part of the 2012 preferred alternative at the interchange. This has been done within the confines of the original impact limits documented as part of the approved 2012 FONSI.

This recommendation will be included in on-going efforts associated with the Brent Spence Bridge Corridor Project supplemental Environmental Assessment and the update to the original Interchange Modification Study.

2012 Preferred Alternative



2012 Preferred Alternative

0 100 200
Feet



U.S. Department of Transportation
Federal Highway Administration

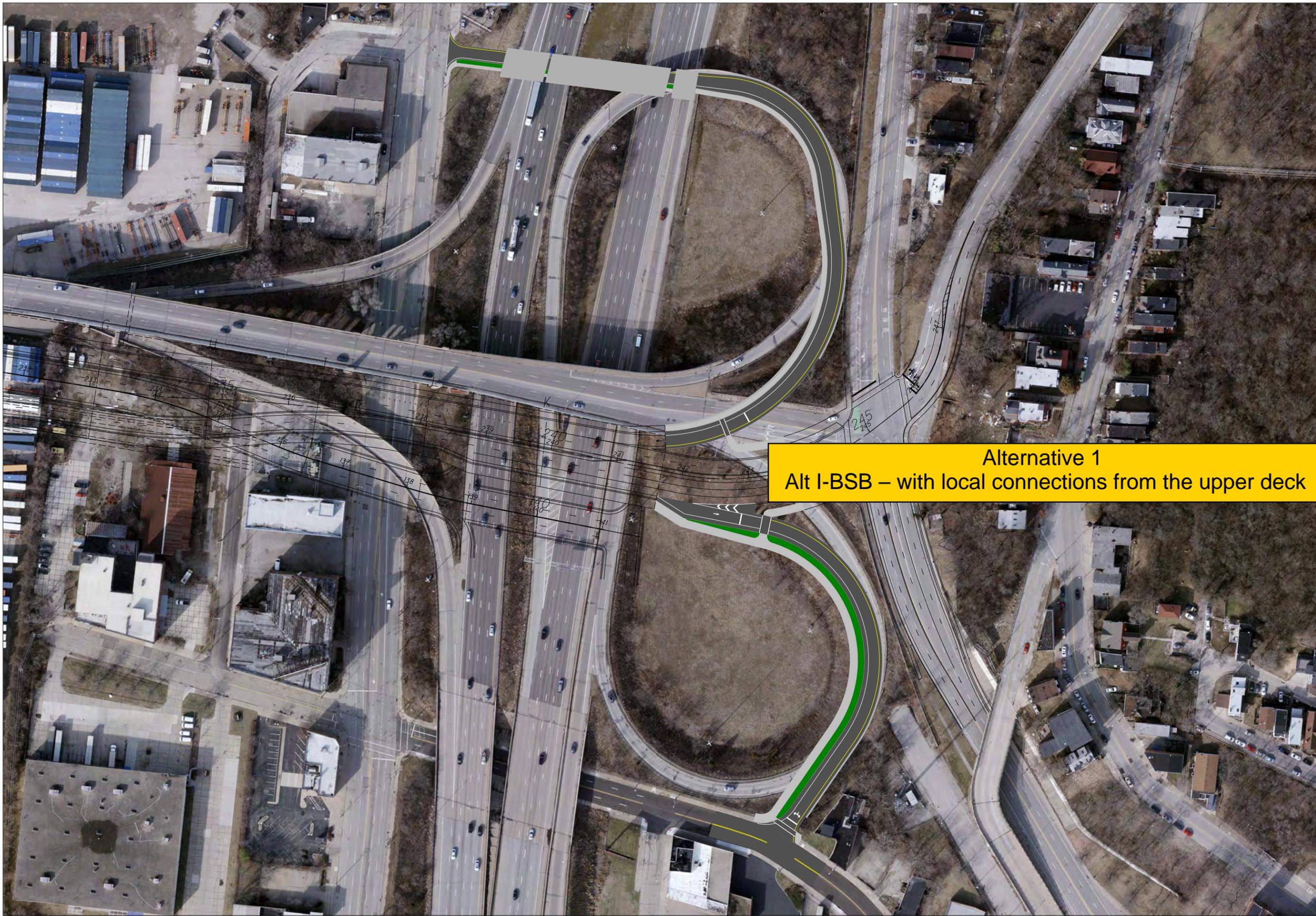


**WESTERN HILLS VIADUCT
TIGHT DIAMOND INTERCHANGE OPTION 1**

EXHIBIT

6

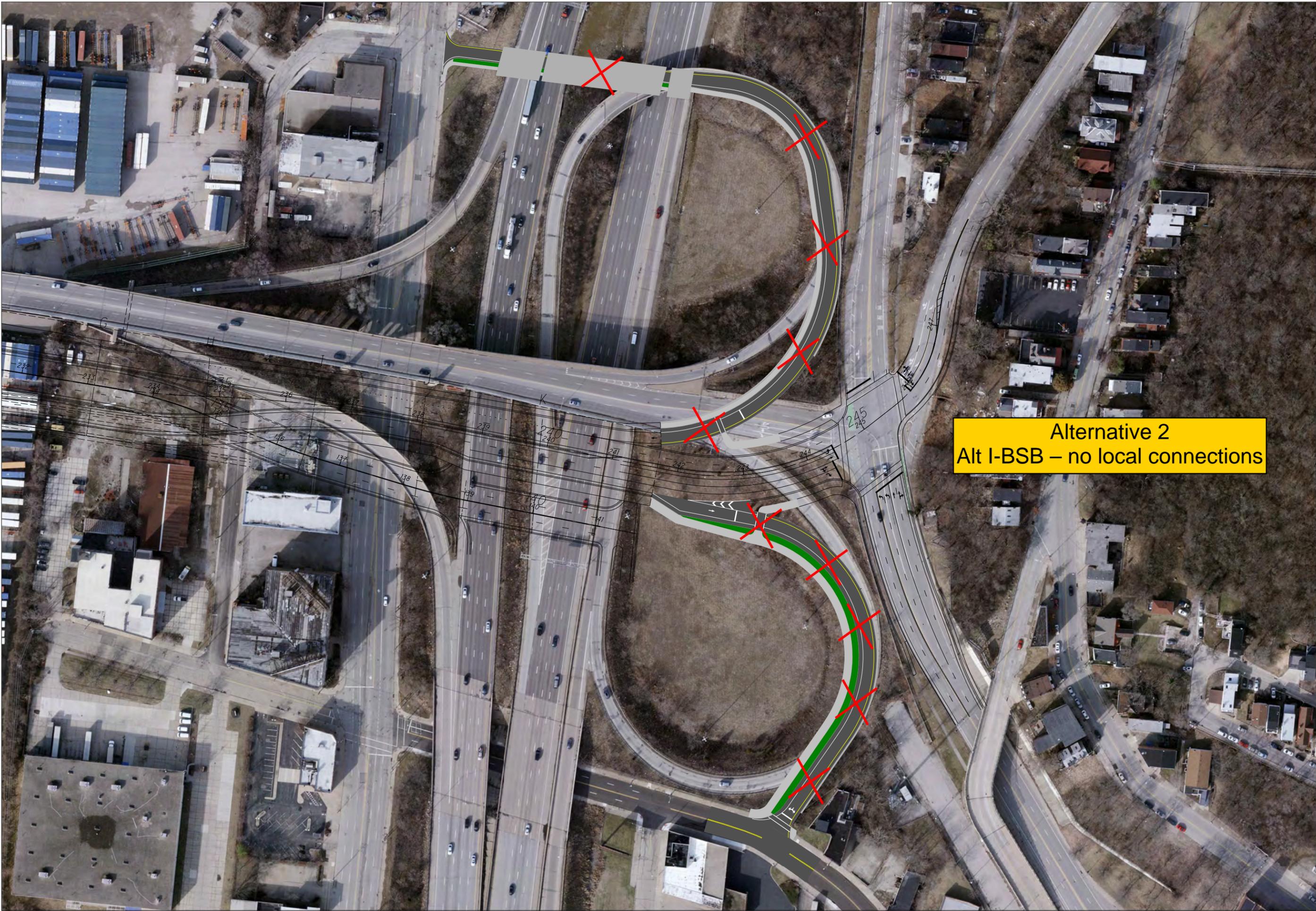
Alternative 1: Alt I-BSB – with Local Connections from the Upper Deck



Alternative 1
Alt I-BSB – with local connections from the upper deck



Alternative 2: Alt I-BSB – No Local Connections



Alternative 2
Alt I-BSB – no local connections

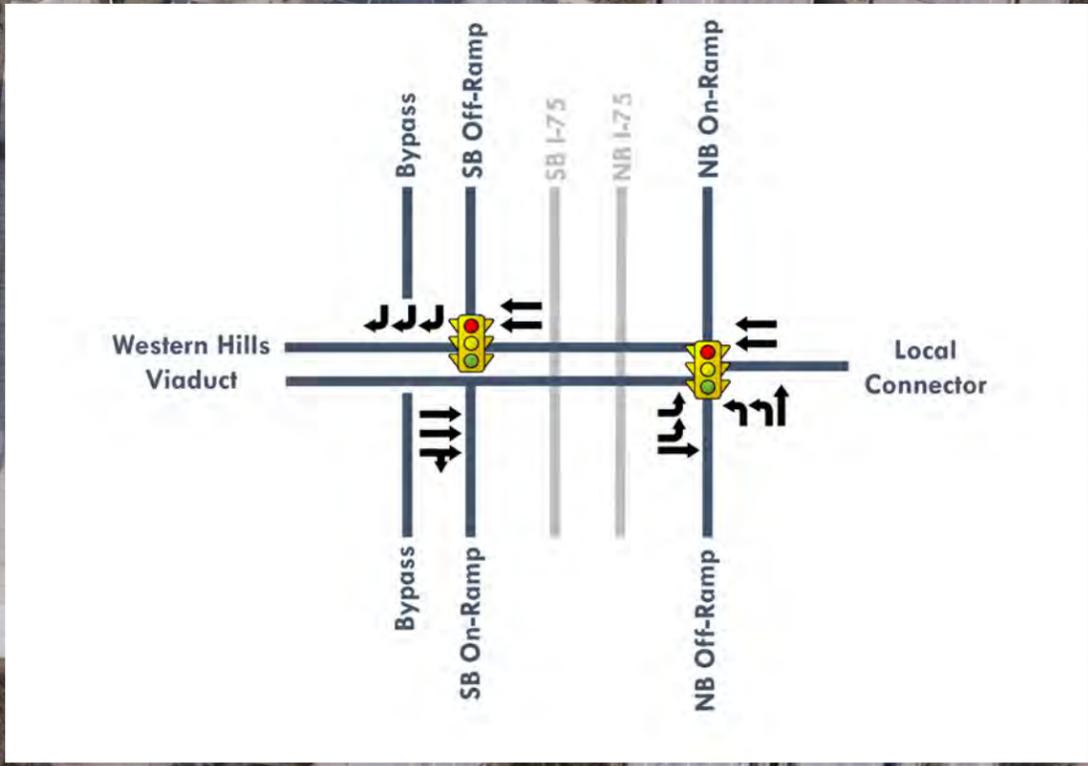
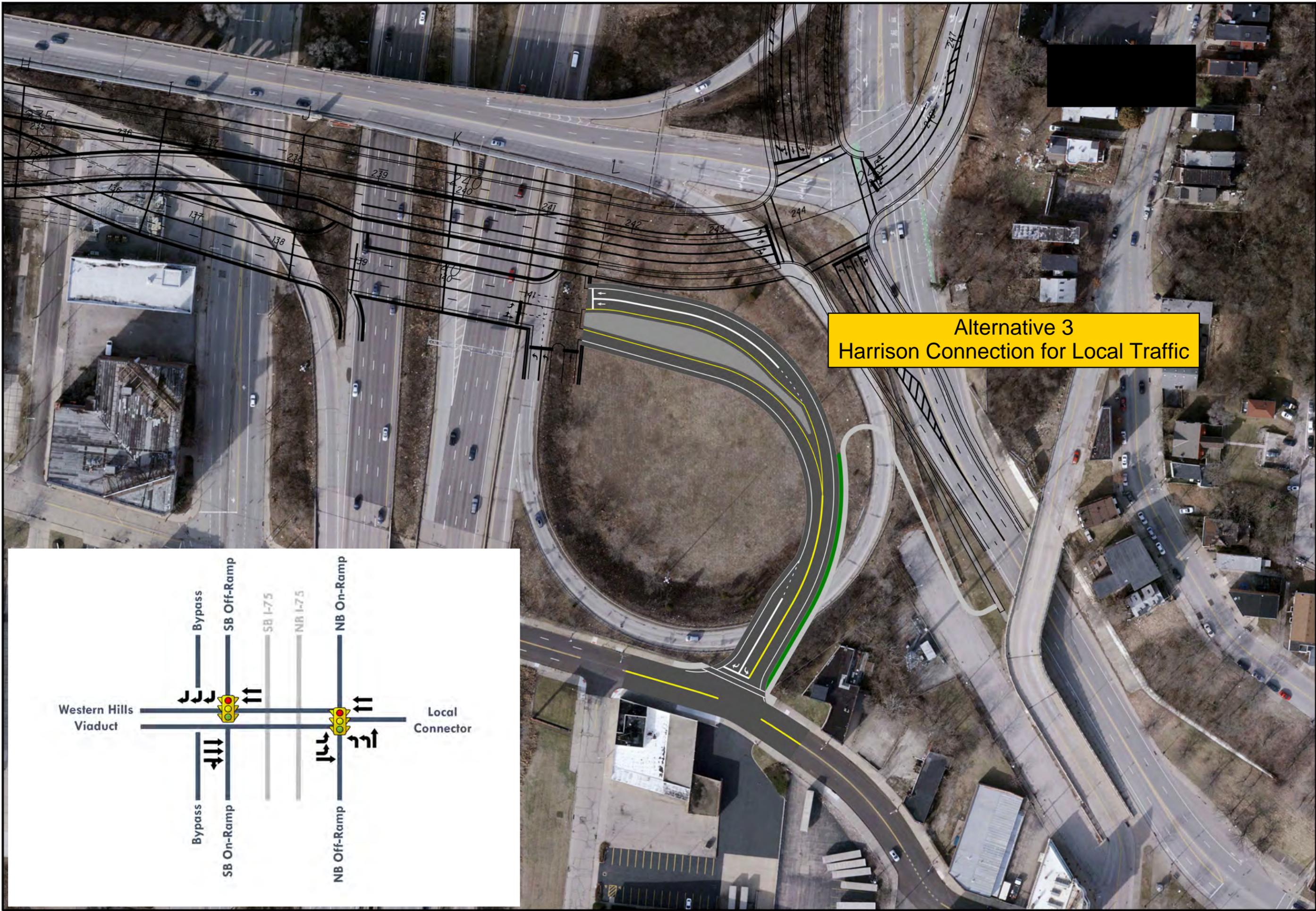


SPRING GROVE AVE / HARRISON AVE CONNECTIONS

HAM-75-WHV



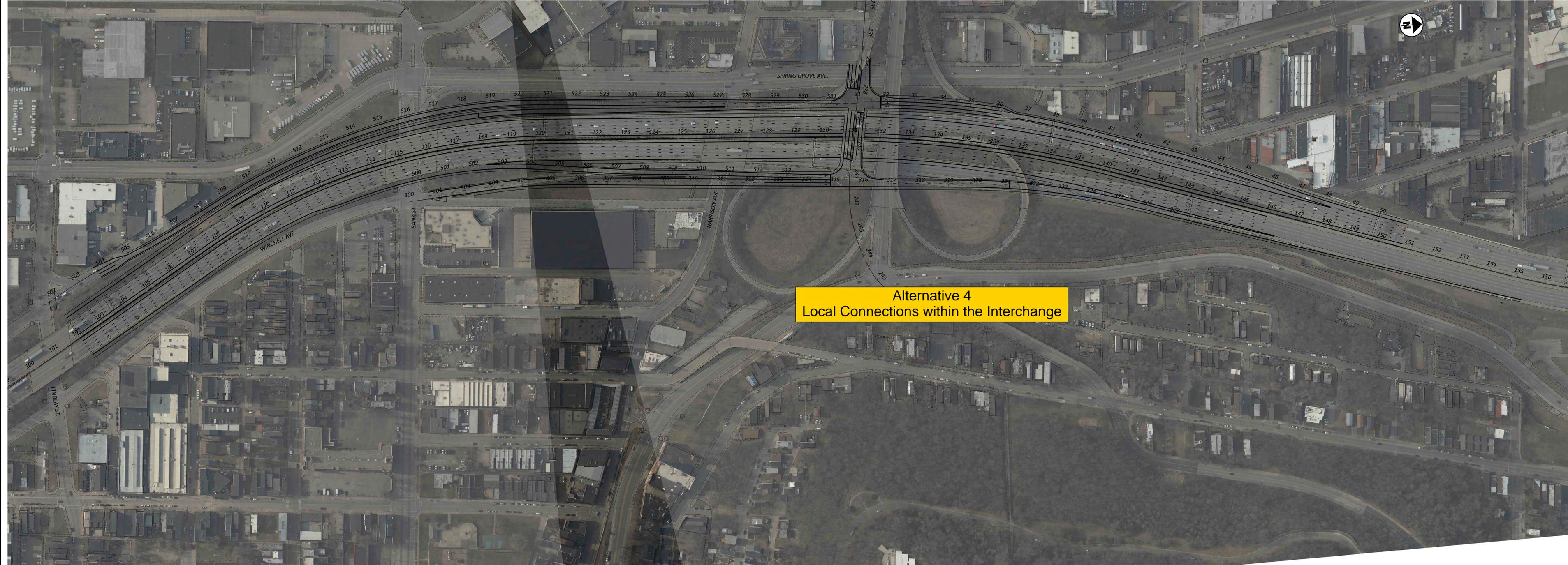
Alternative 3: Harrison Connection for Local Traffic



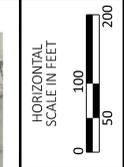
HARRISON AVE CONNECTION

HAM-75-WHV

Alternative 4: Local Connections within the Interchange



Alternative 4
Local Connections within the Interchange



WESTERN HILLS VIADUCT
ALTERNATIVE 4 - WHV INTERCHANGE

DESIGN AGENCY	
DESIGNER	XXX
REVIEWER	XXX
PROJECT ID	XXX MM-DD-Y
SHEET	0
P.O.	0

Alternative 5: Hybrid Local Connections

