

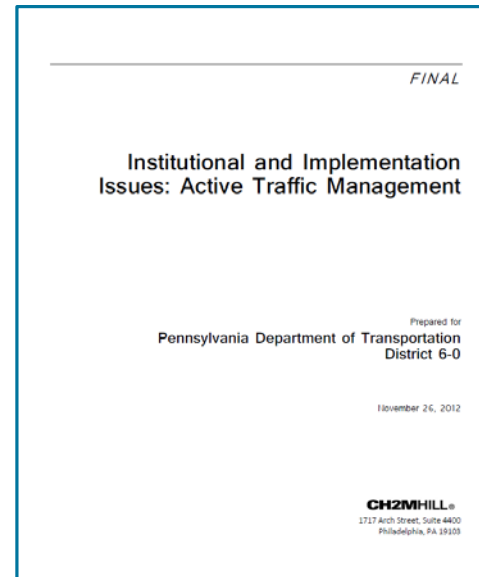
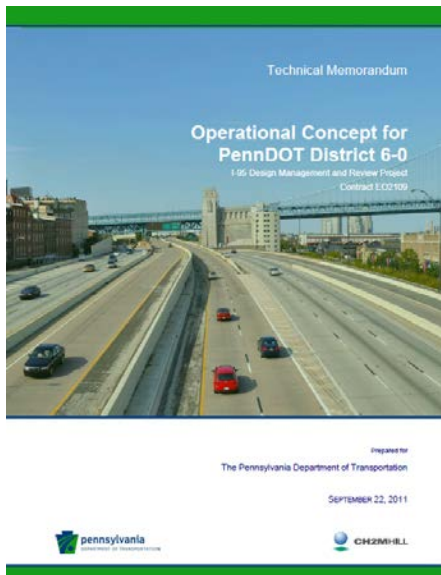


IMPLEMENTING ATM IN PENNSYLVANIA

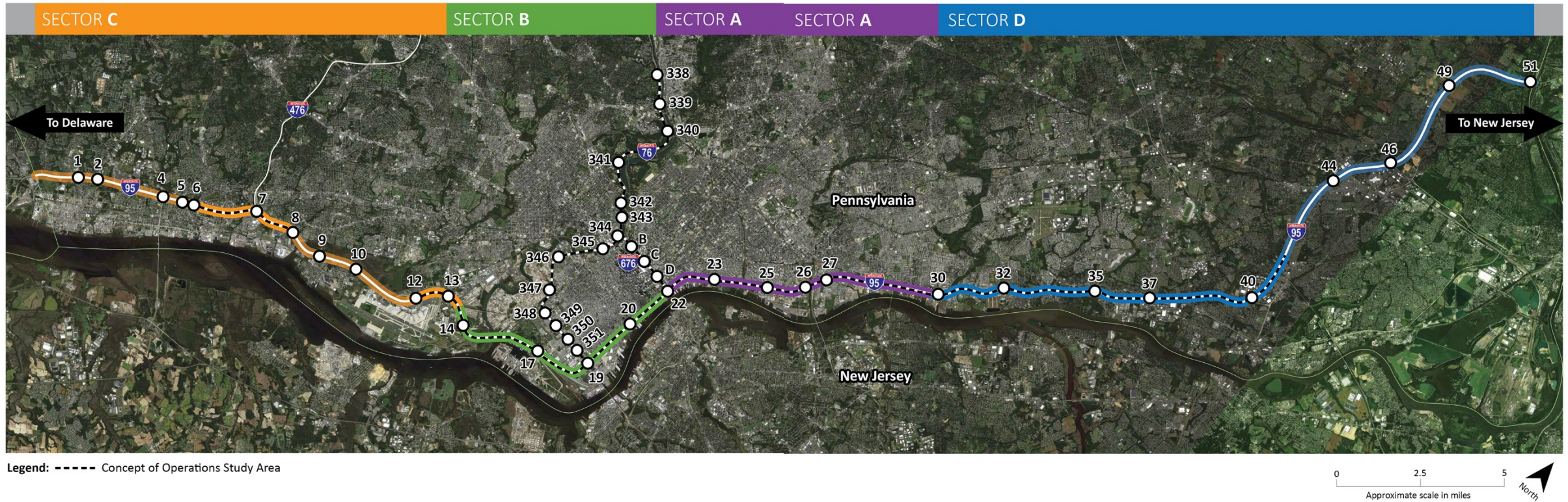
SPEAKERS: TROY ILLIG/WSP AND TORSTEN LIENAU/CH2M

INTRODUCTION

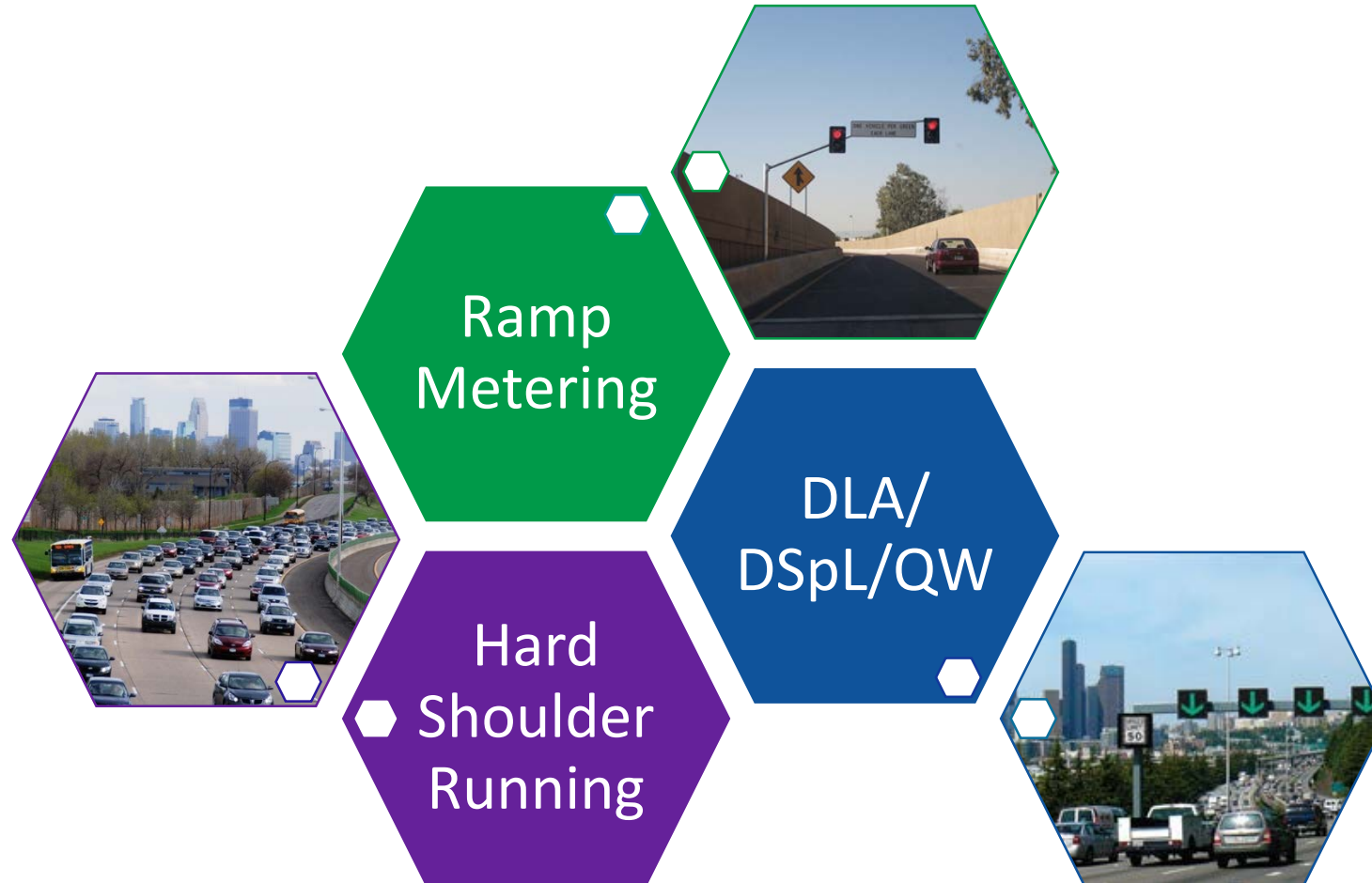
- Revive I-95: Multi-decade Plan
- Prioritization by Sectors
- Need for Interim Operational Improvements
- Transportation Systems Management and Operations



CONCEPT OF OPERATIONS STUDY AREA



CONCEPT OF OPERATIONS ACTIVE TRAFFIC MANAGEMENT



CONCEPT OF OPERATIONS TIERED APPROACH TO IMPLEMENTATION

Tier 1

- One pilot project, to be constructed immediately, highest public benefit

Tier 2

- Set of projects that could be implemented within the next 8 years, with highest B/C ratios and/or coordinate with high B/C ratio projects.

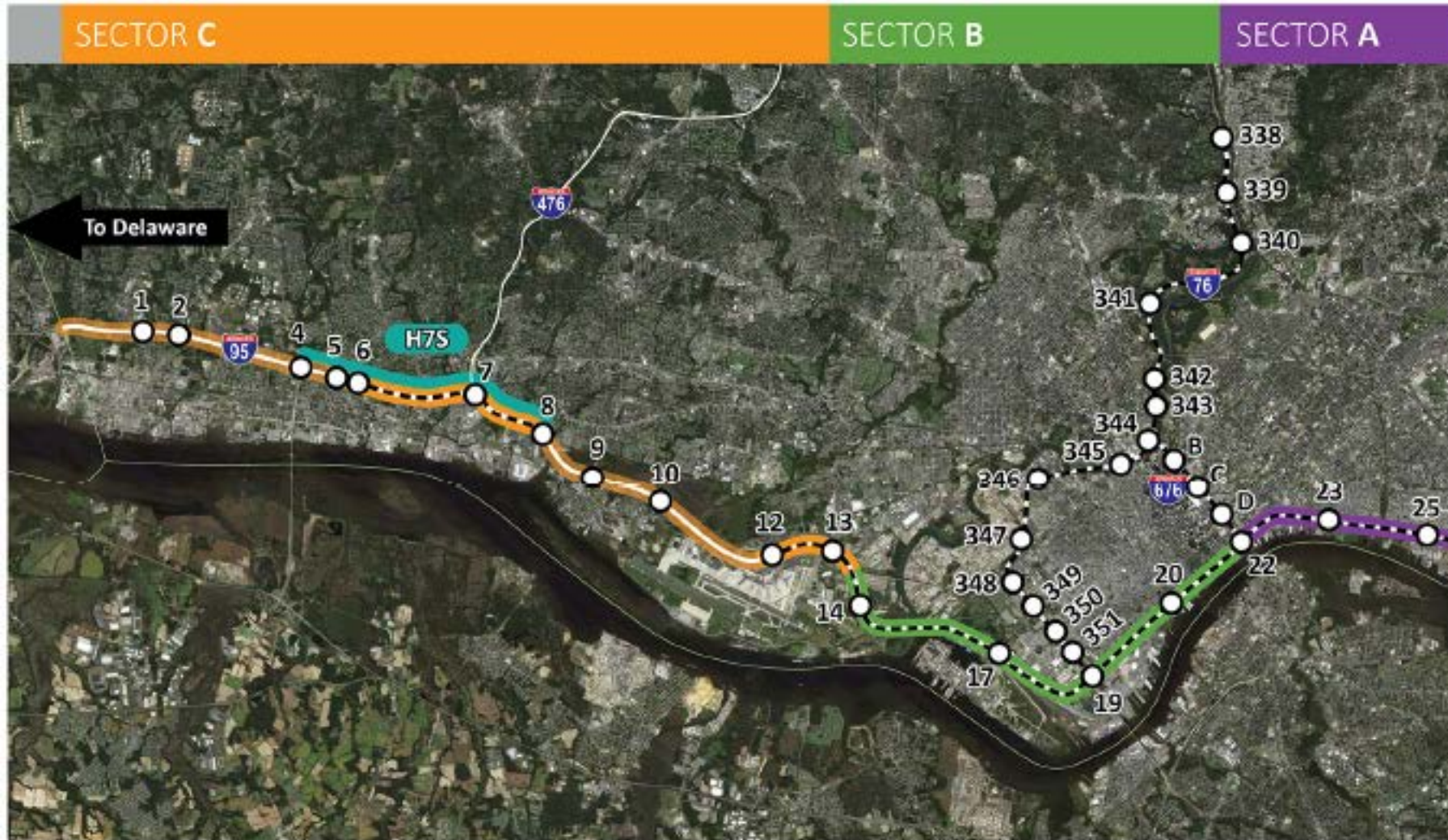
Tier 3

- Set of projects that could be implemented within 15 years, where early implementation does not necessarily provide significant benefit.

Tier 4

- Set of projects that should be implemented because they still have a positive B/C ratio, but whose costs prohibit immediate implementation given the annual spend budget

CONCEPT OF OPERATIONS TIER 1 PROJECT

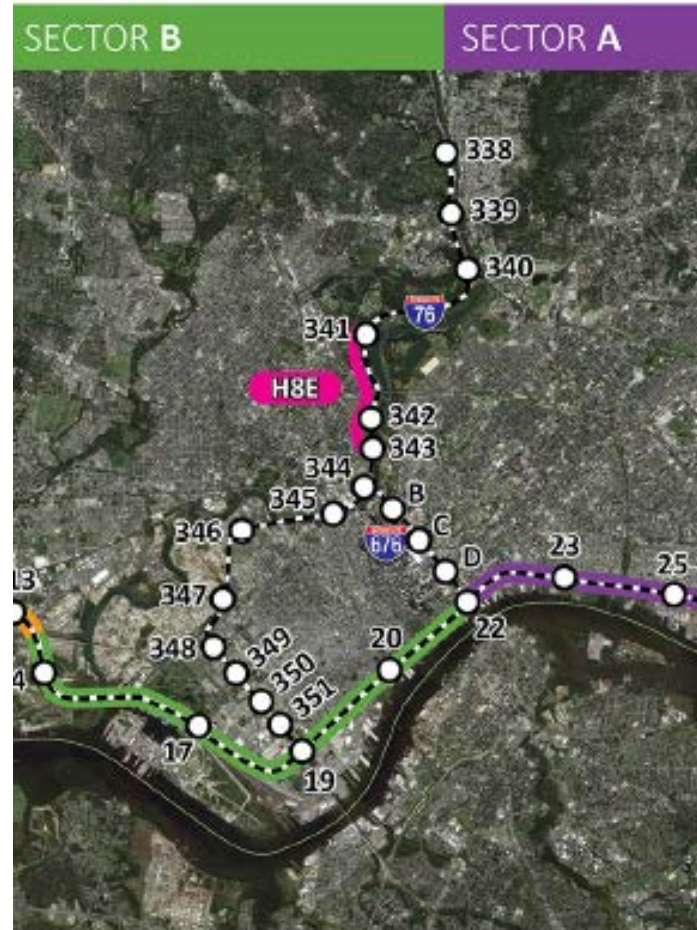
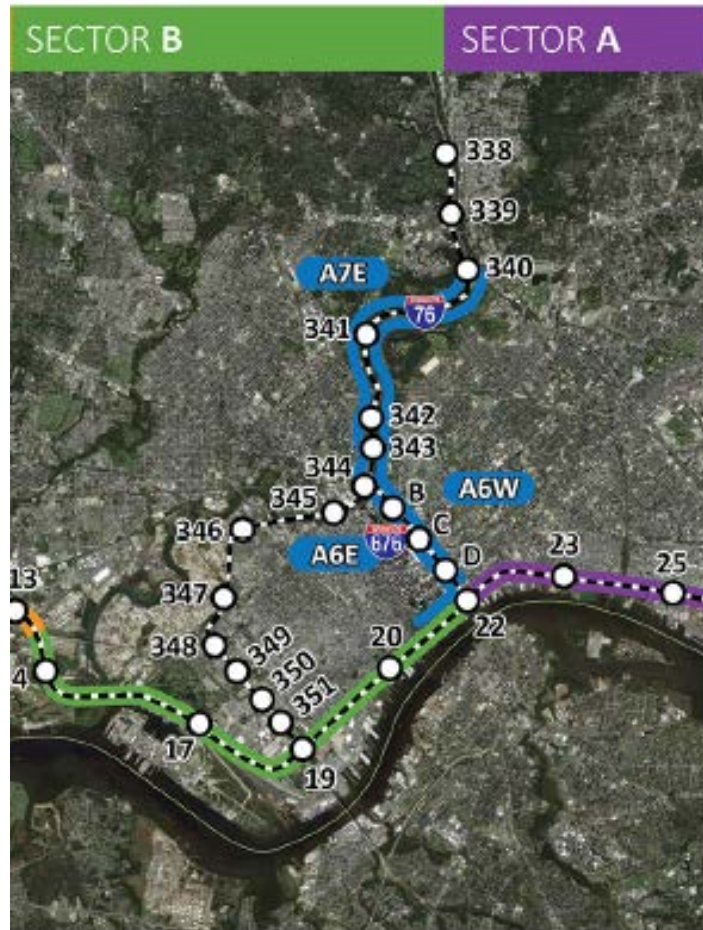


CONCEPT OF OPERATIONS TIER 2 PROJECTS

DSpL/DLA/QW

HSR

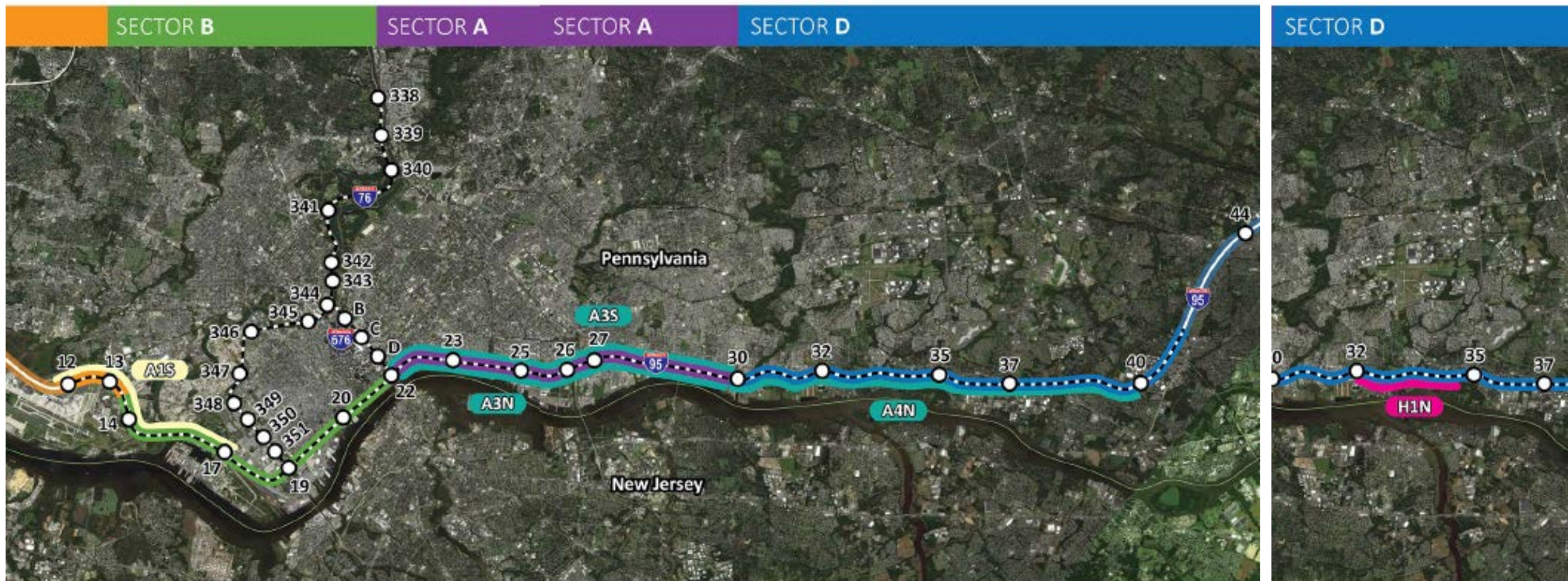
Ramp Metering



CONCEPT OF OPERATIONS TIER 3 PROJECTS

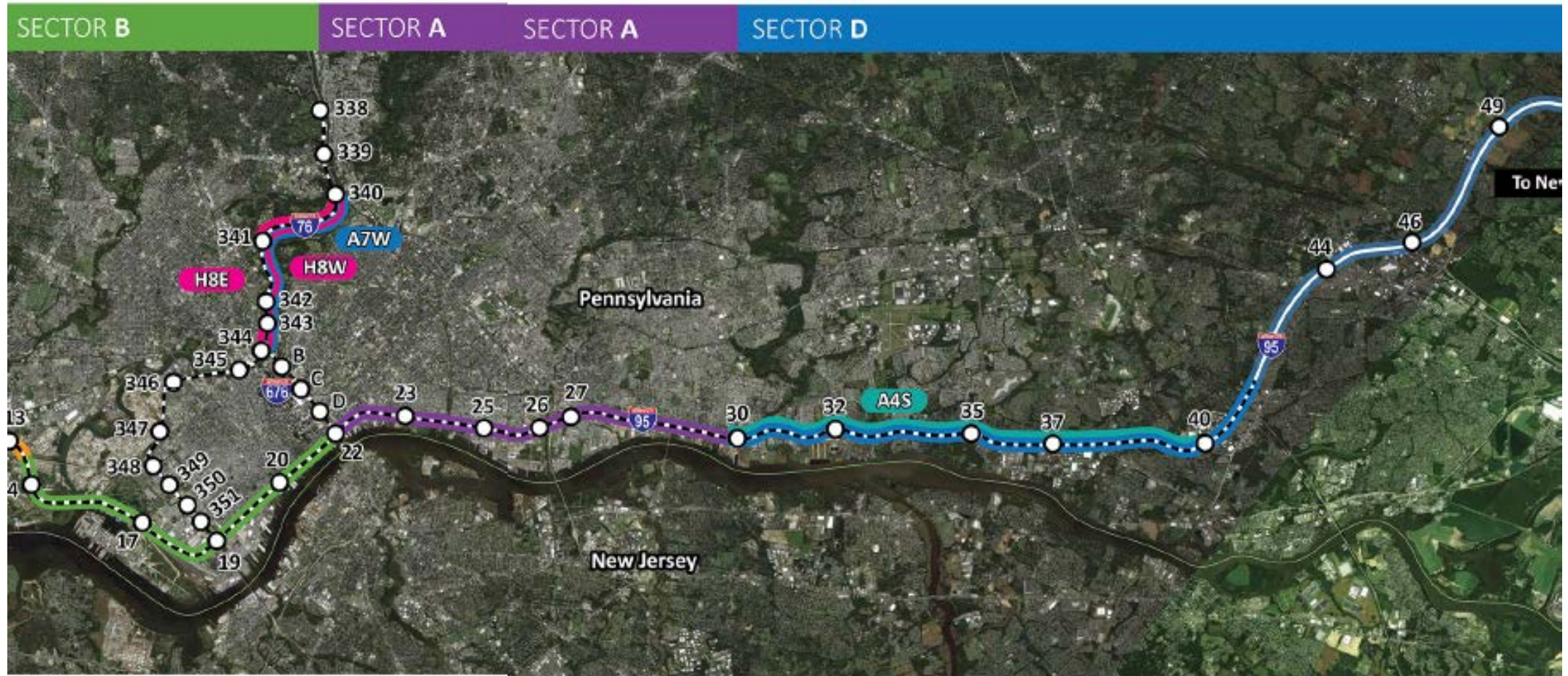
DSpL/DLA/QW

HSR



CONCEPT OF OPERATIONS TIER 4 PROJECTS

HSR and DSpl/DLA/QW



CONCEPT OF OPERATIONS RECOMMENDED PROJECTS

Project	Tier	Annual Congestion Benefits (1,000s)	Annual Safety Benefits (1,000s)	Total Annual Benefits (1,000s)	15-year Benefits (1,000s)	Capital Costs (1,000s)	Annual Operations & Maintenance Costs (1,000s)	15-Year Costs (1,000s)	Benefit /Cost Ratio
H7S—HSR/JC/DSpL/DLA/QW (Full) I-95 SB: Stewart to US 322E	1	\$ 31,098	\$ -	\$ 31,098	\$ 466,471	\$ 22,689	\$ 419	\$ 28,969	16.1
Subtotal Tier 1		\$ 31,098	\$ -	\$ 31,098	\$ 466,471	\$ 22,689	\$ 419	\$ 28,969	16.1
A6E—DSpL (Side-mounted only) I-676 EB: I-76 to I-95	2	\$ 13	\$ 100	\$ 113	\$ 1,694	\$ 583	\$ 30	\$ 1,033	1.6
R4E—Ramp Metering I-676 EB: I-76 to I-95	2	\$ 1,711	\$ 80	\$ 1,791	\$ 26,861	\$ 546	\$ 36	\$ 1,093	24.6
A6W—DSpL (Side-mounted only) I-676 WB: I-95 to I-76	2	\$ 455	\$ 122	\$ 577	\$ 8,660	\$ 583	\$ 30	\$ 1,033	8.4
R4W—Ramp Metering I-676 WB: I-95 to I-76	2	\$ 1,733	\$ 52	\$ 1,785	\$ 26,782	\$ 546	\$ 36	\$ 1,093	24.5
H8E/A7E Phase 1—HSR/DSpL/DLA/QW (Full) I-76 EB: US1 to I-676	2	\$ 4,868	\$ 175	\$ 5,043	\$ 75,646	\$ 13,606	\$ 213	\$ 16,802	4.5
R3W—Ramp Metering I-76 WB: I-676 to Belmont	2	\$ 16,296	\$ 144	\$ 16,440	\$ 246,597	\$ 1,002	\$ 56	\$ 1,841	133.9
Subtotal Tier 2		\$ 25,076	\$ 673	\$ 25,749	\$ 386,241	\$ 16,867	\$ 402	\$ 22,895	16.9
A1S—DSpL/DLA/QW (Hybrid) I-95 SB: Broad to Airport	3	\$ 22	\$ 745	\$ 766	\$ 11,492	\$ 5,422	\$ 137	\$ 7,475	1.5
H1N/A4N—HSR/DSpL/DLA/QW (Full) I-95 NB: Academy to Woodhaven	3	\$ 3,175	\$ 175	\$ 3,350	\$ 50,254	\$ 21,938	\$ 453	\$ 28,732	1.7
A3S/A3N—DSpL/DLA/QW (Hybrid) I-95 NB/SB: Cottman/Princeton to Columbus/Washington	3	\$ 302	\$ 2,435	\$ 2,737	\$ 41,050	\$ 11,045	\$ 270	\$ 15,097	2.7
Subtotal Tier 3		\$ 3,499	\$ 3,355	\$ 6,853	\$ 102,796	\$ 38,405	\$ 860	\$ 51,304	2.0
H8W/A7W/H8E Phase 2 — HSR/DSpL/DLA/QW (Full) I-76 EB/WB: I-676 to US1	4	\$ 34,275	\$ 360	\$ 34,634	\$ 519,513	\$ 33,878	\$ 490	\$ 41,202	12.6
A4S - DSpL/DLA/QW (Hybrid) I-95 SB: Woodhaven to Cottman	4	\$ 369	\$ 745	\$ 1,114	\$ 16,705	\$ 9,317	\$ 247	\$ 13,016	1.3
Subtotal Tier 4 (Long Term)		\$ 34,644	\$ 1,105	\$ 35,748	\$ 536,218	\$ 43,165	\$ 737	\$ 54,217	9.9
TIER 1, 2, 3 TOTAL (Short Term)	1,2,3	\$ 59,673	\$ 4,028	\$ 63,701	\$ 955,508	\$ 77,961	\$ 1,681	\$ 103,169	9.3
TOTAL (Short and Long Term)		\$ 94,317	\$ 5,132	\$ 99,448	\$ 1,491,726	\$ 121,126	\$ 2,417	\$ 157,386	9.5

TEAM EFFORT

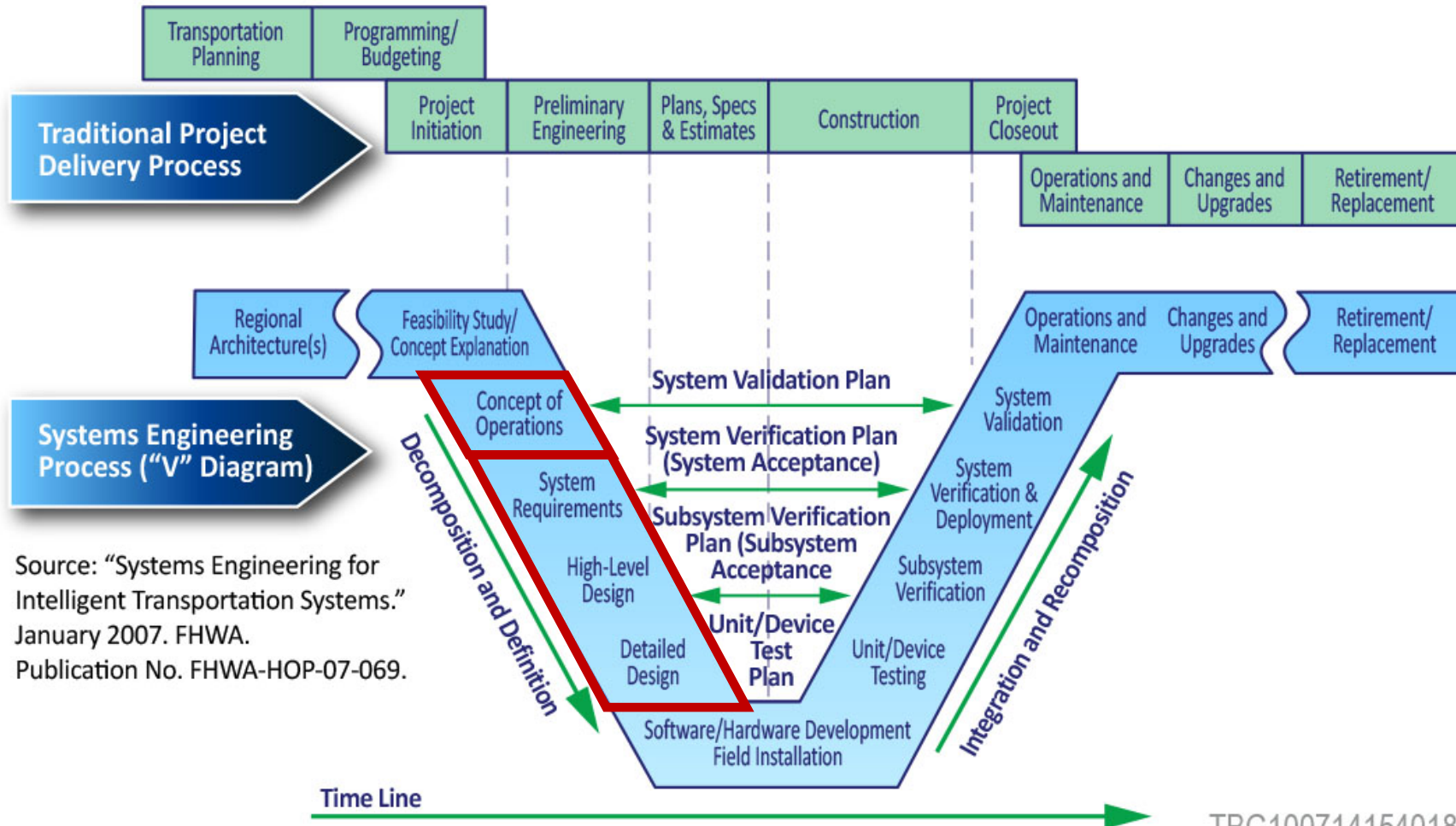
Concept of
Operations Phase



Implementation
Phase



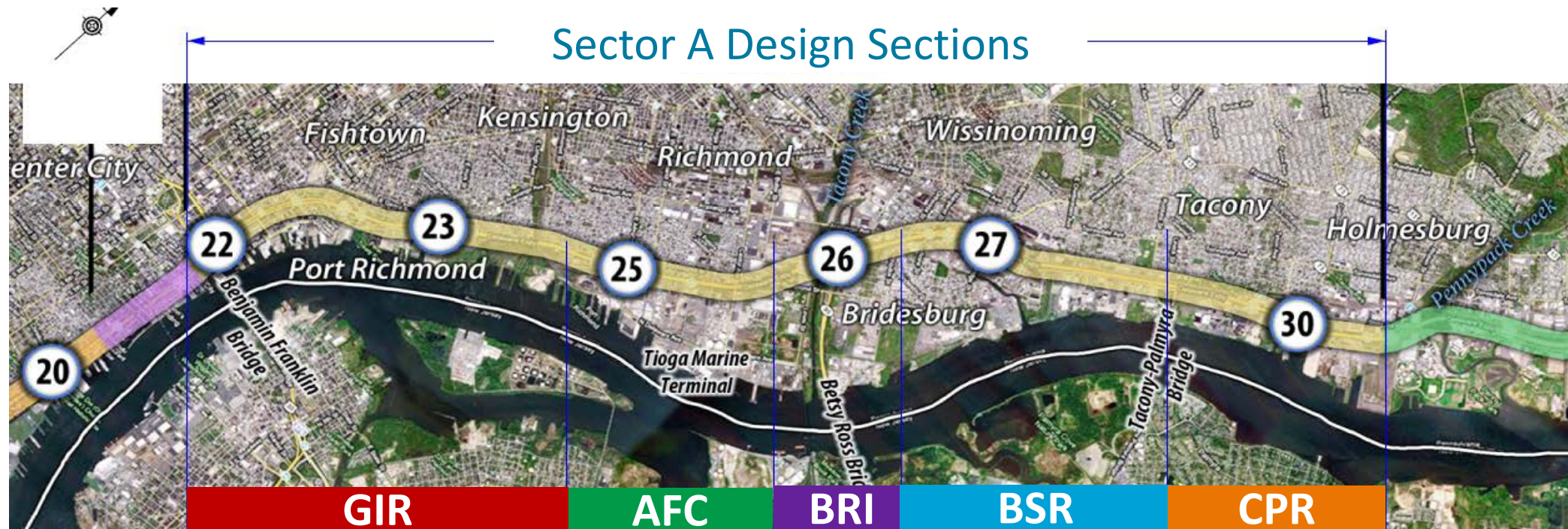
CONCEPT OF OPERATIONS TO SECTOR A TRANSITION



Source: "Systems Engineering for Intelligent Transportation Systems." January 2007. FHWA. Publication No. FHWA-HOP-07-069.

SECTOR A IMPLEMENTATION

- Incorporating ConOps into Sector A design section
- Dynamic Speed Limits, Dynamic Lane Assignment, & Queue Warning
- Requires gantries and speed limit sign structures



GANTRY TYPE

- Exercise researching various gantry types
- Max width of freeway – Gantry Span limitations/concerns
- DMS and Lane Control placement on Gantries
- Challenge of PennDOT standard – no ITS Equipment on Monopipe

PennDOT	●	Pros	<ul style="list-style-type: none"> Allows for maintenance without closing lanes Easy access to ITS equipment 	Cons	<ul style="list-style-type: none"> Not a PennDOT standard sign bridge Aesthetically obtrusive Inside shoulder foundation could be
Maintenance	●				
Span Len					
Guide S					
Foundat					
Acstheti					



I-95 ATM SIGN INSTALLATION CONCEPT
SCHEME 2 - MONOPIPE

PennDOT	●	Pros	<ul style="list-style-type: none"> Smallest cross-section for loadings Small single footprint at each support Less expensive/complex 	Cons	<ul style="list-style-type: none"> Not currently allowed for use with DMS by PennDOT, would require exception from central office Multiple layers of signs more difficult No catwalk Insufficient to span entire cross-section PennDOT standards only allow for span of 160'
Maintenance	●				
Span Length	●				
Guide Sign	●				
Foundation	●				
Acstheti	●				

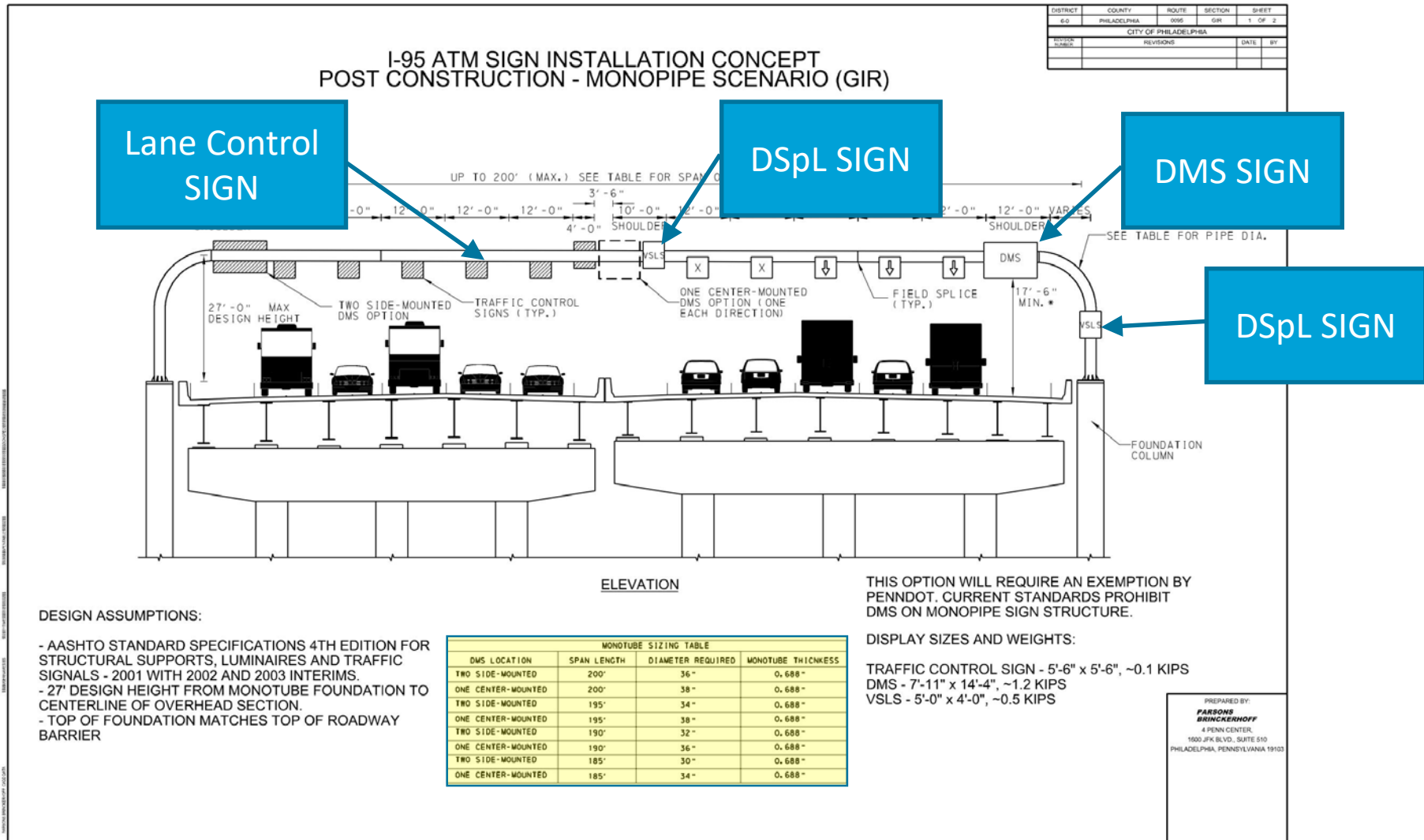
Monopipe – PennDOT 647 & PA Turnpike Commission Monopipe Sign Structures

equipment is relatively easy to obtrusive than "cage" sign distances foundation

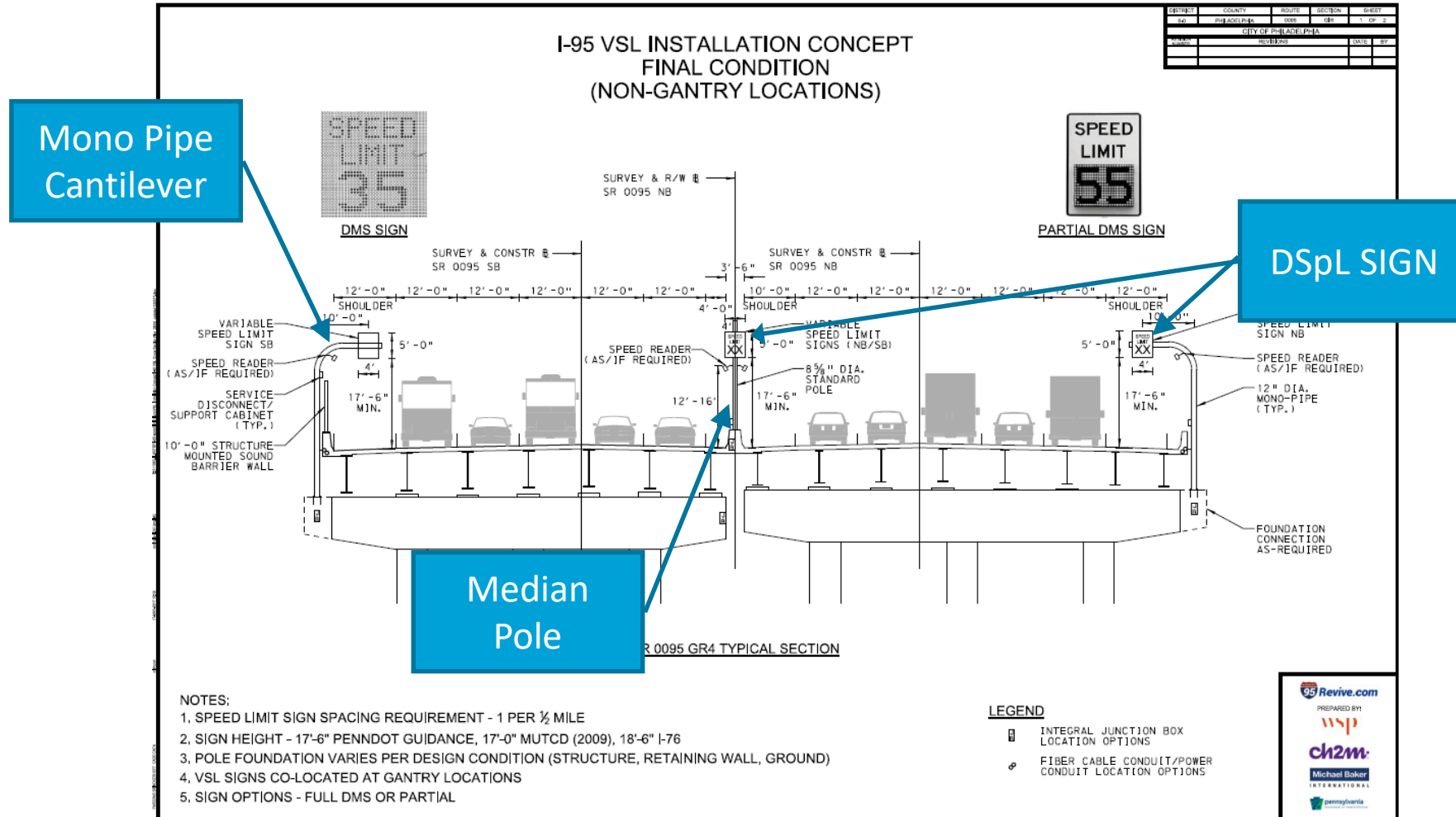
Cons	<ul style="list-style-type: none"> Maintenance would require lane closures Not a PennDOT standard sign bridge, but probably similar to one Guide sign collocation may not be able to be accommodated
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I-66, Virginia Department of Transportation

TYPICAL GANTRY CONCEPT



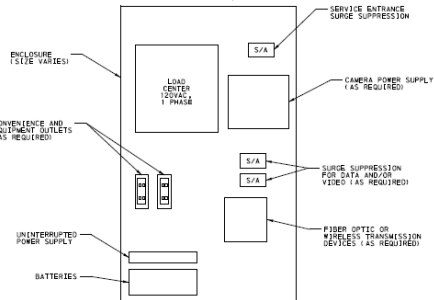
TYPICAL DYNAMIC SPEED LIMIT INSTALLATION



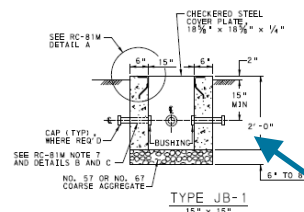
ATM SUPPORT INFRASTRUCTURE

Controller Cabinet

I-95 VSL DESIGN GUIDANCE SYSTEM INFRASTRUCTURE



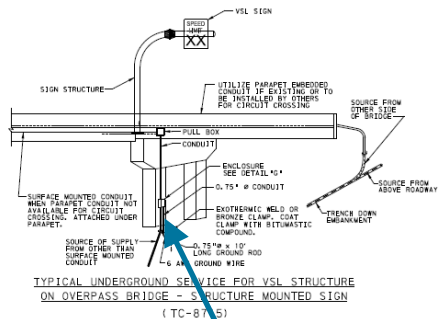
TYPICAL VSL ENCLOSURE EQUIPMENT LAYOUT (ITS-120)



JUNCTION BOXES - LIGHT DUTY (RC-81M)

Junction Boxes

Speed Detectors

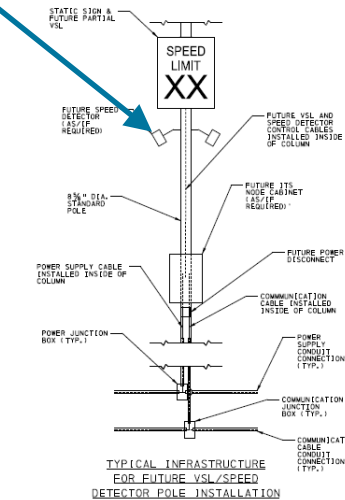


TYPICAL UNDERGROUND SERVICE FOR VSL STRUCTURE ON OVERPASS BRIDGE - STRUCTURE MOUNTED SIGN (TC-87.5)

Power Supply

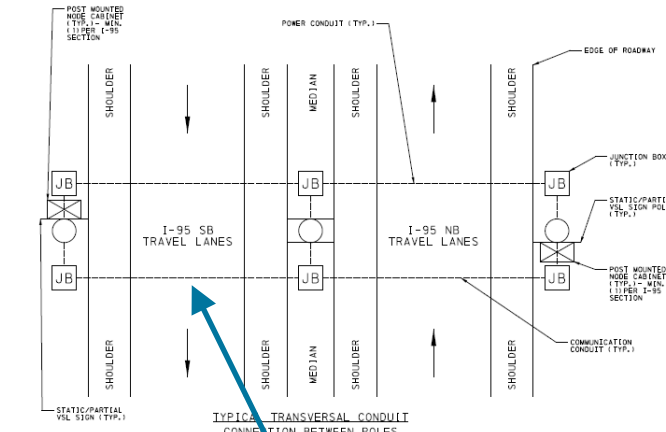
DRAFT

I-95 VSL DESIGN GUIDANCE SYSTEM INFRASTRUCTURE



TYPICAL INFRASTRUCTURE FOR FUTURE VSL/SPEED DETECTOR POLE INSTALLATION

NOTE: 1 - MAX. CABINET WIDTH TO BE LESS THAN MIN. MEDIAN.



TYPICAL TRANSVERSAL CONDUIT CONNECTION BETWEEN POLES

NOTE: - PROVIDE CONDUIT CONNECTIONS AS NEEDED. CONDUIT RUNS CAN BE FLUMED BASED ON POWER AND COMM.

ITEM	RESOURCE LOCATION/REMARKS
JITS CABINET	SIMILAR TO POLE MOUNTED JITS ENCLOSURES IN PUB 647 (STANDARD DRAWING NUMBER 111)
ELECTRICAL DISCONNECT	SIMILAR TO UTILITY SERVICE DETAIL DMS LOCATIONS IN PUB 647 (STANDARD DRAWING NUMBER 111)
FIBER CONDUIT	SIMILAR TO ITS CONDUIT AND TRENCH DETAILS IN PUB 647 (STANDARD DRAWING NUMBER 111)
ELECTRICAL CONDUIT	SIMILAR TO UTILITY SERVICE DETAIL DMS LOCATIONS IN PUB 647 (STANDARD DRAWING NUMBER 111)
JUNCTION BOX	SIMILAR TO ITS JUNCTION BOXES IN PUB 647 (STANDARD DRAWING NUMBER 111)
BRACKET CONNECTION DETAIL	SIMILAR TO PENNDOT ITEM 9933-0002, POST MOUNTED SIGNS, PUB 111

Conduit

NOT TO SCALE

PREPARED BY
WSP
4700 PENN. STATE BLVD.
PHILADELPHIA, PENNSYLVANIA 19104

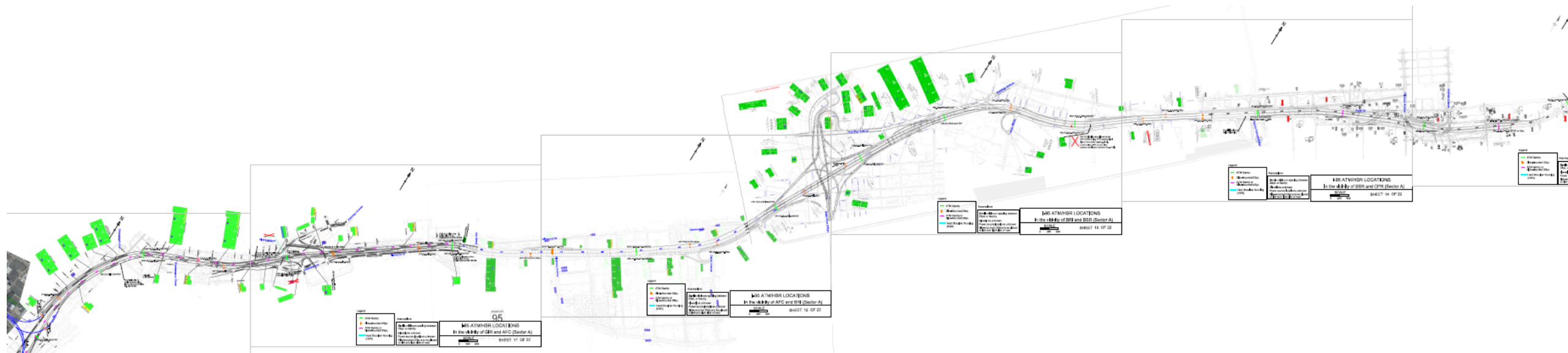
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CHALLENGES OF IMPLEMENTATION IN SECTOR A

- No federal guidelines for implementation of ATM equipment and no PennDOT design standards.
- Retrofitting in some sections, and designing into the plans in others.
- Much of Sector A is on structure.
- Interim conditions, versus long term plan (design for long term, but install short term initially).
- Locating ATM elements to meet FHWA and ConOps spacing requirements.

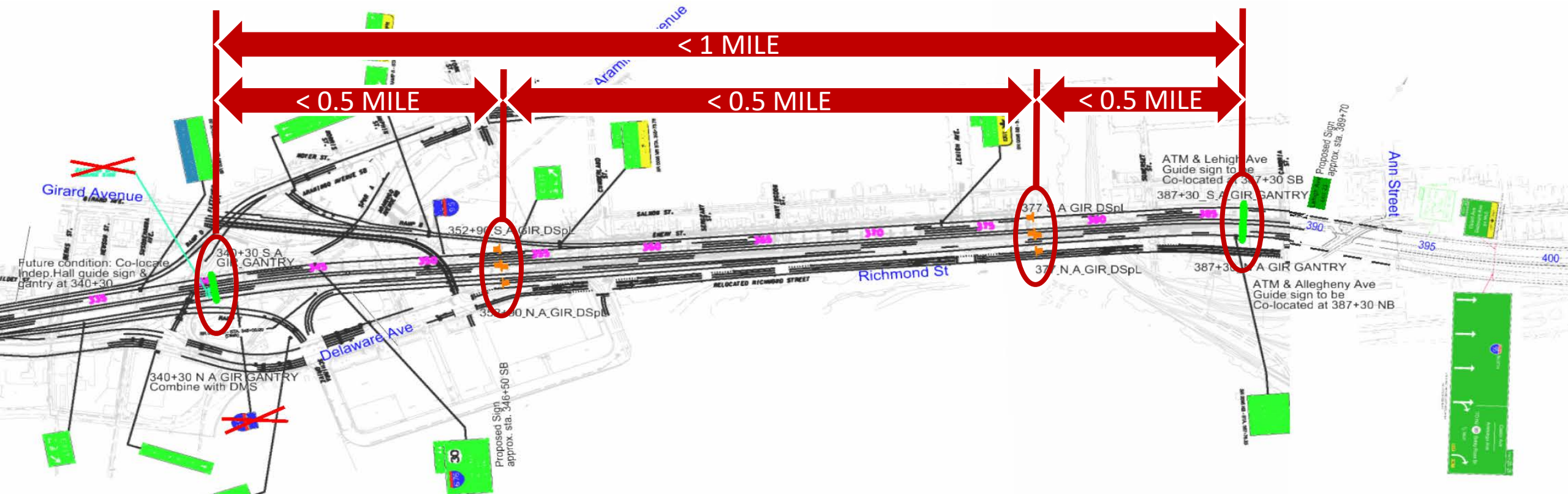
RETROFITTING LOCATION AND SPACING

- Spacing to other signs (requirements from FHWA)
- Location criteria from ConOps
- Side-mount, locating near structure pier cap locations
- Gantries need space for foundation footprint



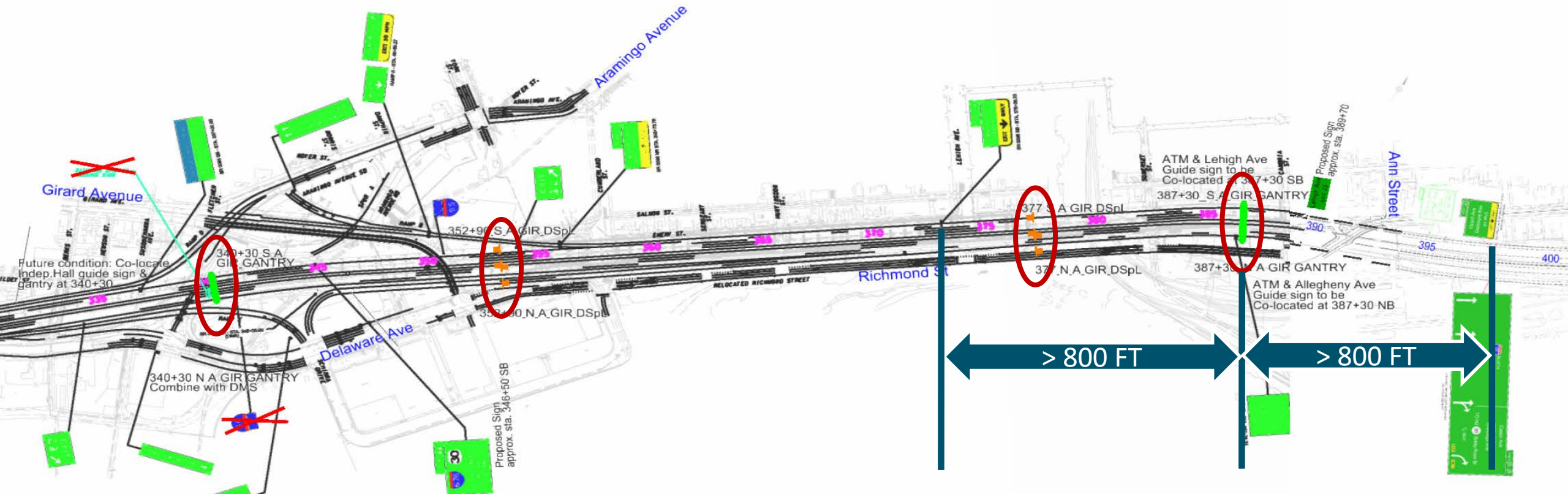
CHALLENGES OF IMPLEMENTATION IN SECTOR A

- Examples of Spacing Challenges
- Domino effect of relocating gantries - GIR, BSR/BRI, AFC, and CPR



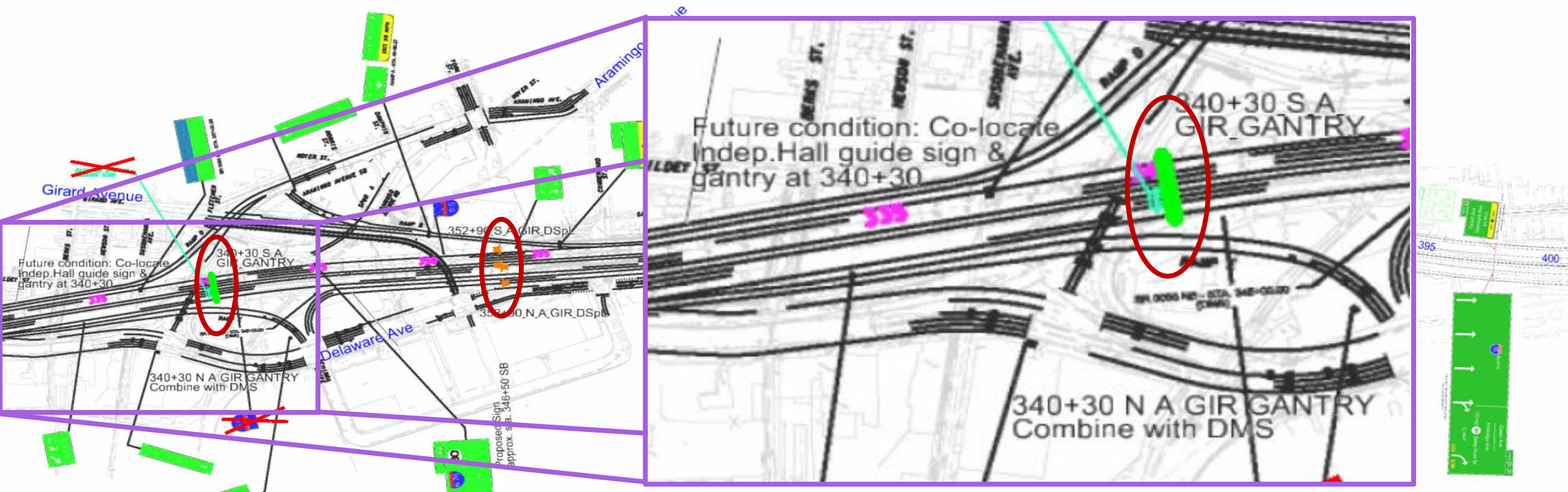
CHALLENGES OF IMPLEMENTATION IN SECTOR A

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CHALLENGES OF IMPLEMENTATION IN SECTOR A

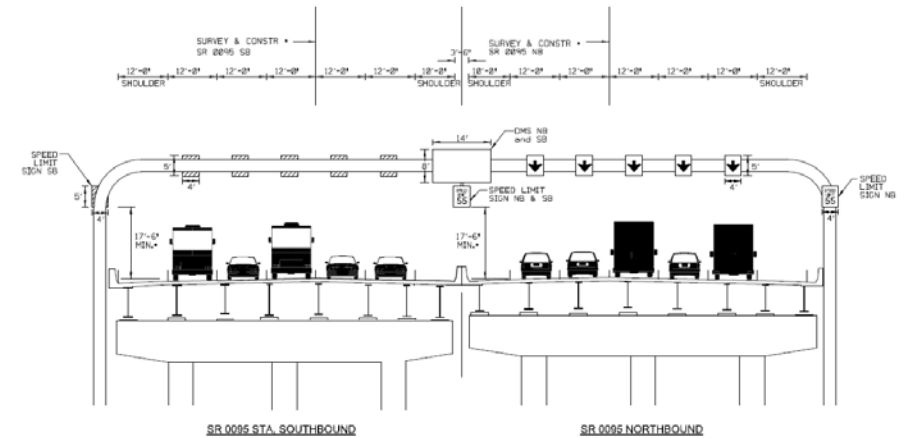
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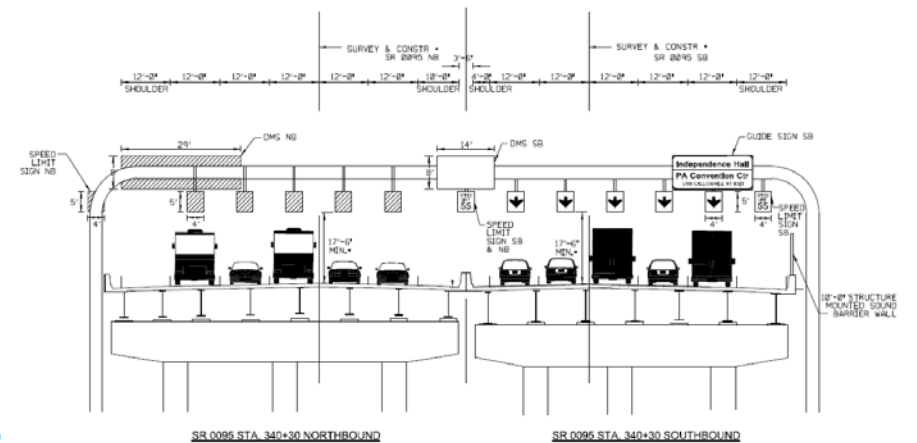
RETROFITTING CHALLENGES

- Goal was avoidance of design deviations
- Vertical and horizontal clearances
- Median “bump outs”
- Noise/retaining walls
- Co-mingling of guide signs and ATM in GIR and BSR – needed FHWA concurrence
- DMS mount on monopipe curve

Variation on typical ATM gantry

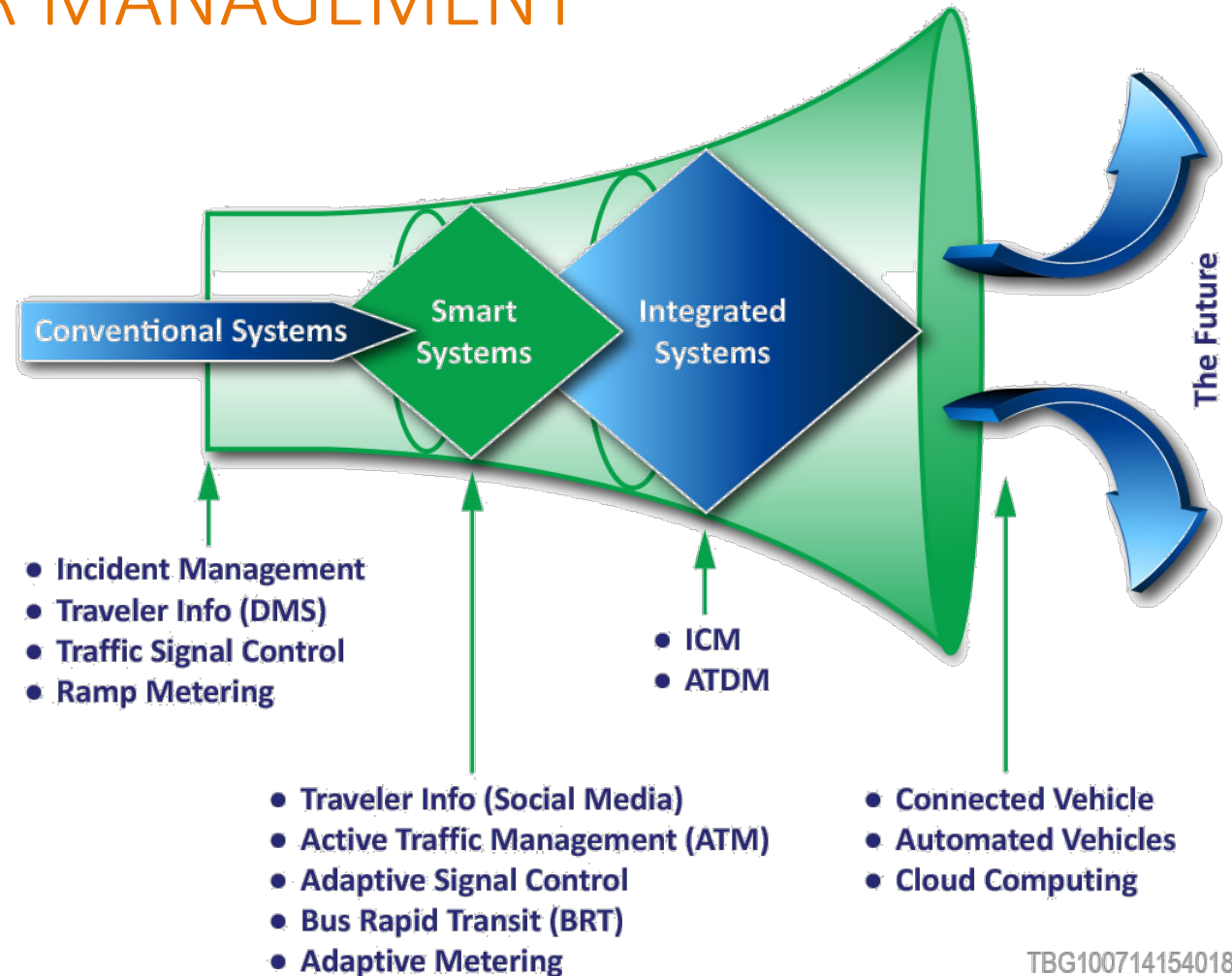


Gantry with Co-located lane control and guide signs
GIR station 340+30 southbound



INTEGRATED CORRIDOR MANAGEMENT

- Part of a bigger ITS plan
- Coordination with existing and future planned ITS equipment/systems
- Not just VSL/DMS and gantries – there's a support system to tie into (JB, conduits, controller cabinets, power, etc.)



CONCLUSIONS/STATUS/NEXT STEPS

- Continue working with designers
- Goal is “design standards” for ATM implementation in District 6-0
- Gantry approval
- ATM need for full system to turn on all at one time, versus current goal is the short term “pieces” implementation

THANK YOU

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