AMERICAN STRUCTUREPOINT INC.

A Unique Application of Railroad Preemption with Queue Mitigation at a Roundabout Interchange

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CONSTRUCTION

Roundabouts Near At-Grade RR Crossings

Two primary concerns:

- Safety - Queue extends from roundabout onto railroad tracks
- Efficiency - Queue extends from railroad tracks into roundabout

Use microsimulation tool to evaluate operations

Roundabouts Near At-Grade RR Crossings

Four Possible Solutions

- Sign the tracks with “Do Not Stop on Tracks” signage
- Provide drivers with a “refuge area” to escape rails when in a queue
- Railroad preemption
- Gates/advance warning

Ohio River Bridges Project

Downtown Crossing:

Sections 1, 2, and 3

East End Crossing:

Sections 4, 5, and 6

East End Design Team

AMERICAN STRUCTUREPOINT INC.

JACOBS

INTERNATIONAL BRIDGE TECHNOLOGIES, INC.

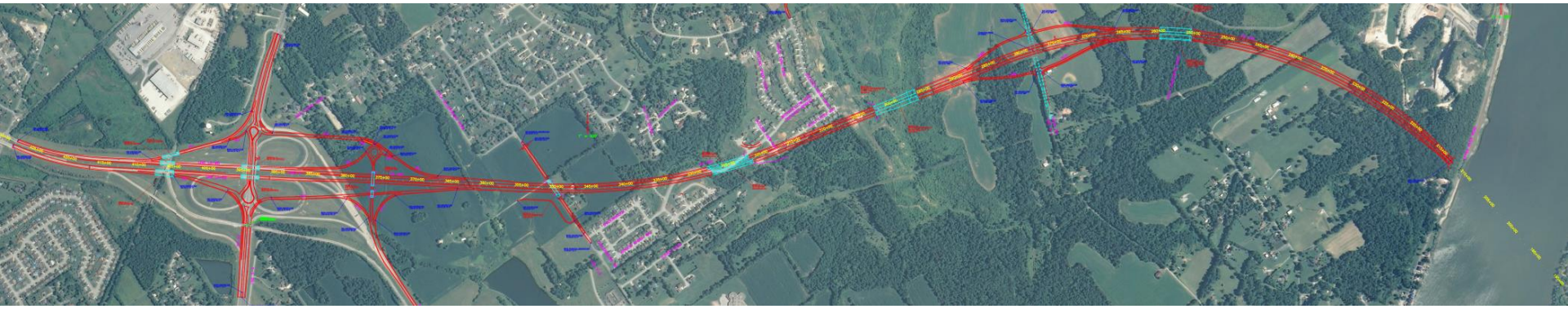
macdonald architects

RWDI

EARTH EXPLORATION INC.

Indiana Approach (Section 6)

- Mainline (SR 265): 4.0 miles
- Two interchanges
- Structures: 5 rehab and 10 new bridges



East End Crossing Schedule

- Begin design – February 2013
- Begin construction – June 2013
- Section 6 open to traffic – fall 2015
- Section 4 open to traffic – summer 2016
- Section 5 open to traffic – late fall 2016

Technical Provisions (TP)

- Guidance document developed by the owner and its consultants to guide design development
- Allows for innovations that bring value to the overall project [Alternative Technical Concepts (ATC)]
- Defines operational objectives
- Can be more or less restrictive

Interchange TP Requirements

Modification to the existing interchange per the criteria below:

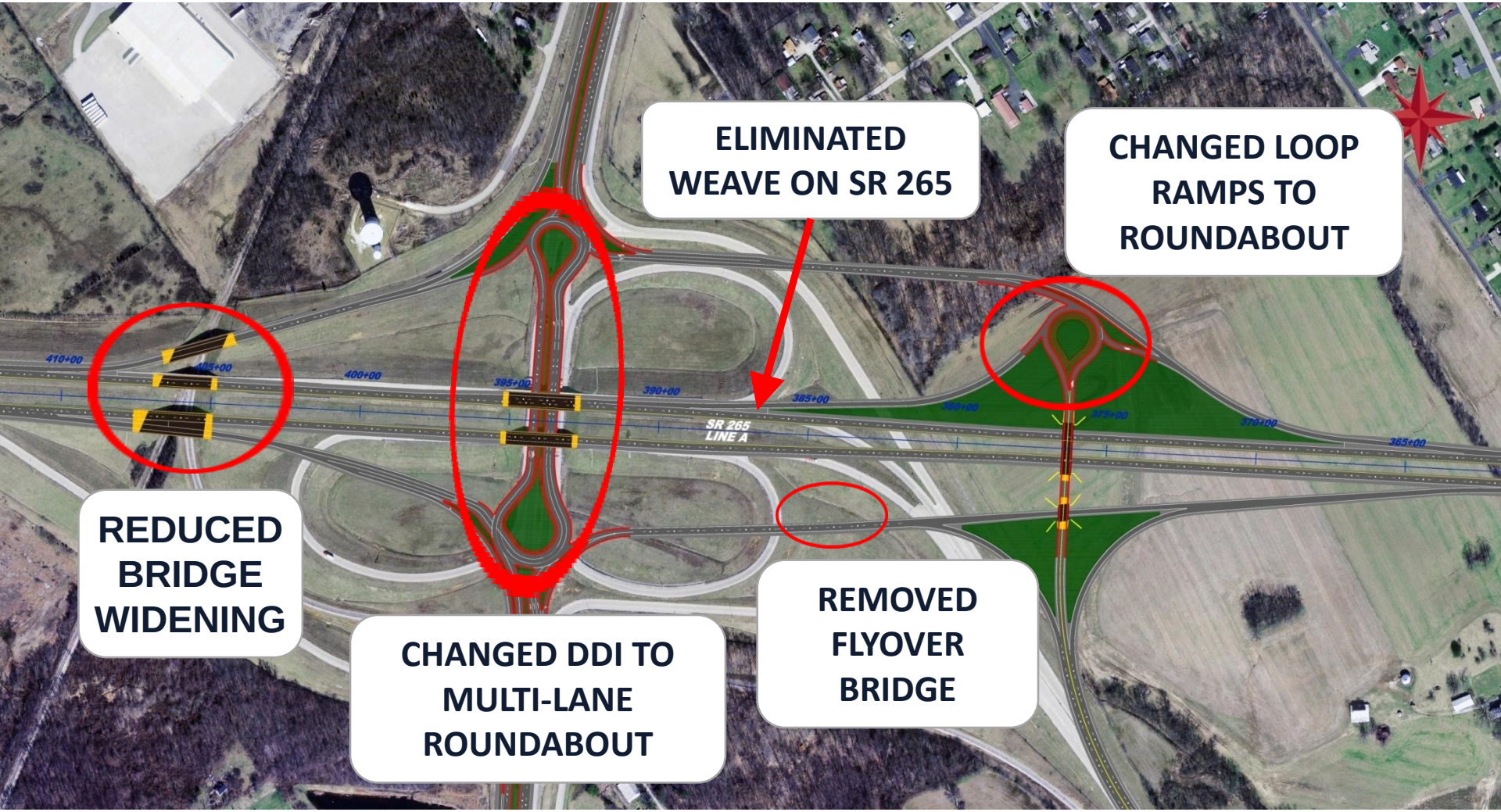
- Maintain all traffic movements, including uninterrupted traffic movements from Port Road to EB or WB SR 265
- Provide better than or equal LOS than TP
- Facilitate movement of 160’ trailer (windmill blade)
- No traffic back up onto SR 265
- At-grade railroad crossing on SR 62

Operational Challenges

- At grade railroad in close proximity
- Queuing impacts following a train crossing
- Proposed solutions
  - Railroad preemption
  - Queue mitigation concept to address queuing impact

TP Base Design – DCD/Trumpet

Proposed Roundabout Interchange

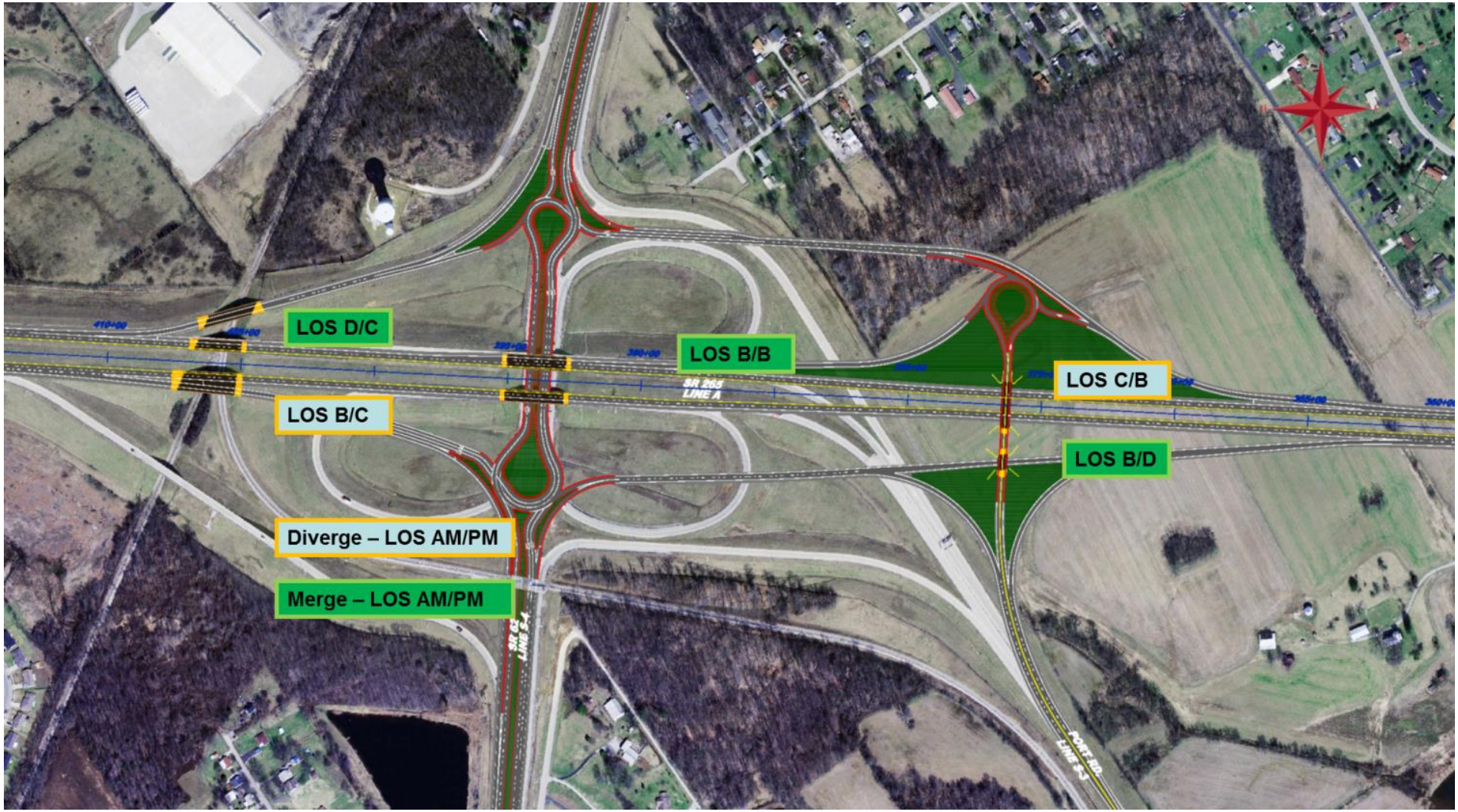


Traffic Analysis Tools

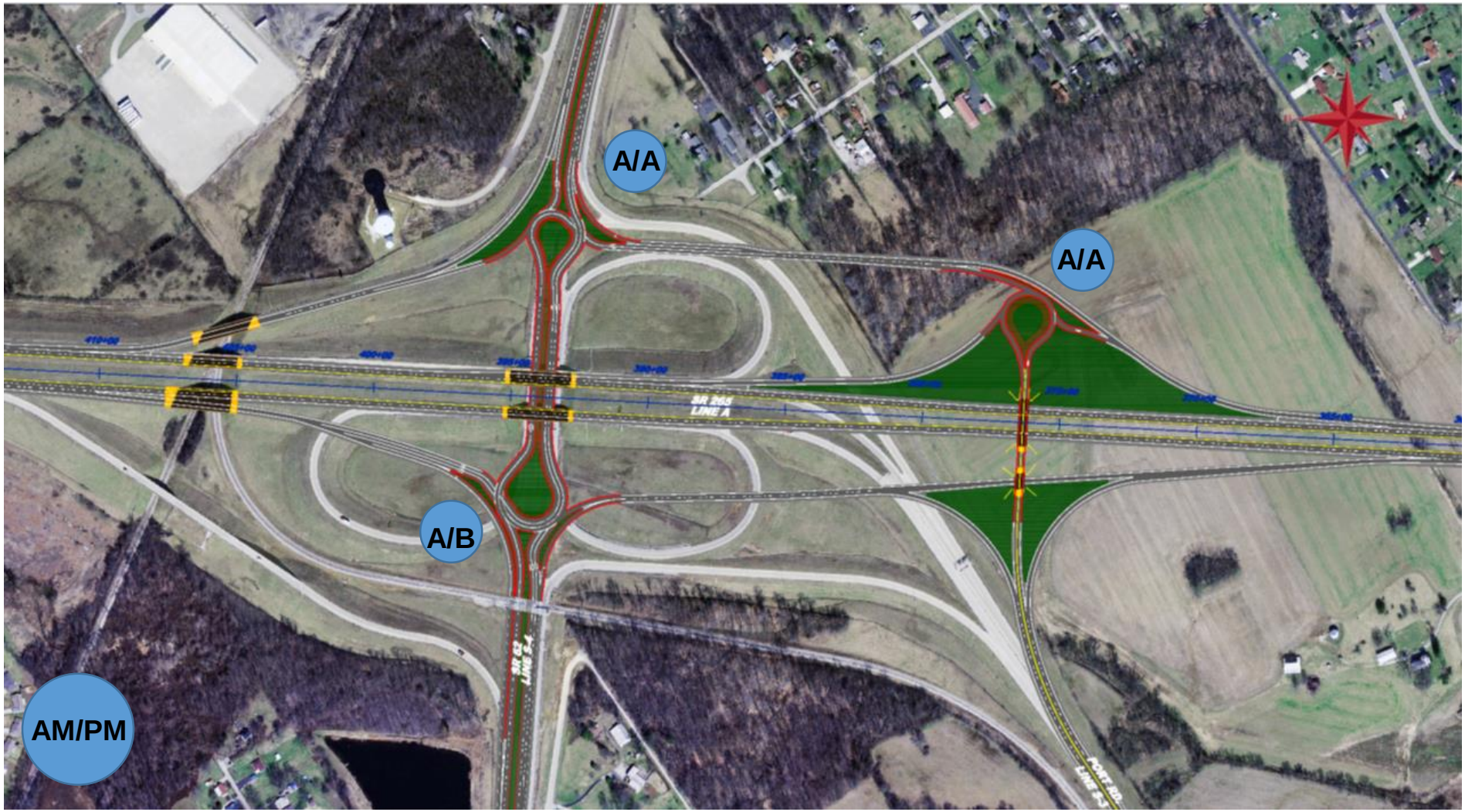
- HCS2010 for Freeway Segments
  - Mainline, Merge, Diverge, Weave
- ARCADY 8
  - Roundabout Capacity
- VISSIM for Traffic Simulation
  - Roundabout Capacity and Operations
  - Merge/Diverge Behaviors
  - Railroad Pre-emption

Traffic analysis performed for 2030 design year volumes

Ramp Merges and Diverges - LOS



Roundabouts - LOS



LOS Summary & Comparison

LOS Comparison: ATC vs. RFP Design				
	2030 Build LOS			
Facility Direction | Ramp Junction	**ATC**		**RFP Design**	
	AM Peak	PM Peak	AM Peak	PM Peak
Diverge Ramp Junctions				
SR 265 EB | SR 62 off-ramp (Diverge)	B	C	B	C
SR 265 EB | Port Road off-ramp (Diverge)	N/A	N/A	A	C
SR 265 WB | SR 62/Port Road off-ramp (Diverge)	C	B	N/A	N/A
SR 265 WB | SR 62 off-ramp (Diverge)	N/A	N/A	C	B
Merge Ramp Junctions				
SR 265 EB | Port Road/SR 62 on-ramp (Merge)	B	D	B	D
SR 265 WB | SR 62 on-ramp (Merge)	D	C	D	C
SR 265 WB | Port Road on-ramp (Merge)*	B	B	N/A	N/A
Weaving Segment				
SR 265 WB | Weave Between Port Road on/off-ramps*	N/A	N/A	C	C
Intersection	**ATC**		**RFP Design**	
SR 62 & SR 265 EB Ramp (South Terminal)	A	B	B	B
SR 62 & SR 265 WB Ramp via WB C-D (North Terminal)	A	A	B	B
Port Road & SR 265 WB Ramp (North Terminal)	A	A	N/A	N/A

Benefits of the Proposed ATC

Improved efficiency over DCD during a train event

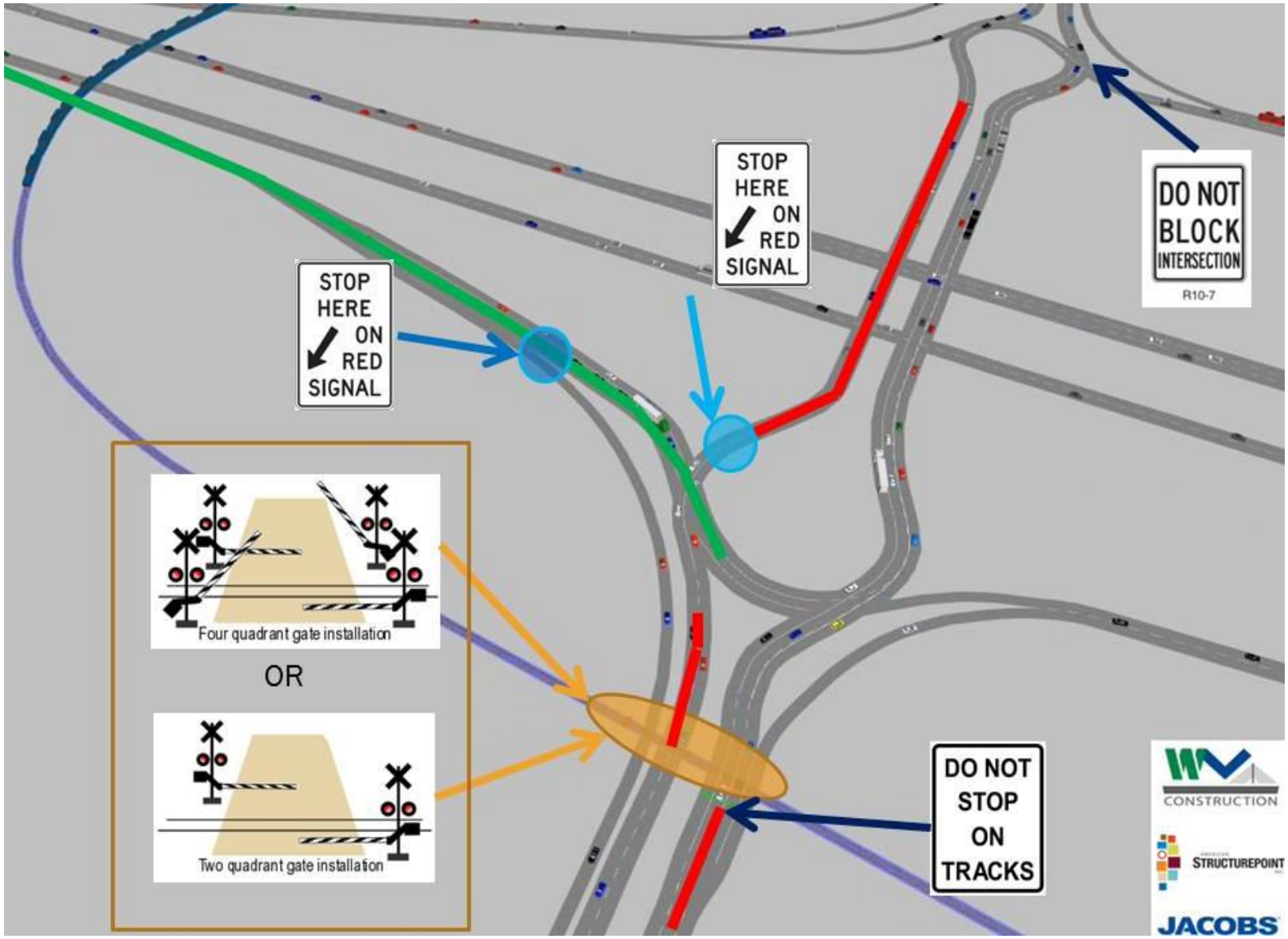
- Less complex signal logic
- Less phases to clear
- Similar movements allowed with fewer bridges
- EB to SB queue has more storage distance

Improved safety over DCD

- More efficient signal logic
- Less opportunity for severe crashes
- Shorter track clearance interval

Cost savings of $8-10 million

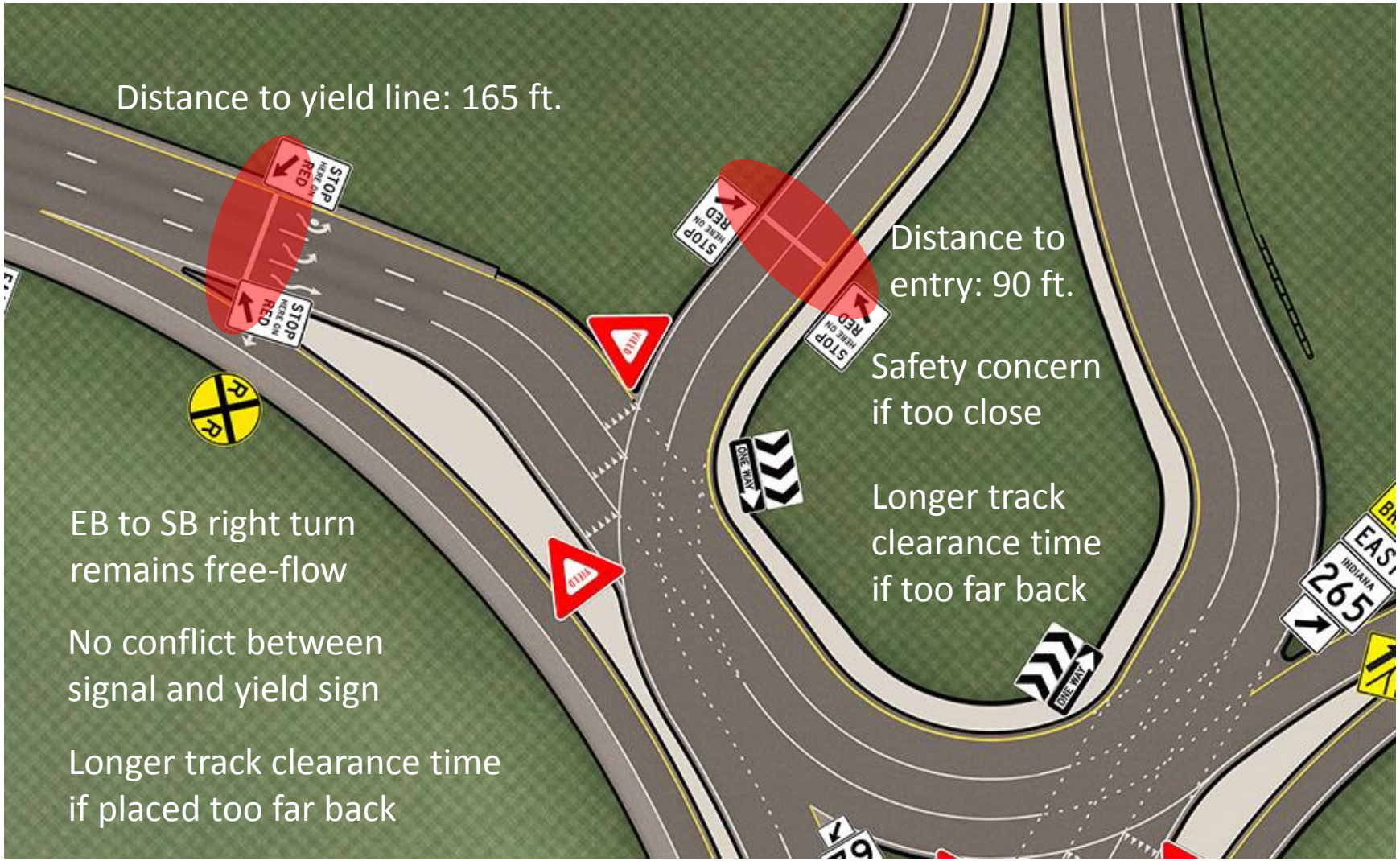
RR Preemption and Queue Mitigation Concept



Proposed Signals for RR Preemption / Queue Mitigation

- Needed something that:
  - Could ideally rest in dark
  - Does not conflict with yield signs at the roundabout
  - Was contextual to the RR crossing
  - Was supported by Indiana State Code
  - HAWK-style signal

Stop Bar Locations



Logic for Railroad Preemption

1) Clear circulatory roadway
   - Stop both southbound SR 62 and eastbound SR 265 off ramp
2) Clear the tracks on northbound SR 62
3) Preemption Hold
   - Southbound SR 62 remains stopped
   - Eastbound SR 265 off ramp allowed to proceed
4) Release southbound SR 62 and return to normal operations

Railroad Preemption Timing

Texas Department of Transportation

Form 2304
(03/09)
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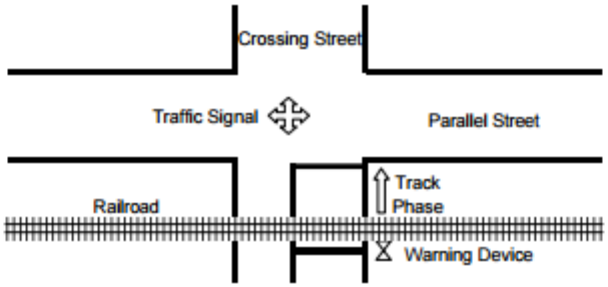
GUIDE FOR DETERMINING TIME REQUIREMENTS FOR TRAFFIC SIGNAL PREEMPTION AT HIGHWAY RAIL GRADE CROSSINGS

City _____ Date _____

County _____ Completed by _____

District _____ District Approval _____

Show North Arrow



Parallel Street Name _____

Crossing Street Name _____

Railroad _____ Railroad Contact _____

Crossing DOT# _____ Phone _____

SECTION 1: RIGHT-OF-WAY TRANSFER TIME CALCULATION

Preempt verification and response time

1. Preempt delay time (seconds) ..... 1. _____
2. Controller response time to preempt (seconds) ..... 2. _____

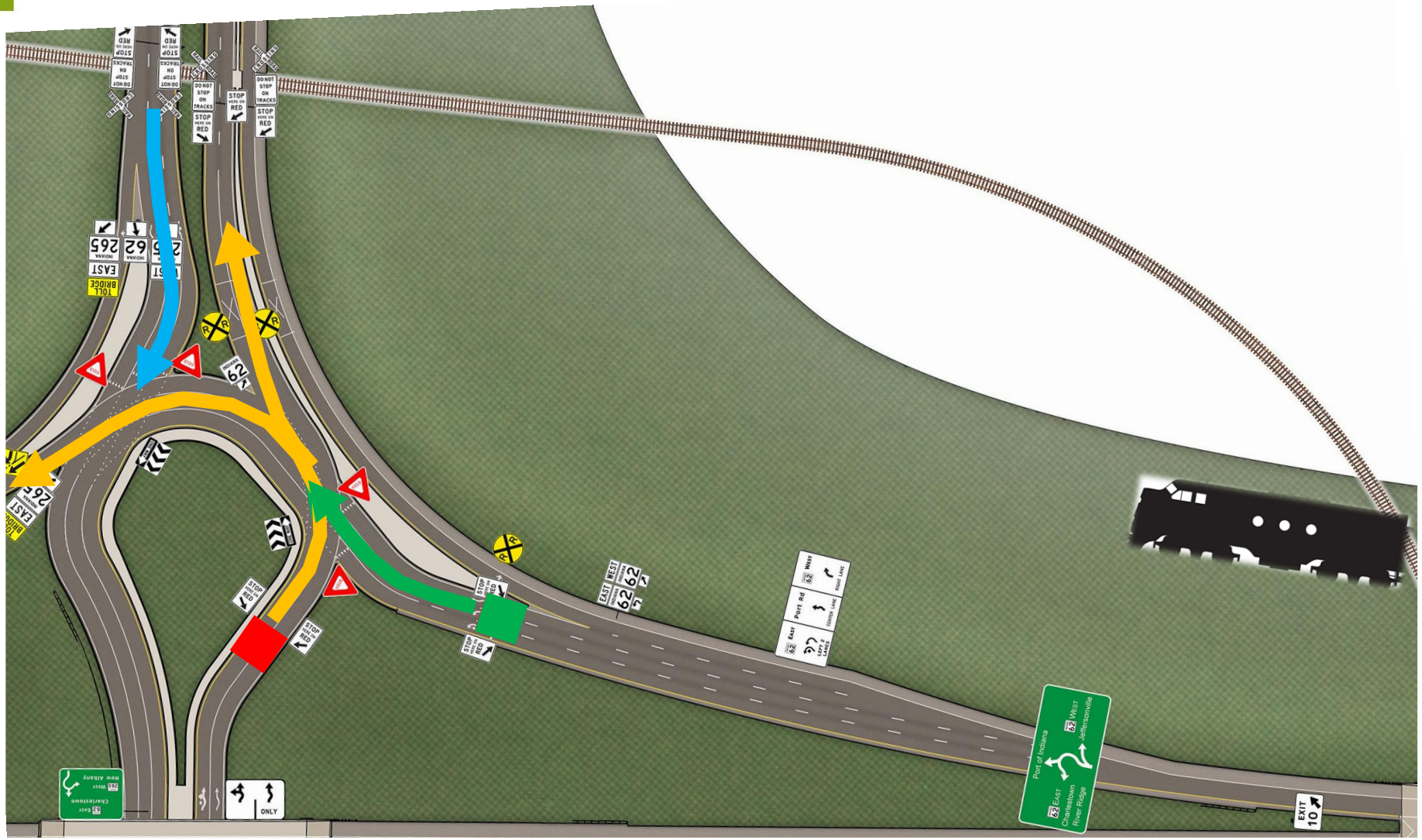
Remarks _____

Controller type: _____

3. Preempt verification and response time (seconds): add lines 1 and 2 ..... 3. 0.0

Worst-case conflicting vehicle time

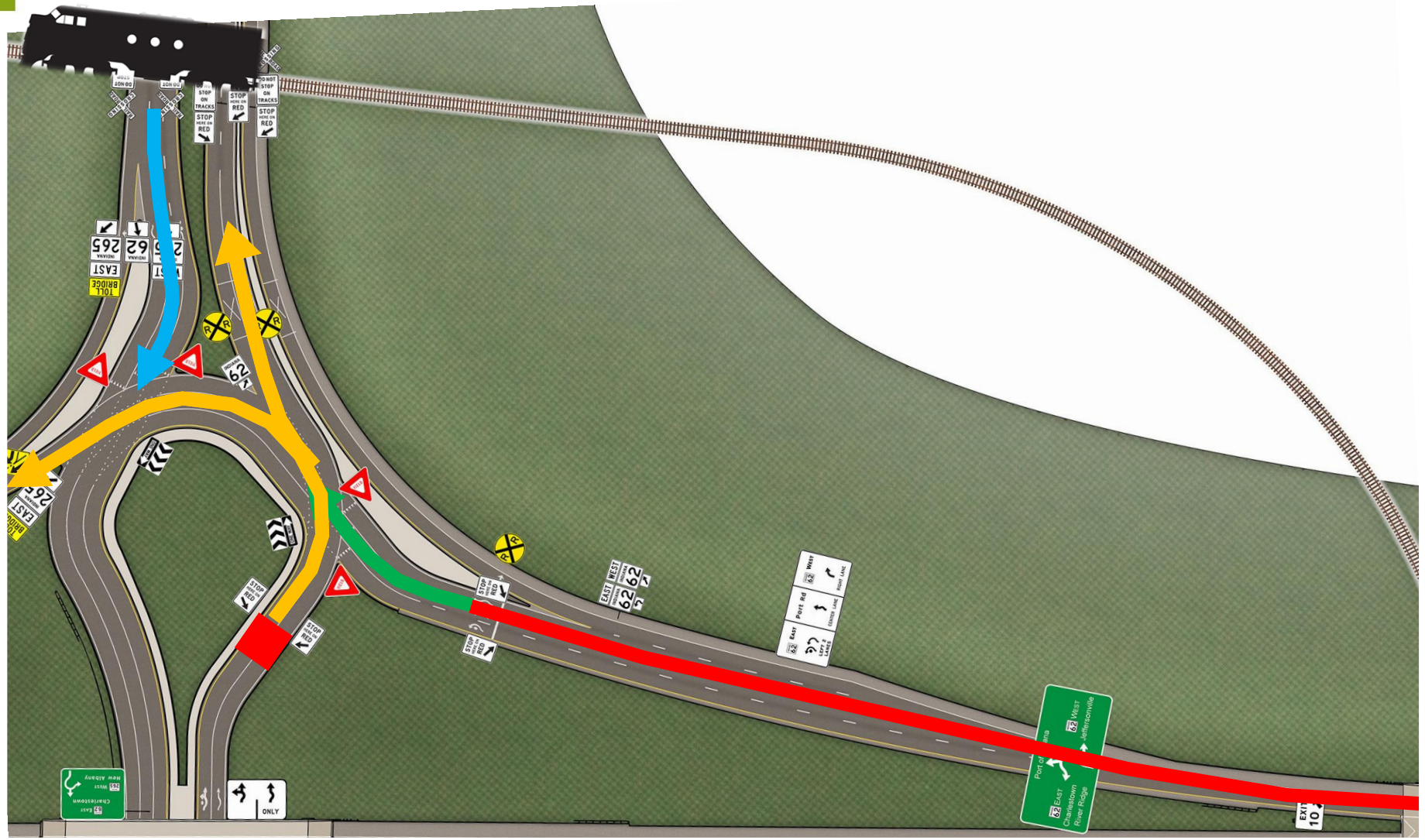
Logic for Railroad Preemption



Logic for Queue Mitigation

1) A critical queue is detected on the eastbound SR 265 off ramp
2) Stop southbound SR 62
3) Provide eastbound SR 265 off ramp ample time to clear the queue and not back up onto SR 265
4) Release southbound SR 62 and return to normal operations

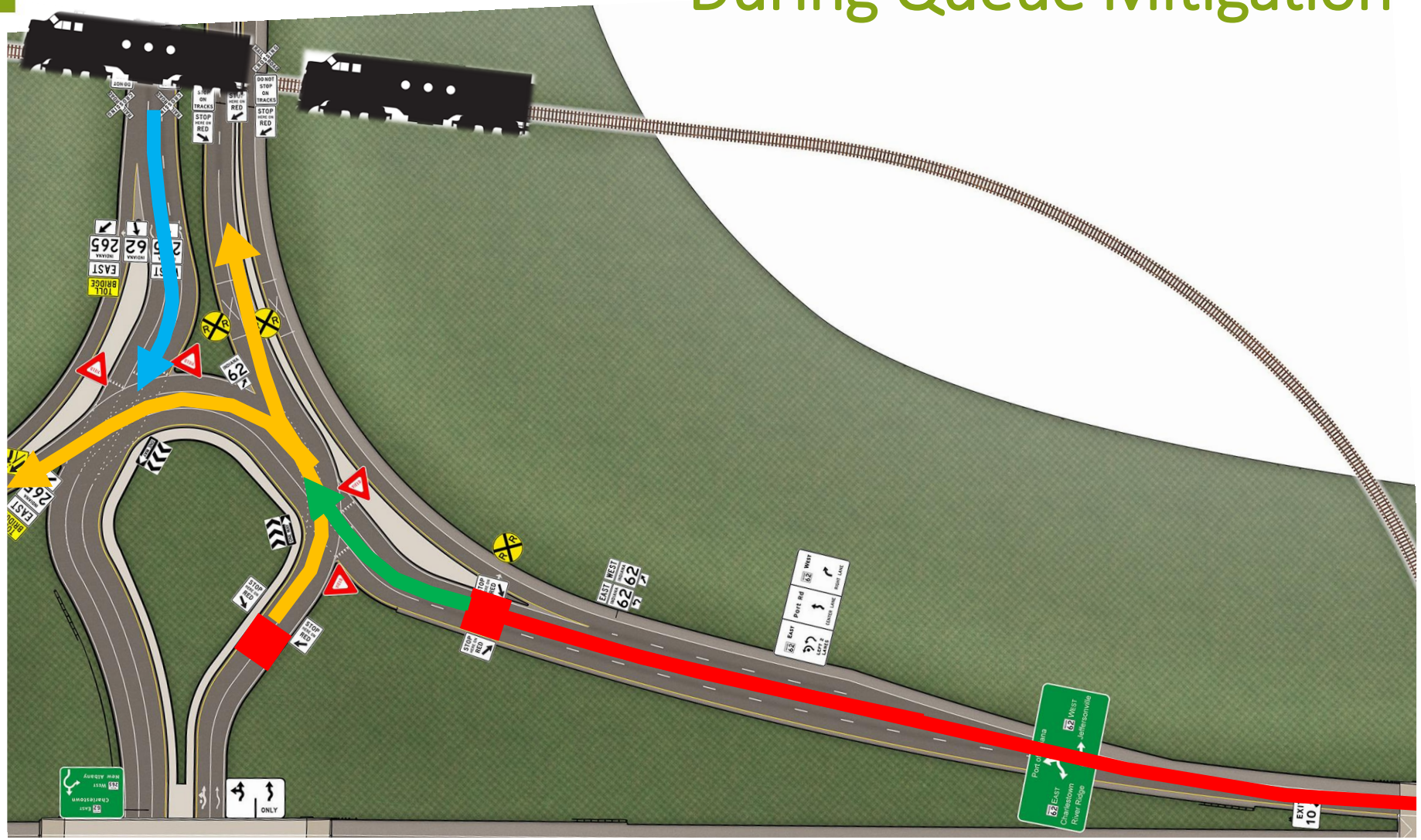
Logic for Queue Mitigation



Plan B: Logic for RR Preemption During Queue Mitigation

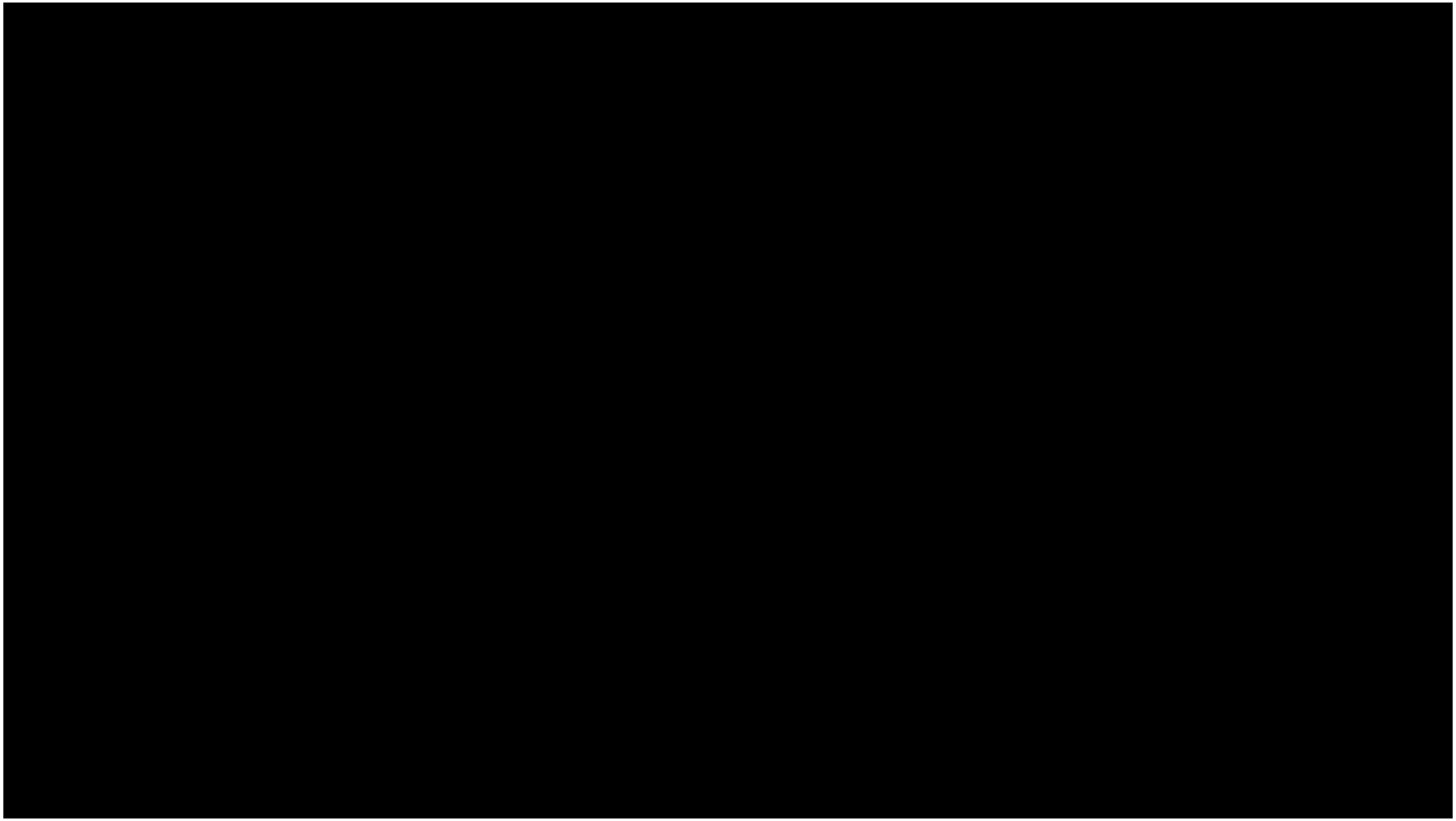
1) Railroad preemption has priority over queue mitigation
2) Southbound SR 62 already stopped
3) Stop eastbound SR 265 off ramp
4) Clear circulatory roadway
5) Clear the tracks on northbound SR 62
6) Preemption Hold
   - Southbound SR 62 remains stopped
   - Eastbound SR 265 off ramp allowed to proceed
7) Release southbound SR 62 and return to normal operations

Plan B: Logic for RR Preemption During Queue Mitigation



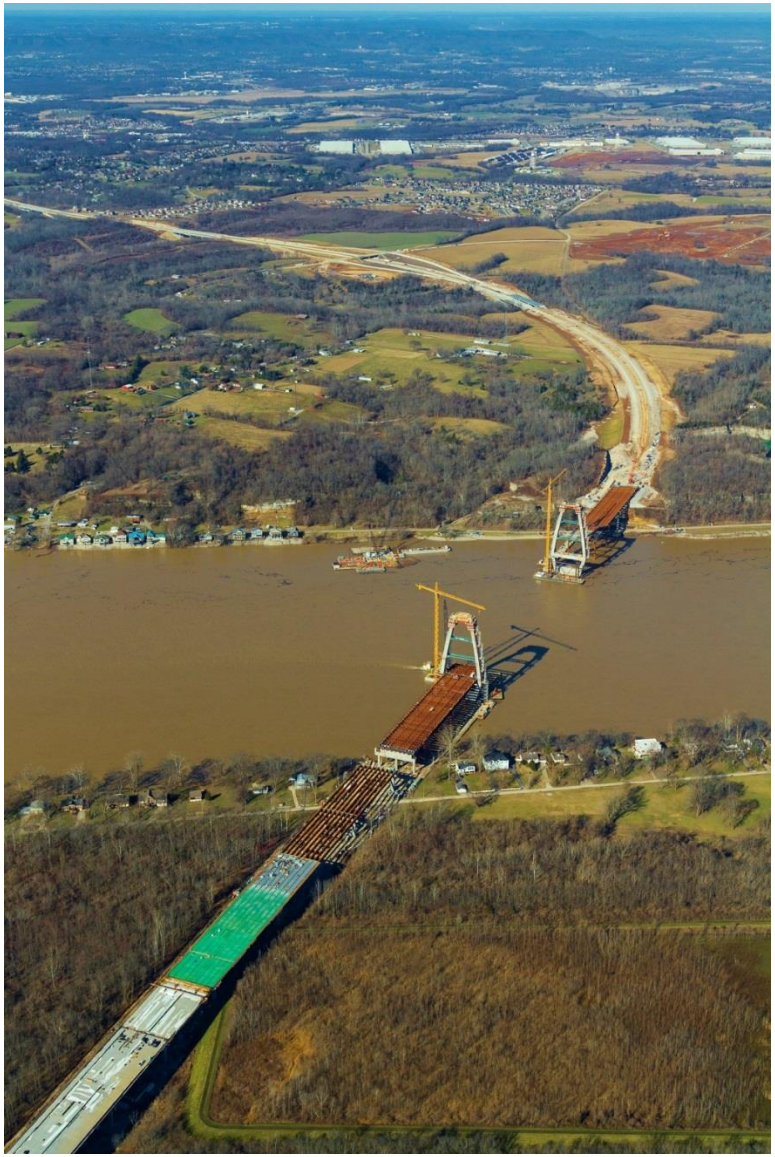
VISSIM Simulation – Normal Operations

VISSIM Simulation – Rail Event

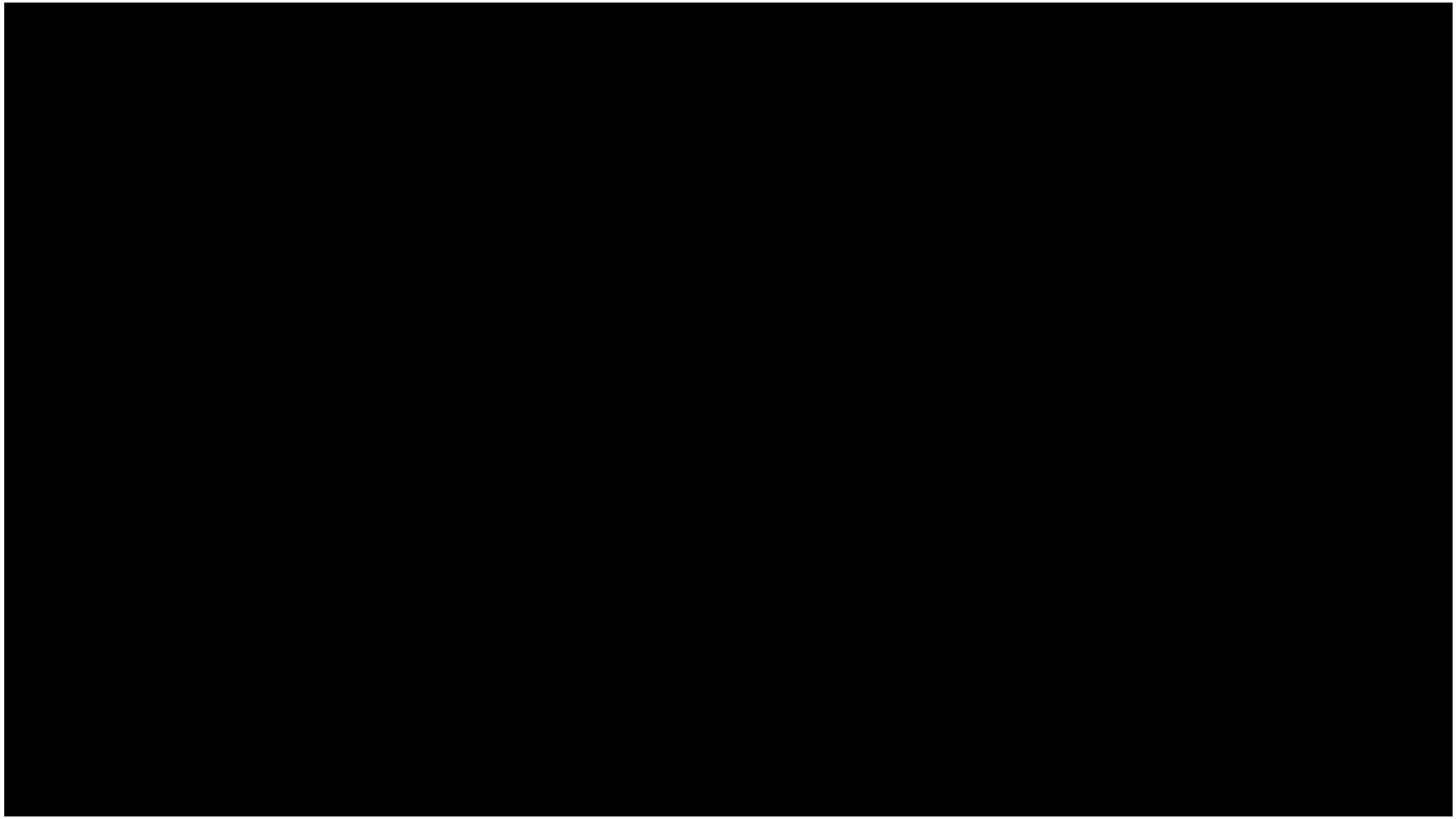


Interchange Aerial

Project Progress



Time-Lapse Video of Train Event



Contact Info

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