FINAL

GTC

NEW YORK STATE OF OPPORTUNITY. Department of Transportation

UPWP Task No. 7952
Ramp Reconfiguration Study

February 2022

I-490 / I-590 / NYS Route 590 Interchange
NYS Route 104 / NYS Route 590 Interchange
Monroe County, New York

Genesee Transportation Council
New York State Department of Transportation

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En Español

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Report Preparation

This report was prepared by Bergmann with assistance from GTS Consulting and Lu Engineers.

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Executive Summary

Interstate 490 (I-490), Interstate 590 (I-590), NYS Route 590, and NYS Route 104 are four of greater Rochester's key transportation corridors. Together they link the City of Rochester with its eastern and southern suburbs. Hundreds of thousands of motorists use them daily to commute, provide services, and deliver goods to the community. The I-490/I-590/NYS Route 590 and NYS Route 104/NYS Route 590 interchanges are two important crossroads in Rochester's regional expressway system. The Genesee Transportation Council (GTC) and New York State Department of Transportation (NYSDOT) partnered to study these interchanges. The New York State Department of Transportation is also planning pavement maintenance projects on I-490, I-590, and NYS Route 590. The recommendations of this study can be considered during the development of future capital projects involving planning, programming, scoping, design, and construction moving forward.

Study Partners

The interchanges are owned and maintained by the NYSDOT; however, they are important to the entire community; therefore, the GTC and NYSDOT engaged representatives of several local agencies as partners in the study. Participants were involved in regular meetings, offered feedback on work products, and provided guidance to the study team regarding upcoming tasks. Steering committee members included representatives of the following agencies:

- Genesee Transportation Council (GTC)
- New York State Department of Transportation (NYSDOT)
- Monroe County Department of Transportation (MCDOT)
- City of Rochester
- Town of Brighton
- Town of Irondequoit
- Town of Penfield
- Town of Pittsford
- Town of Webster

Study Process

The study was progressed as follows:

- Complete an existing conditions inventory;
- Assess needs at each interchange;
- Examine potential alternative concepts; and
- Identify topics for future study or design.

Information was drawn from many different sources including aerial imagery, as-built construction drawings, NYSDOT and Monroe County Department of Transportation (MCDOT) databases, and a licensed traffic data clearinghouse. Field visits were also conducted.

It is assumed that improvements at both interchanges could be complete within the next ten years. A future design year of 2051 (20 years from the estimated time of completion, 2031) was selected for traffic forecasting and analysis purposes. Two growth scenarios were considered to account for possible changes in development patterns, employment, and personal behavior, post COVID-19:

- A “low growth” scenario assuming an average annual traffic growth rate of 0.25% per year. This represents a scenario where motor vehicle traffic volumes do not grow at the same rate one would have expected to see prior to events in the year 2020; and

- A “normal growth” scenario assuming an average annual growth rate of 0.5% per year, consistent with a review of available historic traffic data, consideration of Monroe County Department of Transportation (MCDOT) recommended growth rates for neighboring towns, and discussion with the GTC and NYSDOT Region 4.

Traffic data were obtained from New York State Department of Transportation’s Traffic Data Viewer and a number of other available sources. No new counts were taken. Average weekday morning and evening peak hour volumes were estimated and used along with geometry and traffic control data to develop microsimulation models. The microsimulation models were used to examine existing, no-build, and build condition operations. A set of quantitative results and an animation were produced for each case studied.

Available crash information was also reviewed and summarized. Crash data were obtained from the NYSDOT Accident Location Information System (ALIS) for each interchange over a five-year period ending in late 2019. The analysis revealed a large number of rear end crashes on mainline roadways at each interchange during peak travel periods, which may be due in part to stop and go traffic and lane changes caused by congestion. The crash pattern changes predominantly to “fixed object” during off peak periods when traffic is light. Congestion mitigation should provide a safety benefit during peak periods. Further investigation of the potential link between geometry, pavement surface condition, and the off-peak “fixed object” crash pattern should be investigated in the future.

Needs Assessment

Four key areas at the I-490/I-590/NYS Route 590 interchange stood out as deserving of further consideration:

- I-490 eastbound west of the Winton Road overpass
    - I-490 eastbound currently operates at capacity between the Culver Road overpass and Winton Road overpass during the evening peak hour. All vehicles in this area destined for I-590 or NYS Route 590 must position themselves in the right-hand lane. This causes them to mix with any traffic exiting to Winton Road. Traffic densities are expected to exceed capacity by 2051 with volumes in the range of 5,900 to 6,700 vehicles per hour.
- I-590 southbound approaching the ramp from I-490 westbound (merge) and from I-490 eastbound (lane addition)
    - The ramp from I-490 westbound to I-590 southbound carries more traffic than its counterpart connecting I-490 eastbound to I-590 southbound, yet vehicles on the eastbound to southbound ramp are afforded their own lane when they reach the mainline while those on the westbound to southbound ramp must merge. This area was identified for study during scoping. The area is also an identified crash hot spot. Rear end collisions regularly occur during peak hour periods.
    - Approximately 1,400 vehicles per hour on the ramp from I-490 westbound to I-590 southbound must merge into the right lane on I-590 during the morning peak. This happens on curved section of roadway at the base of the interchange. At the same time, nearly 4,000 commuters approaching the merge on I-590 southbound try to avoid conflicts by moving left into the center lane, resulting in additional congestion. Vehicular demand is expected to exceed capacity in this area within 10 years under a normal growth scenario.
- NYS Route 590 southbound approaching the I-490 interchange
    - The is an identified crash hot spot. Congestion is believed to be contributing to a pattern of rear-end, peak hour crashes.
    - Morning peak hour traffic densities are currently at capacity and expected to remain so throughout the year 2051. A trip through this segment can take up to 90% longer during the morning peak hour than during off-peak periods.

- NYS Route 590 northbound and the weave between the on-ramp from I-490 westbound and the off ramp to Blossom Road

    - The weaving area between the on ramp from I-490 eastbound to NYS Route 590 northbound and the off ramp from NYS Route 590 northbound to Blossom Road is relatively short at 1,150 feet long. Motorists must make multiple lane changes in this area to reach their intended destination during the evening peak hour. This can be difficult when volumes are high. The weave currently operates at capacity during the evening peak hour. Demand is expected to exceed capacity by 2051 under a normal growth scenario, which would lead to reduced speeds, more stop and go traffic, and potentially, additional rear end collisions.

One area at the NYS Route 104/NYS Route 590 interchange stood out as deserving of further consideration:

- NYS Route 590 northbound approaching and between the ramps to NYS Route 104 westbound and NYS Route 104 eastbound

    - The segments of roadway approaching each off-ramp are identified crash hot spots. The southern end of this stretch is notable for run off the road and fixed object type crashes while the northern part experiences more peak hour rear end collisions.

    - Evening peak hour traffic volumes currently meet or exceed capacity. This trend is expected to continue throughout 2051. In general, a larger number of vehicles exit NYS Route 590 headed for NYS Route 104 at both the westbound and eastbound exits; therefore, more traffic tends to utilize the right lanes in these areas, adding to congestion.

    - More than ten years ago, the ramp connecting NYS Route 590 northbound to NYS Route 104 eastbound had two lanes. The left lane merged into the existing three lane section on NYS Route 104 on a curve beneath the Ridge Road overpass. This resulted in crashes. The off-ramp was reduced to one lane as a result. In 2019 the NYSDOT temporarily modified striping inside the NYS Route 104/NYS Route 590 interchange to accommodate a scheduled closure of the bridge carrying NYS Route 104 over NYS Route 590. The modified configuration allowed two lanes to exit NYS Route 590 northbound toward NYS Route 104 eastbound. NYS Route 104 eastbound was reduced to one lane beyond the overpass and lanes continued toward the Irondequoit Bay Bridge. The study team was asked to examine the operational impacts of making that temporary change permanent during scoping.

Conceptual Alternatives

A stated purpose of this study was to examine potential benefits or drawbacks of component-level changes at each interchange as opposed to full-scale reconfiguration. Conceptual alternatives were developed to address areas with overlapping operational and safety issues identified during the needs assessment. Eight concepts were developed in total. Concepts 1, 2, 3, 5, 6 and 8 were deemed feasible. Concepts 4 and 7 were not and dismissed from further consideration. The feasible concepts are summarized as follows:

- Evening peak hour congestion and delays on I-490 eastbound between the Culver Road interchange and I-590/NYS Route 590

    - *Concept 1: Auxiliary lane along I-490 eastbound from Culver Road to I-590:* This would add a full auxiliary lane to I-490 eastbound. After construction, this area would operate at or below capacity during the evening peak throughout the year 2051 under all growth scenarios. I-490 is very close to Norris Drive in this area and potential impacts to an existing pedestrian overpass, noise wall, overhead sign structure, and the local roadway are of note. Cobbs Hill Park is also in close proximity to the proposed work. The planning level construction cost estimate is $18.5 million.

- Morning peak hour congestion and delays on NYS Route 590 southbound approaching the entrances from I-490 eastbound and westbound

    - *Concept 2: Switch the configuration along I-590 southbound so vehicles from I-490 eastbound get an additional lane while those from I-490 westbound must merge:* This would provide vehicles entering I-590 from I-490 westbound with their own travel lane. The ramp from I-490 eastbound would connect to a 1,000-foot parallel acceleration lane and taper in prior to reaching the Highland Avenue overpass. This change would result in peak hour operation below capacity during the morning peak hour throughout 2051 under all growth scenarios. Existing bridge pier, bridge abutment, paved slope, roadside barrier, roadside slopes, and an adjacent noise barrier may be impacted by the proposed work. There are homes along the west side of I-590 that are eligible for inclusion on the National Register of Historic Places, but they are currently separated from the highway by the existing noise barrier. The planning level construction cost estimate is $5.3 million.

- Recurring morning peak hour congestion and delays on NYS Route 590 southbound from the Browncroft Boulevard interchange to the I-490/NYS Route 590 split.

    - *Concept 3: Additional southbound lane from Browncroft Boulevard to I-490:* This would add a fourth southbound travel lane to NYS Route 590. This lane addition would improve morning peak hour operations throughout the year 2051 under all growth scenarios to below capacity. The existing bridges over Blossom Road and Browncroft Boulevard would need to be wider to accommodate this alternative. Moving the roadway closer to adjacent residential properties may trigger the need for noise studies. The planning level construction cost estimate is $26.6 million.

- Evening peak hour congestion and delays on NYS Route 590 northbound approaching, within, and just beyond the weave between the on ramp from I-490 westbound and the off ramp to Blossom Road.

    - *Concept 5: Additional NYS Route 590 northbound lane from the I-490 westbound on-ramp to the Browncroft Boulevard off-ramp:* This would extend the weaving lane between the on ramp to NYS Route 590 northbound and the off ramp to Blossom Road up to Browncroft Boulevard. This is expected to provide operations at or below capacity throughout 2051 during the evening peak hour under all growth scenarios. The existing bridge over Blossom Road would need to be wider to accommodate this alternative. Moving the roadway closer to adjacent residential properties may trigger the need for noise studies. The planning level construction cost estimate is $17.9 million.

- Evening peak hour congestion and delays on NYS Route 590 northbound approaching the NYS Route 104 interchange.

    - *Concepts 6 and 8: Extension of the right lane on approach to both exits along with two lanes on the ramp from NYS Route 590 northbound to NYS Route 104 eastbound and on NYS Route 104 eastbound:* This would extend the right lane on approach to the NYS Route 590 northbound exits to both NYS Route 104 westbound and NYS Route 104 eastbound as far as possible. This would provide additional space for drivers to select the proper lane. It would also retain the current two-lane section on NYS Route 104 eastbound through the interchange while reconfiguring the ramp from NYS Route 590 northbound to NYS Route 104 eastbound to also carry two lanes. This would require a four lane section on NYS Route 104 headed east which would end before reaching the Irondequoit Bay Bridge. This would result operations below capacity throughout 2051 during the evening peak hour under all growth scenarios.

      Concept 6's proposed widening would require extending a box culvert and a steep, tall embankment. Concept 8 would impact an existing paved slope and guiderail beneath the Ridge Road overpass. The existing bridge carrying NYS Route 104 over a maintenance ramp would need to be wider to accommodate this alternative. The surrounding area is in a coastal zone and is within the Town of Irondequoit's Local Waterfront Revitalization Plan boundary. Previously undisturbed areas around the roadway are also classified as archaeologically sensitive. Planning level construction cost estimates for concepts 6 and 8 are $2.2 million and $9.3 million, respectively.

New York State Department of Transportation design criteria from the *Highway Design Manual* were used to develop the horizontal geometry and lane layouts that appear at the end of this Executive Summary. There are also graphics illustrating a preliminary guide sign concept for each interchange assuming incorporation of the conceptual alternatives. Properly designed and located guide signs, extending back to the first sign in each series, would assist motorists with navigation and contribute to a safer roadway environment.

Travel times through the I-490/I-590/NYS Route 590 interchange on NYS Route 590/I-590 southbound in the morning and I-590/NYS Route 590 northbound in the evening would be substantially reduced in comparison to the no-build condition with all feasible conceptual alternatives in place. Evening peak hour travel time increases on NYS Route 590 northbound would also be eliminated throughout 2051 at the NYS Route 104/NYS Route 590 interchange with Concepts 6 and 8 in place. The total vehicle hours of delay at the I-490/I-590/NYS Route 590 interchange would be reduced by 60% during the evening peak hour and 80% during the morning peak hour in comparison to the no-build condition by 2051. The total vehicle hours of delay at the NYS Route 104/NYS Route 590 interchange would be reduced by 80% in the evening peak hour throughout 2051 under the normal growth scenario.

Topics for Future Study

The scope, funding, and timeline of this study were not intended to allow for an exhaustive review of all related issues, similar to what would be accomplished during the development of a NYSDOT *Design Approval Document*. The following topics have been noted and should be considered during future stages of study or design:

- Traffic Volumes:
  - Collect origin and destination data to enhance microsimulation modeling
  - Collect new traffic data including daily and peak hour volumes, post COVID-19

- Crash Analyses:
  - Obtain and review crash reports from the New York State Department of Motor Vehicles
  - Break Priority Investigation Locations down by direction and conduct further review
  - Examine the potential relationship between geometry, pavement condition, and off-peak fixed object crashes along ramps to help identify appropriate spot safety enhancements

- Blossom Road Interchange and Weave Area:
  - Consider the potential benefits and disadvantages of two lanes on the ramp connecting I-490 westbound with NYS Route 590 northbound
  - Consider the potential benefits and disadvantages of larger-scale changes including grade separation of conflicting movements

- Drainage:
  - Investigate community concerns regarding outflows from a detention pond west of NYS Route 590, north of the I-490/I-590/NYS Route 590 interchange

- Separate Concept Analyses:
  - Create separate microsimulation models of each concept, rather than having them grouped together in one model, and run them to assess their individual effects

The areas studied and summarized in this document do not preclude other locations from being studied in greater detail in the future. The microsimulation models could be expanded to include more of the adjacent roadway network to understand the potential impact on upstream and downstream operations.

North

Reconstruction or replacement of a portion of the existing pedestrian overpass is likely needed. An existing pier south of I-490 would be impacted by roadway widening.

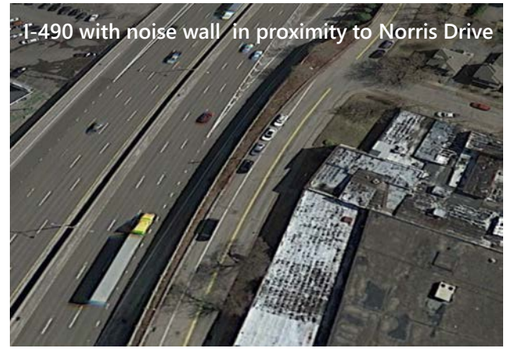
A new auxiliary lane would begin at the end of the Culver Road on-ramp to I -490 EB.

Norris Dr

INTERSTATE 490

MATCH BELOW

Impacts to an existing noise wall and parking lane along the northern edge of Norris Drive are also anticipated. Coordination with the City of Rochester would be necessary.



University Ave

INTERSTATE 490

Norris Dr

New parallel deceleration lane for Winton Road off ramp.

Winton Rd

The new auxiliary lane would end at the off-ramp to I-590 southbound.

Impacts to the existing noise wall and a portion of Norris Drive are anticipated. This segment of Norris Drive could potentially be changed to one-way if there isn't adequate room to maintain two-way travel.

MATCH ABOVE

INTERSTATE 590

1 Auxiliary lane along I-490 eastbound from Culver Road to I-590

Operational Considerations: Eastbound I-490 currently operates at capacity (LOS E) during the evening peak hour. All vehicles destined for I-590 or NYS Route 590 must use the right lane, mixing with traffic exiting to Winton Road. LOS E conditions are anticipated to continue through 2031 and degrade to LOS F by 2051 under both the low and normal growth scenarios.

Conceptual Alternative: This concept would add a full auxiliary lane to I-490 eastbound. After construction, this area would continue to operate at or below capacity (LOS E or LOS D) during the evening peak throughout the year 2051 under all growth scenarios.

Constructability Considerations: There is limited space between I-490 eastbound and Norris Drive from Hillside Avenue to Winton Road. An existing pedestrian overpass, noise wall, overhead sign structure, and Norris Drive itself would be impacted by the proposed widening. The loss of parking along Norris Drive or the conversion of a segment of that roadway to one-way eastbound travel could be a concern for adjacent residents and businesses. Coordination with the City of Rochester and utility companies would be necessary to progress this alternative.

Environmental Considerations: No appreciable concerns unless property were needed from Cobbs Hill Park. That would invoke Section 4(f). Cobbs Hill Park is not on the Section 6(f) list, but the designer should consult with NYSORP. Any noise impacts to the park could also be of concern.

Planning-Level Construction Cost Estimate: $18.5 million

2 Switch the merge along I-590 southbound from Ramp WS to Ramp ES

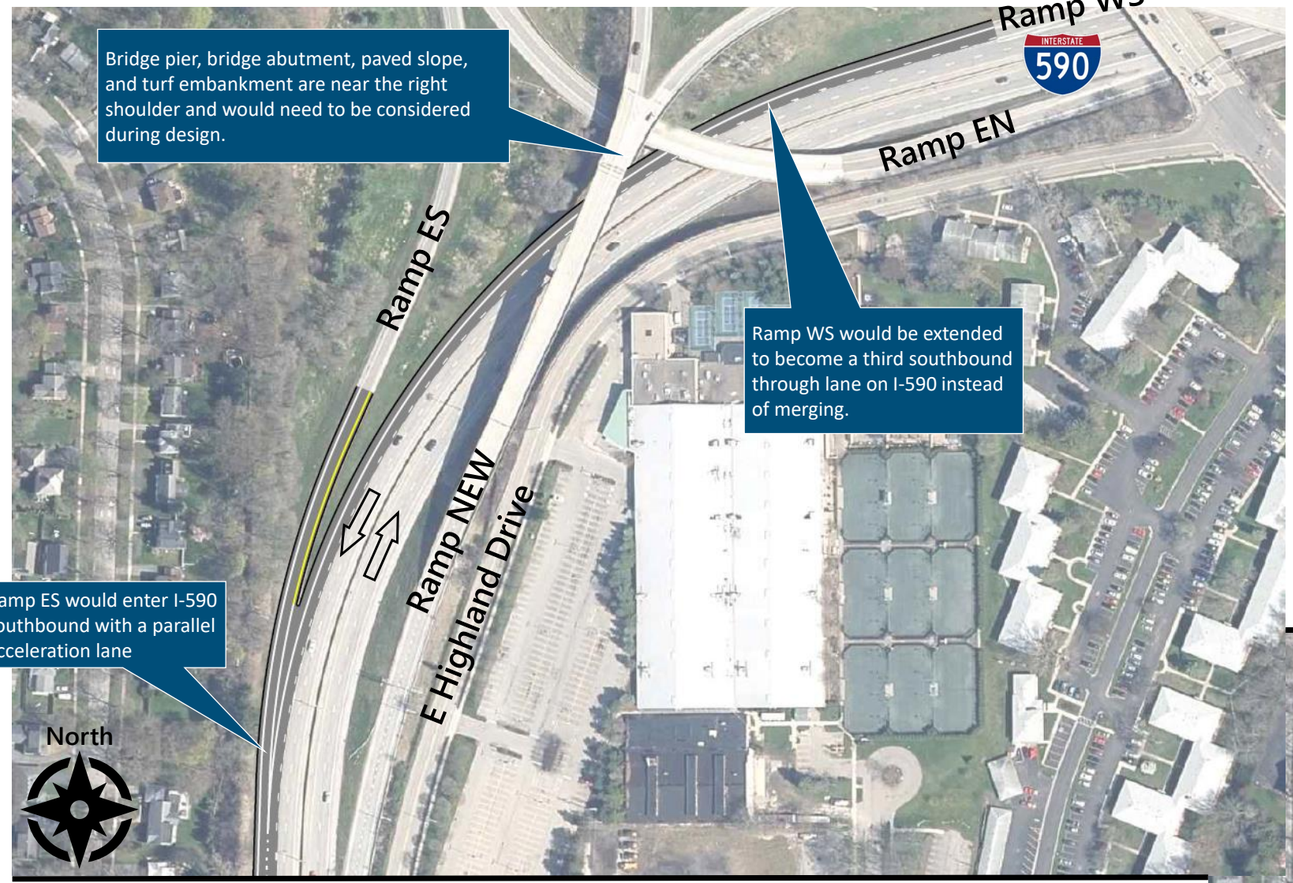
Operational Considerations: Morning peak hour congestion occurs on I-590 southbound as drivers approach the Ramp WS merge from I-490 westbound. Upstream motorists on I-590 tend to move into the center lane to avoid up to 1,200 merging vehicles over a typical morning peak hour. That volume is more than twice the volume entering on Ramp ES during the same timeframe (550 vph). The merge currently operates at capacity (LOS E) and is expected to exceed capacity (LOS F) as volumes grow throughout 2031 to 2051.

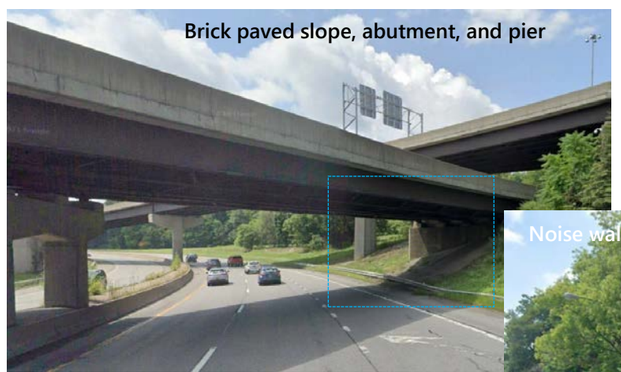
Conceptual Alternative: This concept provides vehicles entering I-590 from I-490 westbound (Ramp WS) their own travel lane. Ramp ES would feed into a 1,000-foot parallel acceleration lane, ending just north of the Highland Avenue overpass. This change would provide adequate capacity (LOS D) throughout 2051 under all growth scenarios. I-590 traffic approaching Ramp WS would no longer have to move into the center lane, reducing upstream lane changing and congestion.

Constructability Considerations: Today Ramp WS begins to taper into I-590 southbound beneath Ramps EN and NEW. There is a paved slope, bridge abutment, and a bridge pier located near the right shoulder. There is also a grade difference between I-590 southbound and Ramp ES as they approach each other. New barrier, possibly combined with a short retaining wall, may be needed in these areas. In addition, there is an existing noise wall between I-590 and the adjacent Hillside Avenue neighborhood that should be evaluated for possible structural and/or functional impacts in conjunction with widening to install a new parallel acceleration lane for Ramp ES.

Environmental Considerations: Homes along the west side of I-590 are eligible for inclusion on the National Register of Historic Places, but they are currently separated from the highway by noise barriers.

Planning-Level Construction Cost Estimate: $5.30 million





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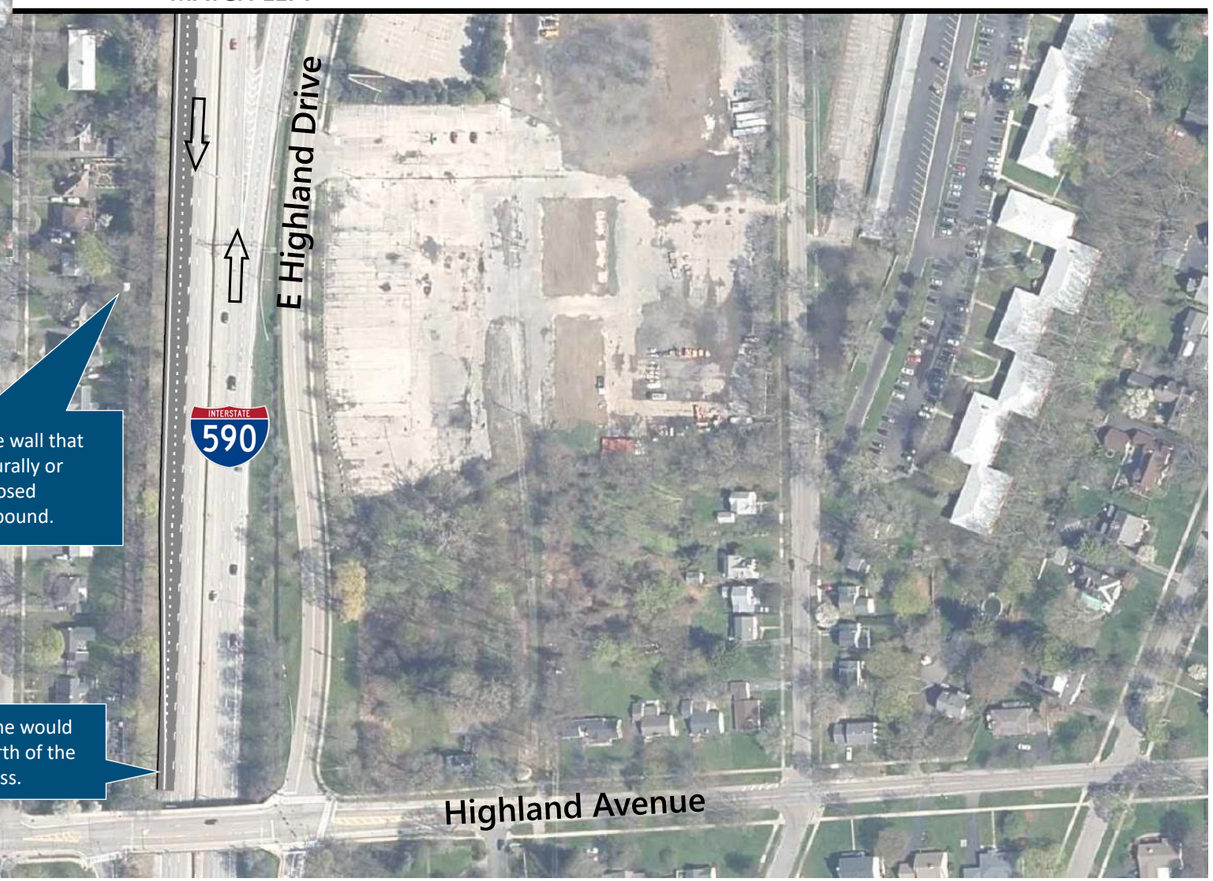


3 Additional southbound lane from Browncroft Boulevard to the I-490/NYS Route 590 split

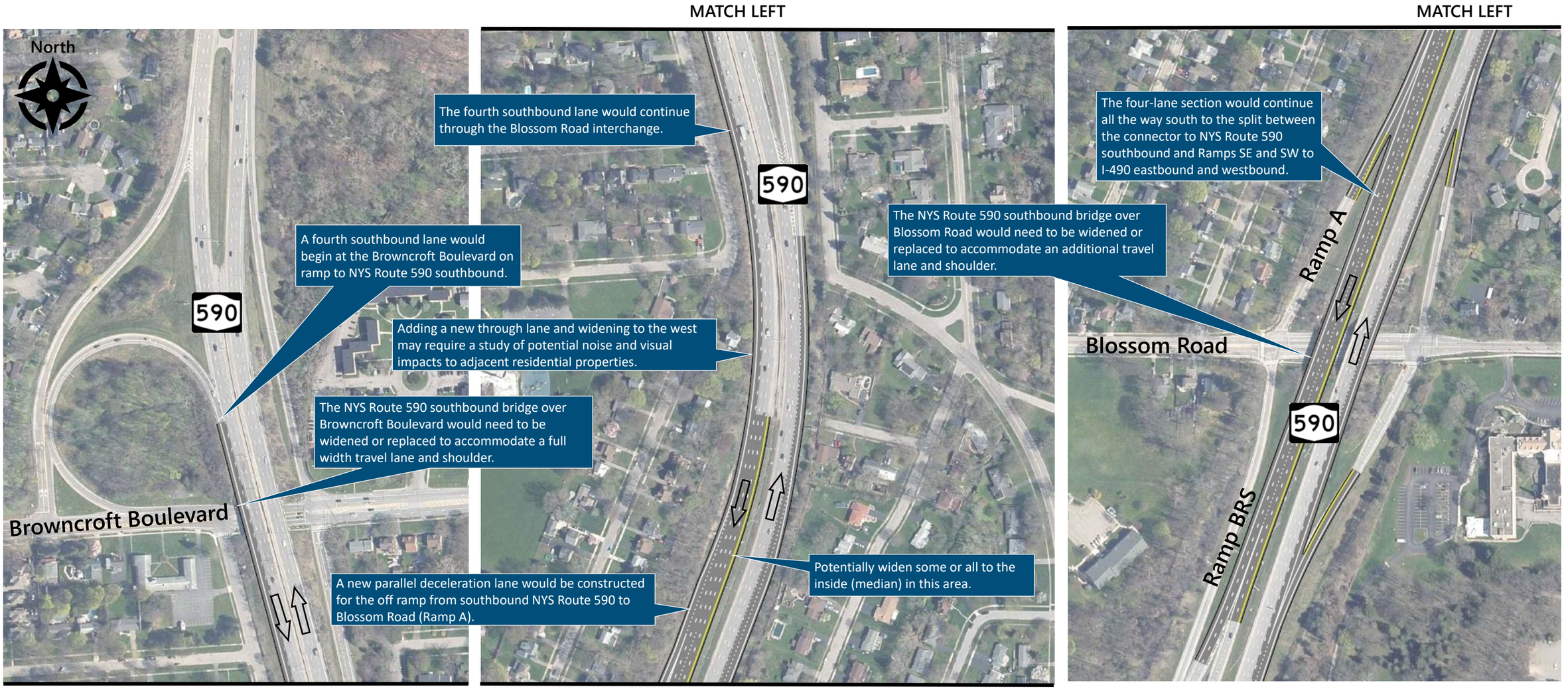
Operational Considerations: This segment of NYS Route 590 features recurring morning peak hour congestion. Traffic densities are currently at capacity (LOS E) and are projected to exceed capacity (LOS F) by 2031 and into 2051.

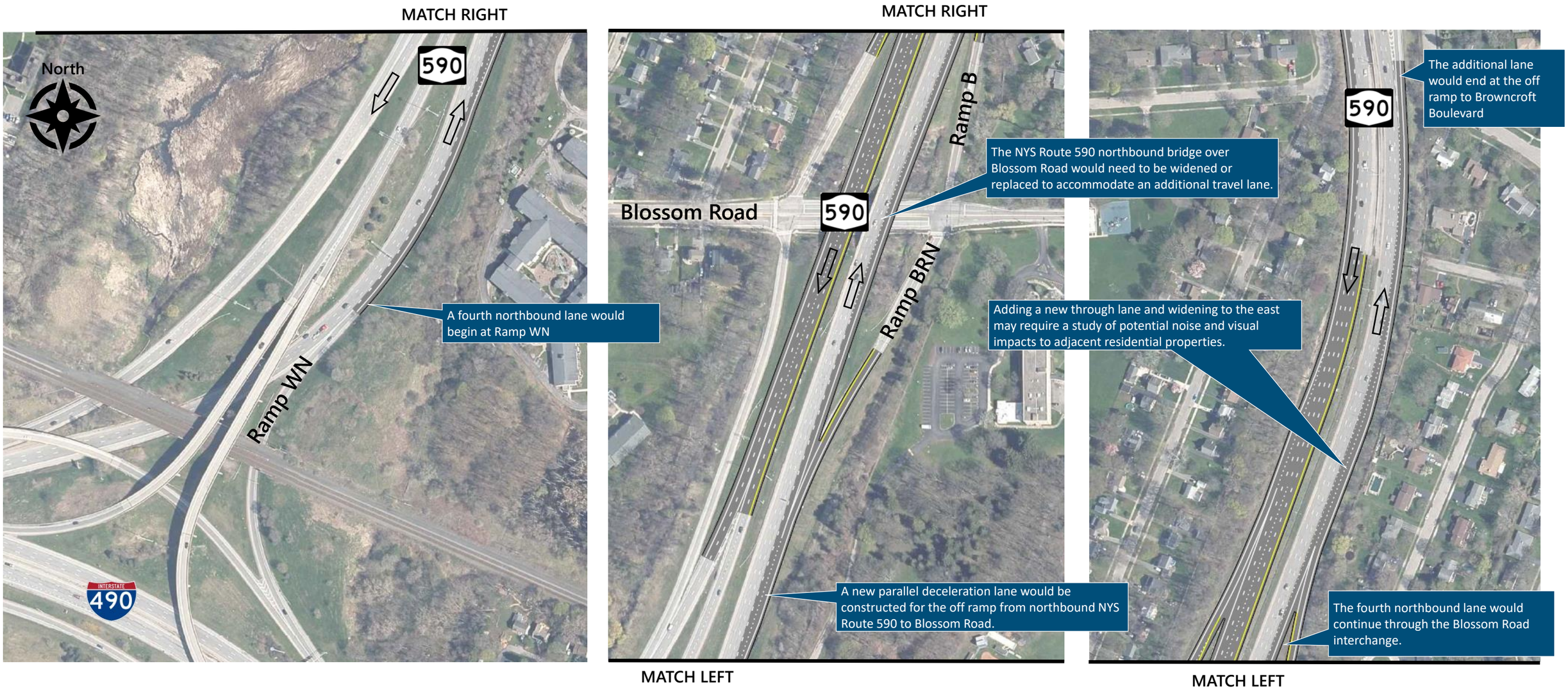
Conceptual Alternative: Concept 3 would add a fourth southbound travel lane to NYS Route 590 from the Browncroft Boulevard on-ramp to the I-490/NYS Route 590 split. The concept would also involve the construction of a new parallel deceleration lane for Ramp A connecting NYS Route 590 southbound to Blossom Road. The addition of this lane would improve operations throughout the year 2051 under all growth scenarios to LOS D or better (below capacity) during the morning peak hour.

Constructability Considerations: The existing NYS Route 590 bridges over Blossom Road and Browncroft Boulevard would need to be widened (rehabilitated or replaced) to accommodate a fourth southbound lane and full width shoulder.

Environmental Considerations: Widening NYS Route 590 to the west and adding a fourth lane could trigger the need to study potential noise and visual impacts to adjacent residential properties and possible mitigation.

Planning-Level Construction Cost Estimate: $26.6 million





4+5 Additional NYS Route 590 northbound lane from Ramp WN to the Browncroft Boulevard off-ramp

Operational Considerations: During the evening peak hour, the segment of NYS Route 590 northbound approaching Ramp WN is expected to reach capacity (LOS E) by 2051 under the low growth scenario and exceed capacity (LOS F) under a normal growth scenario. The 1,150-foot weaving area just downstream, between Ramp WN and Ramp BRN, also currently operates at capacity (LOS E) during the evening peak hour and is expected to exceed capacity (LOS F) by 2051 under the normal growth scenario. Congestion in this area tends to affect both the segments of NYS Route 590 and Ramp WN immediately upstream causing speeds as low as 20 miles per hour and stop and go travel. The segment of NYS Route 590 from Ramp BRN north to the Blossom Road overpass is also operating at capacity (LOS E).

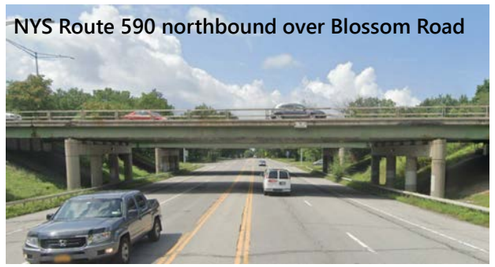
Conceptual Alternative: Concept 5 grew out of Concept 4. Concept 4 would extend the weaving lane between Ramps WN and BRN across the bridge over Blossom Road and end it with a taper prior to the entrance of Ramp B. This would not eliminate projected LOS F (over capacity) conditions in the northbound direction, during the evening peak hour, from south of Ramp WN through the Blossom Road interchange. A congestion causing bottleneck would remain at the taper. Extending the lane through the Blossom Road interchange, adding a new parallel acceleration lane for Ramp B, and connecting the lane to the Browncroft Boulevard off ramp (Concept 5) is projected to provide operations at or below capacity (LOS E or better) throughout 2051 under the normal growth scenario. Anticipated peak hour speeds would improve to 40 miles per hour or higher.

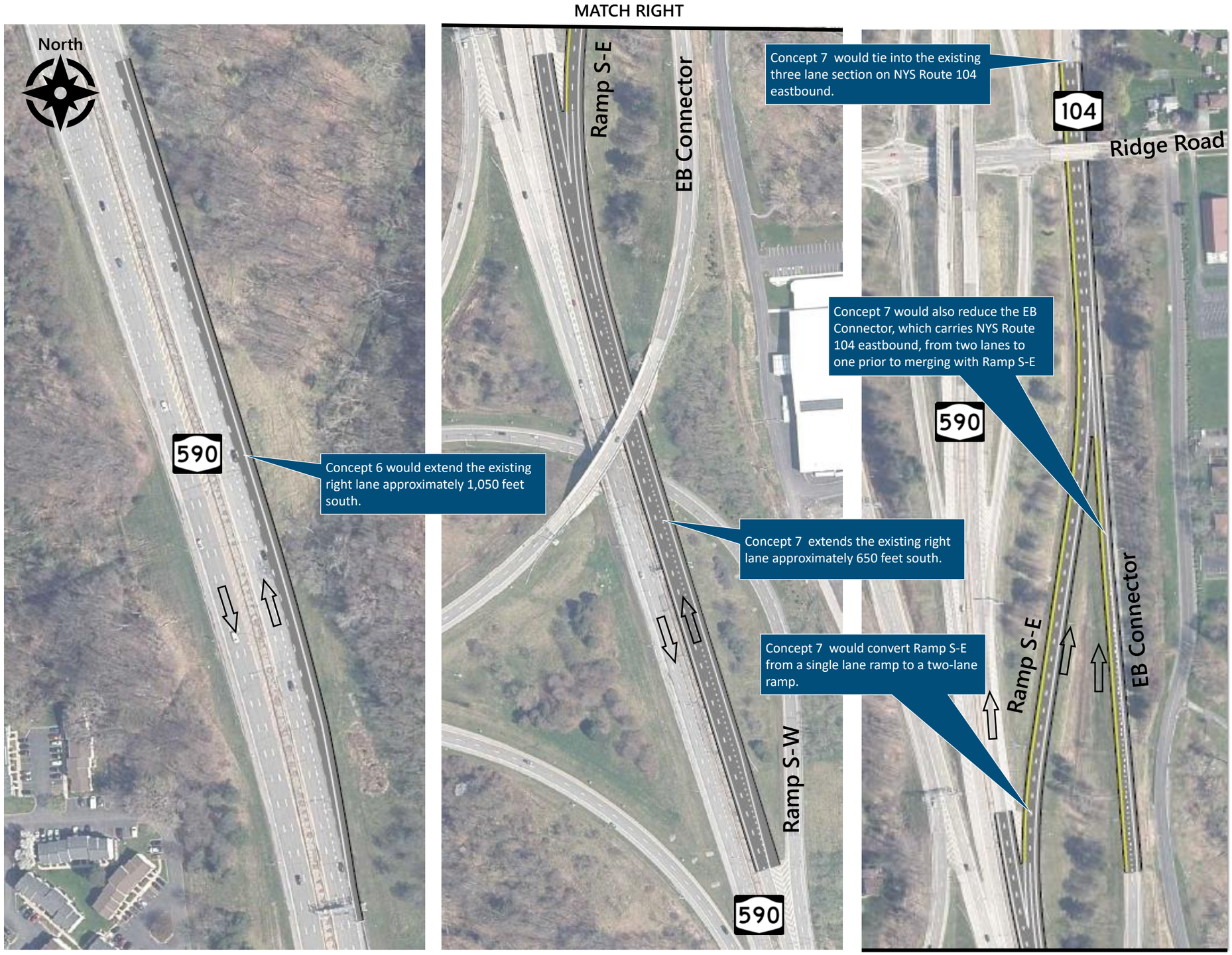
Constructability Considerations: The existing NYS Route 590 bridge over Blossom Road would need to be widened (rehabilitated or replaced) to accommodate a fourth northbound lane and full width shoulder.

Environmental Considerations: Widening NYS Route 590 to the east and adding a fourth lane may trigger the need to study potential noise and visual impacts to adjacent residential properties and the feasibility of mitigation.

Planning-Level Construction Cost Estimate: Concept 4: $10.7 million, Concept 5: $17.9 million

NYS Route 590 northbound over Blossom Road





6+7 Two lanes on Ramp S-E and one lane on NYS Route 104 eastbound

Operational Considerations: The approach to the diverge between NYS Route 590 northbound and Ramp S-W is projected to operate over capacity (LOS F) in 2051 during the evening peak hour under a normal growth scenario. Vehicular speeds are expected to drop into the range of 30 miles per hour.

The NYSDOT temporarily modified the pavement markings on NYS Route 590 northbound, Ramp S-E, and the EB Connector in 2019 providing two lanes on Ramp S-E and one lane on the EB Connector. This was done as part of a construction project involving the bridge carrying NYS Route 104 eastbound over NYS Route 590. The study team was charged with testing if this change could and should be made permanent given existing traffic patterns and continuing growth to the east. As shown below, projected volumes on the two roadways are expected to be and remain similar during the evening peak hour from the year 2031 through 2051.

Roadway	Typical Vehicles Per Hour
Ramp S-E	1950-2150
EB Connector	2150-2400

Conceptual Alternative: Concept 6 would extend the right lane as far south as possible without impacting the Norton Street off-ramp. This would provide additional space for drivers to select the proper lane before reaching the exit to NYS Route 104 westbound (Ramp S-W).

Concept 7 would extend the right lane as far south as possible without impacting the diverge to Ramp S-W. This would provide additional space for drivers to select the proper lane before reaching the exit to NYS Route 104 eastbound. Concept 7 would also convert Ramp S-E from one lane to two lanes. The EB Connector would be reduced from two lanes to one using an 660-foot merging taper to tie directly into the existing three-lane section on NYS Route 104 eastbound.

Both the diverge to Ramp S-W and Ramp S-E would operate below capacity (LOS D or better) during the evening peak hour in the year 2051 under normal growth conditions with Concepts 6 and 7 in place; however, reducing NYS Route 104 eastbound (the EB connector) to a single lane would result in operations at capacity (LOS E). That LOS E led to the development of Concept 8.

Constructability Considerations: Concept 6's proposed widening requires extending a box culvert and a steep, tall embankment.

Environmental Considerations: The surrounding area is in a coastal zone and the Town of Irondequoit Local Waterfront Revitalization Plan boundary. Some federal and state coordination may necessary during design. Previously undisturbed areas around the roadway are also classified as archaeologically sensitive.

Planning-Level Construction Cost Estimate: Concept 6: $2.2 million
Concept 7: $1.2 million

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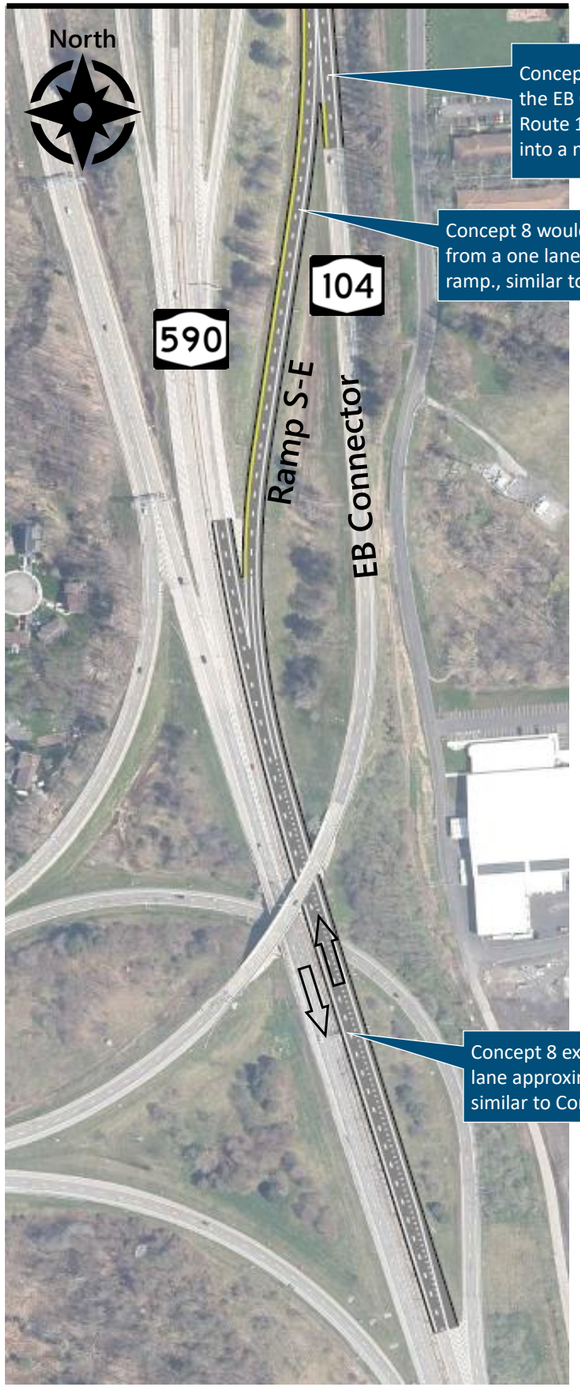

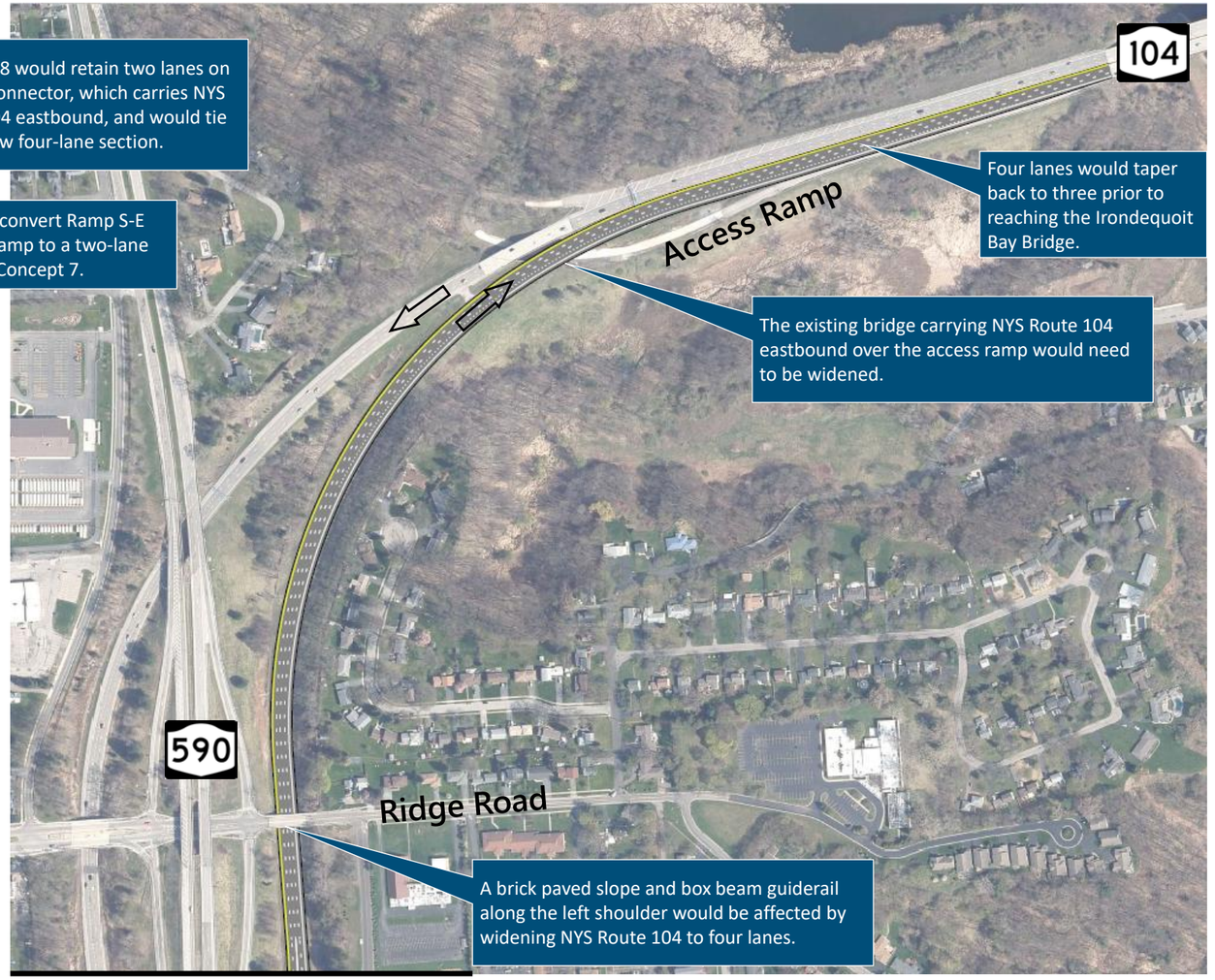

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8 Two lanes on Ramp S-E and two lanes on NYS Route 104 eastbound

Operational Considerations: Concept 7 examined the potential effects of changing Ramp S-E to two lanes and reducing the EB Connector (NYS Route 104) to one lane, tying directly into the downstream three-lane section. That change is projected to result in operations at capacity (LOS E) on the EB connector in the evening peak hour under normal growth conditions by the year 2051.

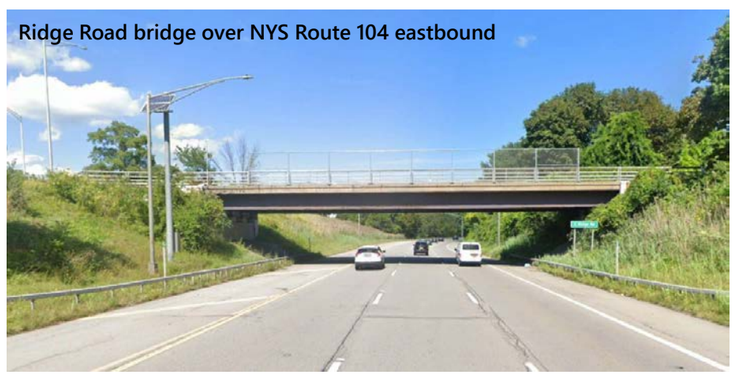
Conceptual Alternative: Concept 8 would retain the current two-lane configuration on NYS Route 104 eastbound (the EB Connector) and modify NYS Route 104 downstream to carry four lanes until it tapers back to three at the Irondequoit Bay Bridge. The result would be greatly improved operations at LOS C or better throughout 2051 during the evening peak hour.

Constructability Considerations: NYS Route 104 would need to be widened beneath the Ridge Road overpass in order to carry a fourth travel lane and full width left shoulder. The existing brick paved slope and box beam guiderail would be impacted. The abutment would need to be checked for potential structural impacts. The existing bridge carrying NYS Route 104 eastbound over the maintenance ramp and the connection to that ramp would also be impacted by the proposed widening.

Environmental Considerations: The surrounding area is in a coastal zone and the Town of Irondequoit Local Waterfront Revitalization Plan boundary. Some federal and state coordination may necessary during design. Previously undisturbed areas around the roadway are also classified as archaeologically sensitive.

Planning-Level Construction Cost Estimate: $9.3 million

Ridge Road bridge over NYS Route 104 eastbound



NYS Route 104 eastbound over the access ramp

Exhibit 4.1.4-1
Concepts 1 - 3, and 5
DRAFT Preliminary Signing Concept
I-490 / I-590 / NYS Route 590

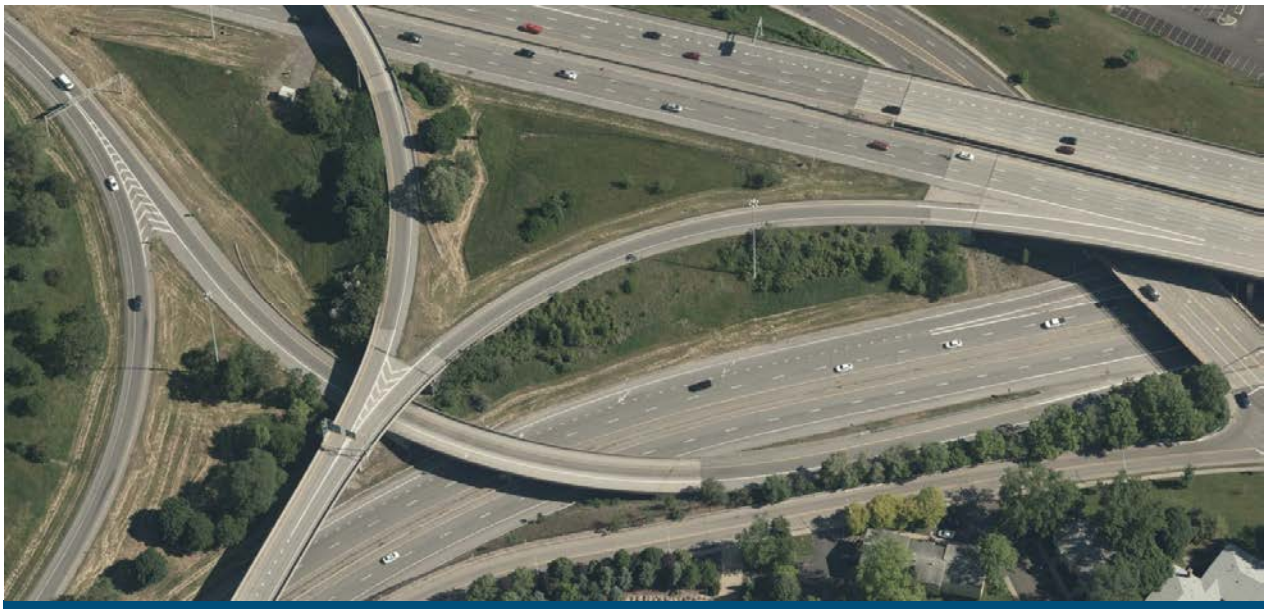
UPWP 7952: Ramp Reconfiguration Study
December 21, 2021

GTC | NEW YORK STATE OF OPPORTUNITY Department of Transportation | BERGMANN ARCHITECTS ENGINEERS PLANNERS

Exhibit 4.1.4-2
Concepts 6 and 8
DRAFT Preliminary Signing Concept
NYS Route 104 / NYS Route 590

UPWP 7952: Ramp Reconfiguration Study
December 21, 2021

GTC | NEW YORK STATE OF OPPORTUNITY. Department of Transportation | BERGMANN



Section 1: Introduction

1.1 Study Purpose

The I-490/I-590/NYS Route 590 and NYS Route 104/NYS Route 590 interchanges are important parts of Rochester's regional expressway system. Hundreds of thousands of motorists use them daily to commute, provide services, and deliver goods to the community. The Genesee Transportation Council (GTC) and New York State Department of Transportation (NYSDOT) partnered to commission this study of the interchanges to inform decisions on future capital projects.

The study examines the potential benefits or drawbacks of component-level changes at each interchange. Two specific locations were selected for examination prior to starting work:

- The ramp from I-490 westbound to I-590 southbound carries more traffic than its counterpart connecting I-490 eastbound to I-590 southbound, yet vehicles on the eastbound to southbound ramp are afforded their own lane when they reach the mainline while those on the westbound to southbound ramp must merge. The study will determine if reversing the existing configuration would benefit the traveling public. Other potential changes will also be considered and evaluated as appropriate.

- The Town and Village of Webster, to the east of the NYS Route 104 and NYS Route 590 interchange, have experienced steady growth over the past decade. New development is also occurring farther east in Wayne County. The Town of Irondequoit has established dense development to the west. Lane reductions were completed on Sea Breeze Drive to the north in 2010. Traffic patterns currently favor movement between NYS Route 590 south of the interchange and NYS Route 104 to the east. It is reasonable to expect that pattern to continue into the foreseeable future. This could make lane reconfigurations possible within the interchange. For example, in 2019 the NYSDOT temporarily modified striping inside the NYS Route 104/NYS Route 590 interchange to accommodate a scheduled closure of the bridge carrying NYS Route 104 over NYS Route 590. The modified configuration allowed two lanes to exit NYS Route 590 northbound toward NYS Route 104 eastbound. NYS Route 104 eastbound was also reduced to one lane beyond the bridge, before

merging with the now two-lane ramp so three lanes could continue toward the Irondequoit Bay Bridge. This study will examine the operational impacts of making that once temporary change permanent along with other improvements that could strategically improve operations at the interchange.

Overall, the study involves the following elements:

- An existing condition inventory;
- Interchange needs assessment;
- Examination of potential alternative concepts; and
- The identification of topics for future study or design.

Conclusions are based on the best available information at the time including traffic volumes, records of recurring congestion, past safety performance, estimated future growth, and regional travel patterns. Traffic modeling (microsimulation) results are used to quantify operational measures of effectiveness including travel time, speed, and delay. The study also considers the feasibility of changes from a physical standpoint — identifying potential impacts to elements including geometry, pavement, bridge supports, barriers, signing, marking, lighting, and drainage features. All conceptual alternatives are based on NYSDOT design standards.

1.2 Study Area

The I-490/I-590/NYS Route 590 and NYS Route 104/NYS Route 590 are both located to the east of the City of Rochester in Monroe County, New York.

The study limits are as follows:

I-490/I-590/NYS Route 590 Interchange
- I-490: Pedestrian overpass to Penfield Road
- I-590: Highland Avenue to I-490
- NYS Route 590: I-490 to Blossom Road

NYS Route 104/NYS Route 590 Interchange
- NYS Route 104: Culver Road to the Irondequoit Bay Bridge
- NYS Route 590: Norton Street to Orland Drive

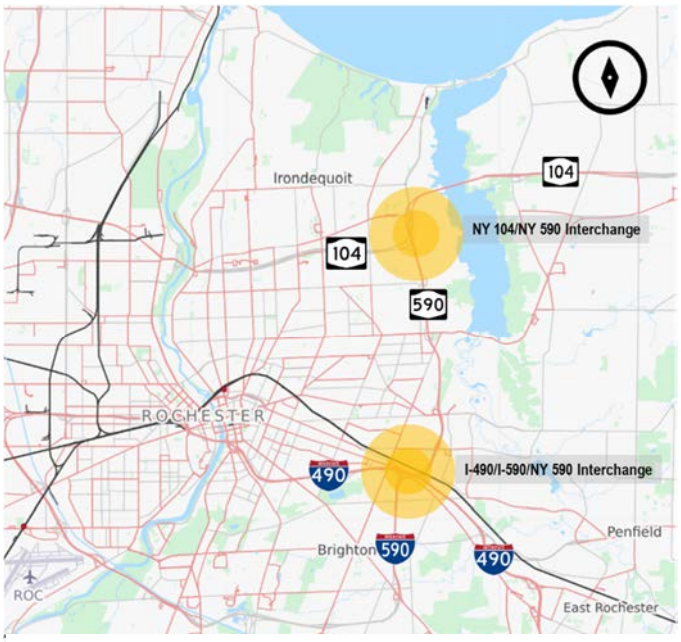


Exhibit 1.2-1: Study Area Locations

The study area includes only the mainline expressways and ramps. Although ramp terminal intersections are sometimes included in the microsimulation model, they are not a subject of the analysis.

1.3 Sources of Information

Information for the study was drawn from a number of different sources. The following information was gathered in support of the study:

Exhibit 1.3
Sources of Information for the Ramp Reconfiguration Study

Information	Source
Aerial imagery	NYS GIS Clearinghouse
Available as-built drawings	NYSDOT
Posted speed limits	Field reconnaissance
Posted advisory speeds	Field reconnaissance
Traffic control features (signing, markings, etc.)	Field reconnaissance
Ramp terminal intersection traffic signal programming	NYSDOT
Traffic volume, classification, and speed data	NYSDOT
Historic crash data	ALIS via GTC
Travel time and recurring daily congestion information	INRIX via GTC

1.4 Study Partners

The GTC and NYSDOT engaged representatives of several other local agencies as partners in the study. Throughout the study, this steering committee was engaged through regular meetings, reviewed and provided feedback on draft work products, and provided guidance to the study team regarding upcoming tasks. Steering committee members included representatives of the:

- Genesee Transportation Council (GTC)
- New York State Department of Transportation (NYSDOT)
- Monroe County Department of Transportation (MCDOT)
- City of Rochester
- Town of Brighton
- Town of Irondequoit
- Town of Penfield
- Town of Pittsford
- Town of Webster

The first steering committee meeting was held on January 29, 2021. The purpose of this meeting was to introduce the members to each other, discuss study plans and goals, and to solicit information from each of members that would prove useful for the study.

The focus of the second steering committee, meeting held on May 18, 2021, was to review findings from the existing conditions inventory. The group was also tasked with reviewing and offering comments on the initial draft sections of the study report.

The third steering committee meeting was held on June 28, 2021. The purpose of this meeting was to present the needs assessment covering the study area interchanges. The group discussed the identified issues and locations of concern for each interchange separately.

The focus of the fourth steering committee meeting, held on November 4, 2021, was to review additional existing conditions findings in response to comments offered by the NYSDOT and to review the alternative concepts designed to address the previously identified needs. The group discussed and offered comments on the concepts.

The fifth and final steering committee meeting was held on January 28, 2022. The study findings were presented, and the entire group was provided with one more opportunity to provide input. Several specific comments issued by the NYSDOT on the draft report submission were discussed to ensure they would be addressed to the Department's satisfaction in the final study document.

Meeting minutes from each gathering are published in Appendix D.

For additional information regarding this study or potential future projects within these interchanges, please contact the Genesee Transportation Council. Please refer to this as the UPWP 7952: Ramp Reconfiguration Study in all correspondence.

Genesee Transportation Council
50 West Main Street
Suite 8112
Rochester, NY 14614-1227
(585) 232-6240

Section 2: Existing Conditions Inventory

The existing conditions inventory provides information necessary to establish an understanding of the needs and opportunities at each study interchange. Available data were gathered from numerous sources including the GTC and NYSDOT. That information was supplemented by field observations and further studies. The section is divided into two parts, one covering the I-490/I-590/NYS Route 590 interchange and one covering the NYS Route 104/NYS Route 590 interchange. Definitions of several important terms appear in the section on the I-490/I-590/NYS Route 590 interchange for the reader's information as it appears first.

2.1 I-490 / I-590 / NYS Route 590 Interchange

2.1.1 General Description

The I-490/I-590/NYS Route 590 interchange connects three major expressways. It was originally constructed in the 1950s and 1960s as part of what was to become Rochester's Outer Loop. The interchange was substantially reconfigured in the late 1980s and early 1990s to eliminate weaving, congestion, and crashes caused by the original design that had earned the junction its name: "The Can of Worms".

Exhibit 2.1.1-1: Rochester's Can of Worms circa 1981, Source: Democrat and Chronicle

The current I-490/I-590/NYS Route 590 interchange study area is illustrated in Appendix A, Exhibit 2.1.1-2. It covers I-490 from an existing pedestrian overpass (west of Winton Road) to the Penfield Road overpass. It also includes I-590 from the Highland Avenue overpass to I-490 and NYS Route 590 from I-490 to the Blossom Road underpass. This interchange is a "system interchange" as all connected roadways are fully access controlled. This means vehicles may only enter and exit at designated locations. It can also be characterized as a "four-way directional" interchange, providing free-flow movements along all connections between the four quadrants. Additional information is provided in Exhibit 2.1.1-3.

Exhibit 2.1.1-3 I-490 / I-590 / NYS Route 590 Interchange – General Description			
Segment	I-490: Culver Road to Penfield Road	I-590: Highland Avenue to I-490	NY 590: I-490 to Blossom Road
Route Number	I-490	I-590	NYS Route 590
Reference Markers	490I 43022061 to 490I 43023007	590I 43012000 to 590I 43012004	590 43011000 to 590 43011006
Ownership & Maintenance Jurisdiction	NYSDOT	NYSDOT	NYSDOT
Access Control	Full	Full	Full
Functional Classification	Urban Principal Arterial Interstate	Urban Principal Arterial Interstate	Urban Principal Arterial Expressway
NHS	Yes	Yes	Yes
Qualifying or Access Highways	Qualifying	Qualifying	Qualifying

Reference markers are small green signs placed at roughly tenth of mile intervals along New York State highways that serve as location references. The original purpose of the markers was to track crash history, but today they also help engineers and planners track or direct work along highways.

Roadways are classified according to the character of service and travel function they provide. For example, freeways and expressways like Interstate 490 (I-490) and NYS Route 590, move large volumes of traffic at high speeds with limited local access. The mainline roadways in the study area are functionally classified as either Urban Principal Arterial Interstate or Urban Principal Arterial Expressway.

The United States Department of Transportation (USDOT) and FHWA have designated approximately 230,000 miles of roadways that are important to North America's economy, defense, and mobility. This group is collectively known as the National Highway System (NHS). This system, which includes the interstates, includes roadways in rural and urban areas that connect ports, airports, public transportation facilities, military bases, and other intermodal transportation facilities. All mainline roadways in the study interchange are included on the NHS.

In New York State, large trucks are required to travel on a network of highways that can physically accommodate them. This network consists of Qualifying and Access Highways. Special dimension vehicles, including tractor trailer combinations, auto carriers, etc., are allowed to travel on these highways. All mainline interstates and expressways in the study area, including connecting ramps, are Qualifying Highways.

2.1.2 Geometry

The I-490/I-590/NYS Route 590 interchange is made up of a series of mainline segments and ramps. The cross section of each mainline roadway varies as one travels from west to east and south to north through the study area; however, I-490, I-590, and NYS Route 590 all have three through travel lanes in each direction toward the ends of the interchange. Connecting ramps typically have one through travel lane. Lane arrangements throughout the interchange, in areas where roadways meet or separate (merge and diverge areas), are shown in Appendix B, Exhibit 2.1.2-1. Each ramp is identified by a letter code, consisting of one to three letters, taken from available NYSDOT record plans. All mainline travel lanes are 12 feet wide. Ramp travel lanes are 12 feet wide or wider. Shoulders are relatively wide, as is typical for interstates and expressways, but do vary depending on location.

Exhibit 2.1.2-1 shows the lane arrangements in one of the study's two preset focus areas. This includes Ramp WS connecting I-490 westbound to I-590 southbound, Ramp ES connecting I-490 eastbound to I-590 southbound, and I-590 southbound itself. This segment of I-590 has two through travel lanes. Ramp WS has a single through travel lane that merges into I-590 over approximately 980 feet on the outside of a horizontal curve. Ramp ES becomes a third (right hand) southbound lane where it meets I-590.

The overall shape of the interchange is illustrated in Exhibit 2.1.1-2. Ramps connecting I-590 northbound and NYS Route 590 southbound with I-490 are found at the highest level of the interchange. I-490 crosses at the mid-level of the interchange. I-590 and NYS Route 590 are at the lowest level. Ramp connections from I-490 to I-590 and NYS Route 590 go either under or over the other roadways. I-490 runs from west to east on a tangent alignment. The mainline transition between I-590 and NYS Route 590 runs on a diagonal from the southwest to the northeast, bounded by a horizontal curve on each end. East Avenue also passes through the middle of the interchange at the mid-level.

Grades along the Ramp WS vary as one travels from I-490 toward I-590, passing under Ramps SE and SW, over I-590, beneath East Avenue and I-490, and ultimately tying into I-590 southbound as illustrated in Exhibit 2.1.2-2. The maximum grades occur over I-590 at +/- 5%. I-590 descends much more gradually from north to south as it approaches the merge with Ramp WS, with a maximum grade of –2.5%

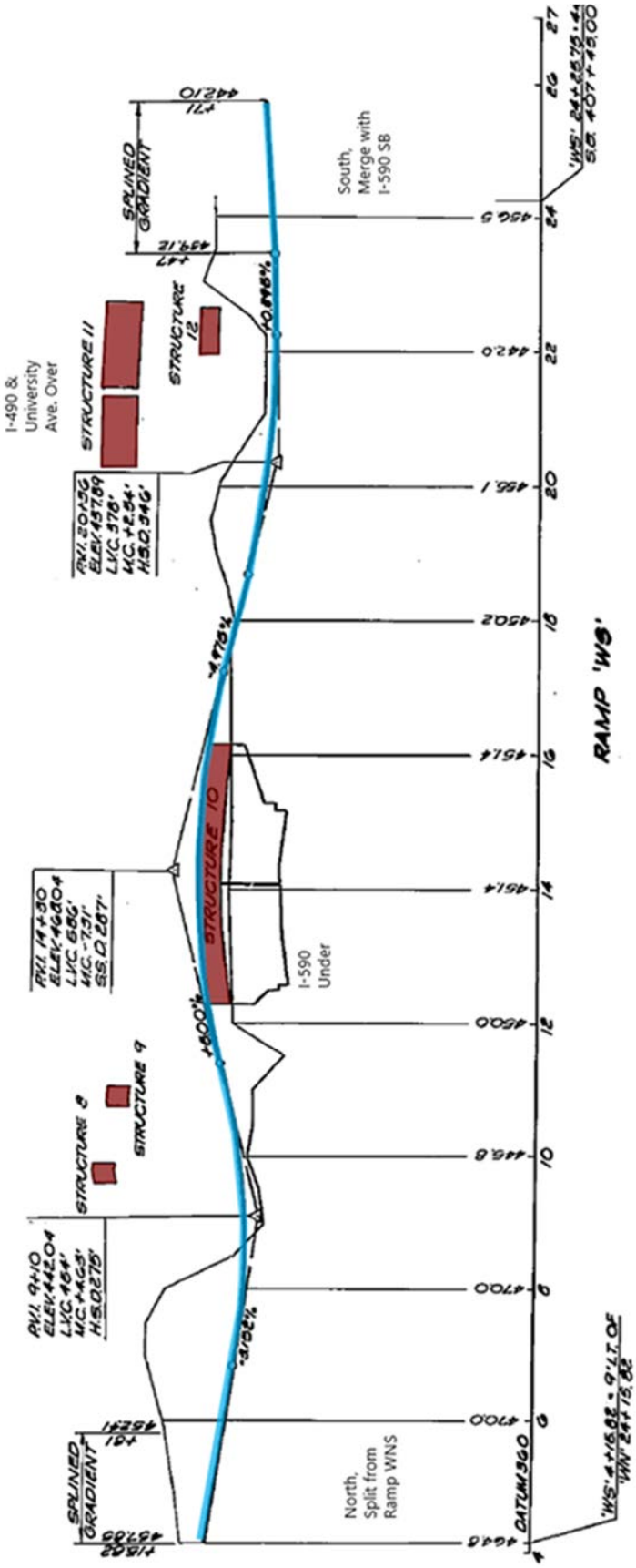


Exhibit 2.1.2-2: Profile of Ramp WS, Source: NYSDOT Record Plans

2.1.3 Relevant Physical Features

A. Bridges

There are a total of 20 bridges within the I-490/I-590/NYS Route 590 interchange study area. Four bridges carry non-vehicular traffic (1 pedestrian and 3 railroad) and the rest carry roadways. Below is a list of the bridges along with the corresponding Bridge Identification Number (BIN) and original year of construction:

- BIN 1025980 – Highland Avenue over I-590 (1991)
- BIN 1048860 – Clover Street over I-490 EB/WB (1989)
- BIN 1048519 – Penfield Road over I-490 EB/WB (1989)
- BIN 1074060 – Ramp NEW: Ramp from I-590 NB to I-490 EB/WB over I-590 (1990)
- BIN 1074070 – Ramp EN: Ramp from I-490 EB to NY 590 NB over I-590 (1990)
- BIN 1048810 – Pedestrian Bridge over I-490 (Unknown)
- BIN 1048829 – Winton Road over I-490 EB/WB (1989)
- BIN 1074080 – Ramp NW: Ramp from I-590 NB to I-490 WB over I-490 (1990)
- BIN 1074090 – Ramp UAW: Ramp from I-490 WB to University Avenue over East Avenue (1990)
- BIN 4074111 – I-490 over I590/East Avenue (1990)
- BIN 4074112 – I-490 over I590/East Avenue (1990)
- BIN 1074100 – East Avenue over I-590 NB/SB (1989)
- BIN 1074120 – Ramp WS: Ramp from I-490 WB to I-590 SB over NY 590 NB/SB (1990)
- BIN 1074130 – Ramp SW: Ramp from NY 590 SB to I-490 WB over NY 590 NB (1990)
- BIN 1074140 – Ramp SE: Ramp from NY 590 SB to I-490 EB over NY 590 NB and I-490 (1990)
- BIN 7063880 – CSX Railroad Bridge over Ramp WN from I-490 WB to NY 590 NB (Unknown)
- BIN 7715160 – CSX Railroad Bridge over NY 590 NB (Unknown)
- BIN 7715150 – CSX Railroad Bridge over NY 590 SB (Unknown)
- BIN 1026041 – NY 590 NB over Blossom Road (1960)
- BIN 1026042 – NY 590 SB over Blossom Road (1960)

Of particular interest to the study are a brick paved slope, graded at 1-foot vertical on 2 feet horizontal, and a bridge pier / abutment supporting Ramp NEW from I-590 NB, and Ramp EN from I-490 EB. They are separated from the right shoulder on Ramp WS with a weak post corrugated w-beam guiderail as shown in Exhibit 2.1.3.A-1.

Exhibit 2.1.3.A-1 Brick Paved Slope and Bridge Abutment / Pier Adjacent to Ramp WS, Source: Google Street View

B. Noise Barriers and Retaining Walls

Noise barriers are structures designed to protect inhabitants of sensitive land uses adjacent to a highway from noise pollution. The following noise barriers and retaining walls are found within the study area based on available record plans and field observations:

Exhibit 2.1.3.B-1: Noise Barrier Along West Side of I-590, Source: Google Street View

- Between I-490 EB and Norris Drive from the Pedestrian Bridge to the off ramp at Winton Road
- Between I-490 WB and Harvard Street from the eastern study limit to the Pedestrian Bridge
- Between I-590 SB and Hillside Avenue from Highland Avenue to Ramp ES

There are two noise barrier and retaining wall combinations:

- Between I-490 EB and East Avenue from Ramp EAE to the Clover Street overpass
- Between I-490 WB and Rawlingswood Park / Walden Place from Ramp WNS to the eastern study limit

There are also six retaining walls within the study limits:

- North side of the I-490 westbound on ramp from Winton Road
- North side of I-490 westbound at the Winton Road bridge
- South side of I-490 eastbound from Winton Road to Ramp ENS
- South side of the I-490 eastbound off ramp to Penfield Road
- East side of I-590 northbound along East Highland Drive
- South side of Ramp EN along East Highland Drive

C. Drainage Systems

Stormwater is typically removed from the interchange via sheet flow and a closed drainage system consisting of catch basins, field inlets, and underground storm sewer pipes. The outlet of a 4' x 13.5' concrete box culvert (CIN 1074470) was identified during field study. That structure is located just north of the CSX Railroad bridge. It is believed the culvert was extended as part of the NYSDOT's major interchange reconstruction project.

Exhibit 2.1.3.C-1: Existing Detention Pond

Based on available record plans, the culvert receives stormwater from neighborhoods south of the interchange. It outlets to an existing detention pond along the west side of NYS Route 590. The northern end of the pond features a concrete weir to control

the elevation of the water surface during large storm events (433 feet). This is close to the elevation of Ramp BRS where it meets Blossom Road (434 feet). From there, water crosses from west to east beneath NYS Route 590 via a corrugated metal pipe, runs briefly between NYS Route 590 northbound and Ramp BRN, is piped north across Blossom Road in two twin pipes, east across Ramp B (also in two twin pipes), and then flows east. The downstream area features dense residential development. During the data collection phase, representatives of the Town of Brighton noted that homeowners in this area have raised concerns regarding periodic flooding in this area.

D. Railroads

A CSX Transportation, Inc. (CSXT) rail line cuts across the northern portion of the interchange from west to east. It has two mainline tracks utilized by both passenger (Amtrak) and freight trains. There are three railroad bridges that carry the tracks either under or over roadways within the interchange. These bridges are owned by CSXT.

E. Lighting

The interchange is lit during hours of darkness by a combination of single and dual cobra head luminaries mounted on truss arms connected to individual poles and high-mast lighting. Single cobra head luminaries are typically found along the right side of mainline roadways and interchange ramps. Dual cobra head luminaries are generally located in the median between the mainline directions. High-mast lighting is located around the interchange's infield areas.

F. Roadside Barrier

Roadside barriers within the study area include weak post corrugated w-beam guiderail, box beam guiderail, bridge rail, and concrete barrier. The barriers vary in condition from poor to good depending on the location. Some concrete barriers are of an older, jersey barrier shape in contrast to the more current single slope style. Barriers were generally not checked for conformance with current standards; however, there are some median barriers with turned down end terminals rather than attenuating terminals within the study limits. This condition would not meet current standards. Damaged barrier was observed in the I-590 median south of Highland Avenue and along the west side of NYS Route 590 NB at the Blossom Road exit at the time of the field study in February 2021.

2.1.4 Traffic Control

A. Speeds

Measurements of operating speed were not made for this study nor were spot speed study results available from the New York State Traffic Data Viewer. The posted speed limit on all roadways through the interchange is 55 miles per hour (mph). Posted ramp advisory speeds are summarized in Exhibit 2.1.4.A-1.

Exhibit 2.1.4.A-1 I-490 / I-590 / NYS Route 590 Interchange – Ramp Advisory Speeds		
Ramp Designation	Description	Advisory Speed (mph)
Ramp X	Winton Road to I-490 westbound	None
Ramp Y	I-490 eastbound to Winton Road	None
Ramp EN	I-490 eastbound to NYS Route 590 northbound	35
Ramp ES	I-490 eastbound to I-590 southbound	40
Ramp HA	Highland Avenue to I-590 southbound	None
Ramp HB	I-590 northbound to Highland Avenue	None
Ramp NEW	I-590 northbound to I-490 eastbound and westbound	None
Ramp NE	I-590 northbound to I-490 eastbound	40
Ramp NW	I-590 northbound to I-490 westbound	40
Ramp EAE	East Avenue to I-490 eastbound	None
Ramp PE	I-490 eastbound to Penfield Road	None
Ramp PW	Penfield Road to I-490 westbound	None
Ramp WNS	I-490 westbound to I-590 southbound and NYS Route 590 northbound	None
Ramp WN	I-490 westbound to NYS Route 590 northbound	40
Ramp WS	I-490 westbound to I-590 southbound	40
Ramp SE	NYS Route 590 southbound to I-490 eastbound	40
Ramp SW	NYS Route 590 southbound to I-490 westbound	40
Ramp UAW	I-490 eastbound to University Avenue	None
Ramp BRN	NYS Route 590 northbound to Blossom Road	None
Ramp BRS	Blossom Road to NYS Route 590 southbound	None
Ramp B	Blossom Road to NYS Route 590 northbound	None
Ramp A	NYS Route 590 southbound to Blossom Road	None

B. Pavement Markings

Pavement markings on I-490, I-590, and NYS Route 590 were in fair to good condition and visible as of the date of field observation in February of 2021. They are replaced on a regular cycle under NYSDOT pavement marking maintenance programs. Marking patterns generally appear to be in compliance with current *Manual on Uniform Traffic Control Devices* and *New York State Supplement* (MUTCD) standards.

C. Guide Signs

Major mainline and ramp guide signs in the I-490/I-590/NYS Route 590 interchange study area were inventoried and are shown in Appendix B, Exhibits 2.1.4.C-1 and Exhibit 2.1.4.C-2. The signs are in generally good to fair condition with some fading and peeling of legends in select areas. Some overhead sign panels feature a diagrammatic legend in contrast to an arrow-per-lane design found elsewhere around Rochester.

Exhibit 2.1.4.C-3: Diagrammatic Sign Legend

Exhibit 2.1.4.C-4: Arrow-Per-Lane Sign Legend

D. Intelligent Transportation Systems (ITS)

There are Intelligent Transportation Systems (ITS) features near the interchange. This includes a series of overhead Closed Circuit Television (CCTV) cameras in the vicinity of the interchange, including at I-590 at Elmwood Avenue, I-490 at Winton Road, Ramp NW, Ramp EN, I-490 at East Avenue, and NYS Route 590 at Blossom Road.

2.1.5 Traffic Volumes

A. Daily Traffic Volumes

Daily traffic data within the I-490/I-590/NYS Route 590 interchange study area are depicted in Exhibit 2.1.5.A-1. Historic average annual daily traffic volumes (AADT) were obtained from the NYSDOT Traffic Data Viewer. No new 24-hour continuous traffic counts were taken as part of this study. AADT is the volume of motor vehicle traffic that utilizes a roadway under average conditions each day throughout the year. I-490 carried nearly 76,000 vehicles per day (vpd) in 2019. I-590 carried over 101,000 vpd while NYS Route 590 carried over 120,000 vpd. Ramp WS, which merges with I-590 southbound, carried about 11,000 vpd in 2019 while Ramp ES, which gets its own lane on I-590 southbound, carried slightly less traffic at approximately 8,000 vpd.

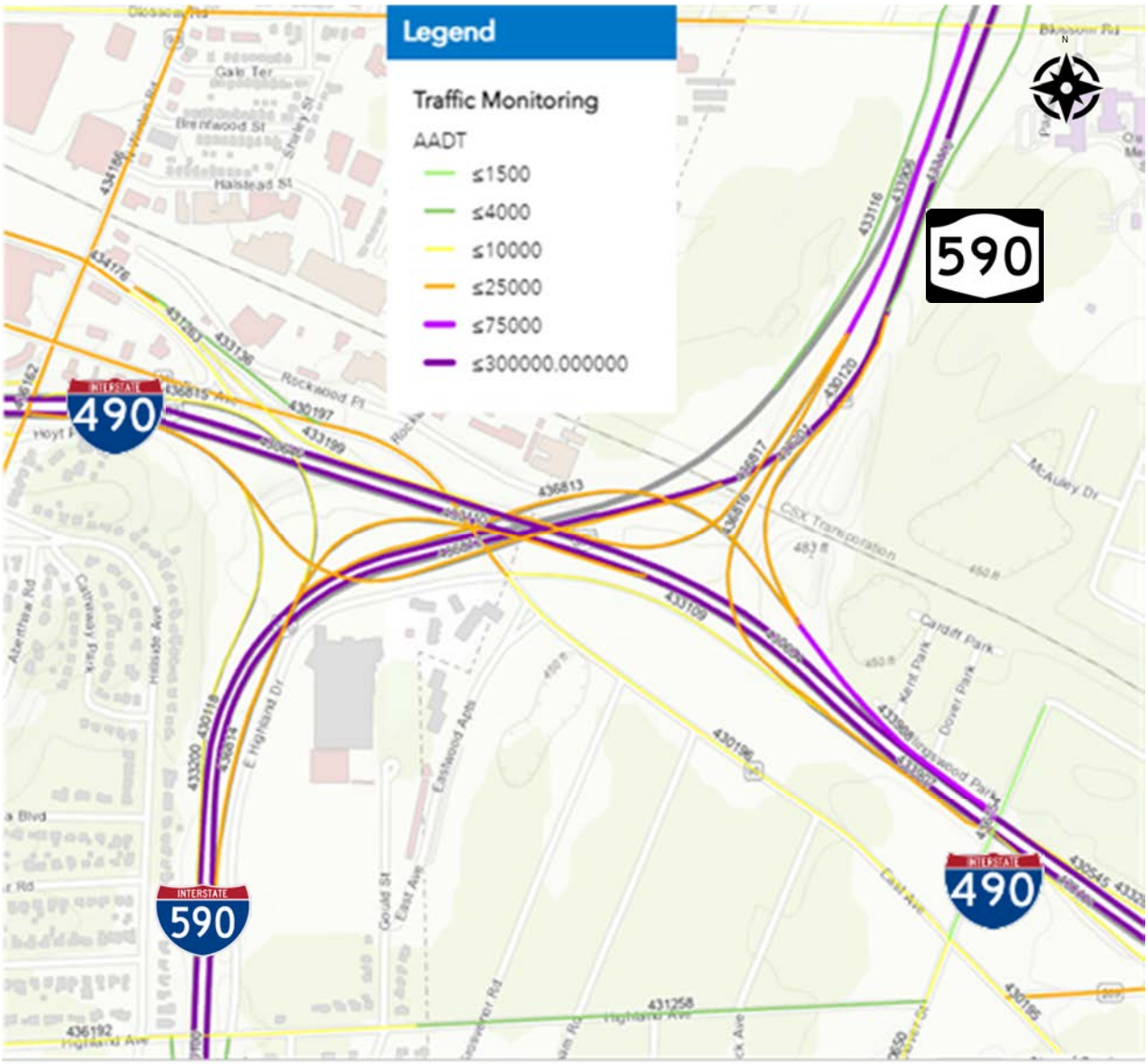


Exhibit 2.1.5.A-1: Daily Traffic Volumes at I-490/I-590/NYS Route 590, Source: NYSDOT Traffic Data Viewer

B. Peak Hour Traffic Volumes

Average weekday morning and evening peak hour volumes were developed for the study area using data gathered from a number of available sources, providing necessary information for traffic microsimulation models. The volumes are measured in vehicles per hour (vph) and represent the typical morning and evening peak hour periods prior to the pandemic in 2020. The morning peak period generally occurs between 7:00 AM and 8:00 AM. The evening peak period generally occurs between 4:00 PM and 5:00 PM. The morning and evening peak hour volumes throughout the interchange are shown on Exhibit 2.1.5.B-1 in Appendix C.

Exhibit 2.1.5.B-1 shows volumes in the I-590, Ramp WS, and Ramp ES focus area. Both ramps carry a

similar magnitude of volume during the evening peak (i.e., 700 vph and 810 vph); however, Ramp WS carries more than twice the traffic of Ramp ES during the morning peak (1,210 vph versus 550 vph, respectively).

C. Reliability

Inrix data were mined to assess performance trends on expressway mainlines within the study area. The Inrix system collects anonymous data from connected vehicles and offers users a cloud based tool to analyze and visualize trends over time. For this study, data from the years 2015 to 2019 were reviewed in search of locations experiencing recurring congestion that could point to opportunities to improve system function and reliability. Travel time index ultimately proved to be the most meaningful measure of effectiveness with which to assess I-490, I-590, and NYS Route 590. Travel time index is the ratio of travel time during a set period, for example the peak hour of travel, to the time necessary to complete the same trip under free-flow conditions.

Exhibit 2.1.5.C-1: Travel Time Index Legend

Exhibit 2.1.5.C-2 illustrates the travel time index during the morning peak hour throughout April 2019. Immediately north of the I-490/I-590/NYS Route 590 interchange is an area with a travel time index of 2.0 to 2.5. This suggests a 100% to 150% increase in travel time on approach to the interchange in the morning. This may be attributable to motorists jockying for position. Field observations suggest vehicles on NYS Route 590 southbound prefer to move left in this area, positioning themselves away from the downstream merge with Ramp WS. The travel time index in the vicinity of Ramp WS and Ramp ES is in the range of 1.6 to 2.0, suggesting a 60% to 100% increase in travel time in comparison to free-flow conditions.

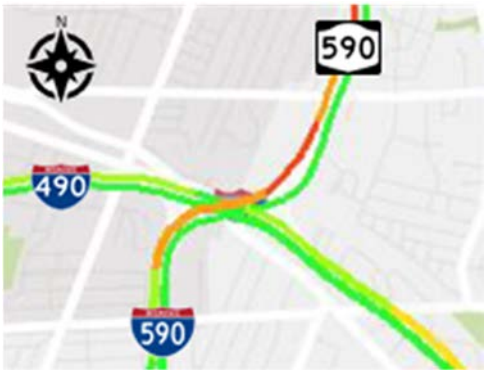


Exhibit 2.1.5.C-2: April 2019 Morning Peak Travel Time Index : I490/I-590/NYS Route 590

The evening peak hour at the same interchange, as illustrated in Exhibit 2.1.5.C-3, had a travel time index of 1.3 to 2.0 (30% to 100% increase over free-flow conditions) on the westbound approach to Ramp WNS. This could be caused by a heavy volume of vehicles joining the end of queues caused by slowdowns where Ramp WNS splits into Ramp WN and WS. Northbound NYS Route 590 approaching Ramp WN and Blossom road also exhibits a travel time index of 1.3 to 1.6, a 30% to 60% increase over free flow conditions. This could be caused in part by a relatively higher traffic density in the 1,150-foot long weaving area between the two ramps.

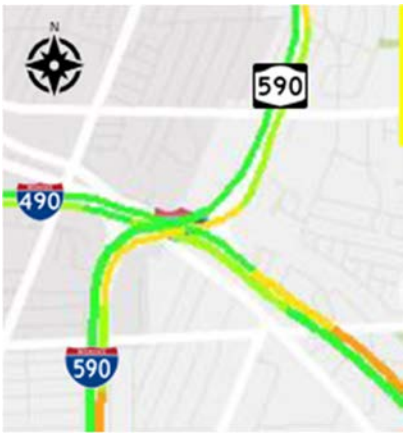


Exhibit 2.1.5.C-3: April 2019 Evening Peak Travel Time Index: I-490/I-590/NYS Route 590

2.1.6 Traffic Operations

Existing traffic operations were evaluated to establish a baseline for comparison during the development of conceptual alternatives and to support the needs assessment. Level of Service (LOS) is a qualitative measure describing motorist satisfaction with various factors influencing traffic congestion including travel time, speed maneuverability, and delay on an average day. The methodology for performing capacity analyses and determining level of service is documented in the *Highway Capacity Manual* (HCM).

LOS for freeways is determined from the average number of passenger cars per mile per lane (pc/mi/ln). Large trucks and buses are converted to an equivalent number of passenger cars using a mathematical formula. LOS ranges from A to F. LOS A describes conditions with free-flow operations at desirable travel speeds and little or no delay. On freeways and expressways such as I-490, I-590, and NYS Route 590, LOS E denotes operation at or near capacity and substantial traffic density. At LOS E minor disruptions to traffic flow can cause substantial delay. LOS F denotes operation over capacity and highly congested conditions with stop and go traffic, low speeds, significant congestion, and substantial delays. The HCM definitions for LOS on free-flow facilities appear below.

Level of Service	Mainline Thresholds	Weaving & Ramp Thresholds
A – Free flow	Less than 11 pc/mi/ln	Less than 10 pc/mi/ln
B – Reasonable free flow	11.1 to 18.0 pc/mi/ln	10.1 to 20.0 pc/mi/ln
C – Stable flow	18.1 to 26.0 pc/mi/ln	20.1 to 28.0 pc/mi/ln
D – Approaching unstable flow	26.1 to 35.0 pc/mi/ln	28.1 to 35.0 pc/mi/ln
E – Unstable flow	35.1 to 45.0 pc/mi/ln	More than 35.1 pc/mi/ln
F – Breakdown flow	More than 45.0 pc/mi/ln	V/C More than 1

VISSIM (Version 11) was used to model the existing I-490/I-590/NYS Route 590 interchange. VISSIM is a microscopic, multi-modal traffic flow simulation software. The program models each specific vehicle using basic car following logic. VISSIM is a NYSDOT accepted standard for the simulation and analysis of traffic systems including local streets and intersections, expressways, interchanges, ramps, and roundabouts. The program is used to accurately determine the Levels of Service, queues, and lane densities for traffic traveling through a study area. VISSIM can also be used to produce a real-time animation of traffic operations.

The model was calibrated based on volume, speed, model observations regarding spot congestion, and engineering judgement. Multiple runs were completed for the morning and evening peak hour periods to account for variability within the model. Measures of effectiveness including density, LOS, average vehicular speed, travel time, and total hours of vehicle delay were extracted from the microsimulation runs and averaged. Densities were converted to LOS based on HCM definitions.

A. Existing Morning Peak Hour

Tabulated results of the traffic operations analysis of existing, pre-pandemic, morning peak hour conditions within the I-490/I-590/NYS Route 590 interchange are available in Appendix C, Exhibit 2.1.6.A-1. The NYSDOT *Highway Design Manual*, Chapter 5, indicates that LOS D is generally considered the minimum acceptable condition for motor vehicle facilities for an area with an urban

character. The majority of areas throughout the interchange currently operate at LOS D or better. Locations with a poor level of service or specific operational issues are summarized breifly below.

- NYS Route 590 from the diverge with Ramp A (to Blossom Road) to the diverge at the I-490 ramps (Ramp SW and SE) currently operates at capacity (LOS E) with a density of approximately 41 pc/mi/ln and speeds around 45 mph. This is consistent with the area of low reliability identified in Section 2.1.5.C.

- NYS Route 590/I-590 also operates at capacity (LOS E) with a density of approximately 35 to 40 pc/mi/ln and speeds between 40 and 55 mph in the vicinity of the Ramp WS merge and just north of the Ramp ES lane addition. Ramp WS carries more volume than Ramp ES during a typical morning peak hour as noted in Section 2.1.5.A. Animations of this area produced using the VISSIM model also suggest that vehicles on Ramp ES experience some difficulty merging into the heavy volume of traffic on I-590 southbound.

Exhibit 2.1.6.A-2: VISSIM Screen Shot: Morning Peak on I-590 (Ramp WS Merge)

On average it takes a vehicle in the model between 2 and 2.5 minutes to travel through the interchange study area on both I-490 and I-590/NYS Route 590 under morning peak hour conditions. The distance is just under 2 ¼ miles. The total estimate of vehicle hours of delay is 56.4 hours.

B. Existing Evening Peak Hour

Tabulated results of the traffic operations analysis of existing, pre-pandemic, evening peak hour conditions wtihin the I-490/I-590/NYS Route 590 interchange are available in Appendix C, Exhibit 2.1.6.B-1. As during the morning, many areas throughout the interchange currently operate at LOS D or better. Locations with a poor level of service or specific operational issues are summarized breifly below.

- I-490 eastbound, west of the Winton Road overpass, currently operates at LOS E with a density of approximately 37 pc/mi/ln and speeds of 52 mph during the evening peak. All vehicles in this area and destined for I-590 and NYS Route 590 must position themselves in the right hand lane prior to the opening of a 630-foot long additional deceleration lane dedicated to Ramp ES.

- The segment of I-590 northbound between Highland Drive and the Ramp NEW diverge to I-490 operates at LOS E with a range of densities between 38 and 56 pc/mi/ln and speeds between 30 and 48 miles per hour. This is another area where motorists must make decisions on lane use in heavy traffic to reach their intended destination

- The segment of NYS Route 590 northbound, which includes the weave between Ramp WN and Ramp BRN and extends to the merge with Ramp B, currently operates at LOS E with a density of approximately 39 to 49 pc/mi/ln and speeds between 37 and 58 mph. The available weaving distance is 1,100 feet.

On average it takes a vehicle in the model between 2 and 2.5 minutes to travel through the interchange study area on both I-490 and I-590/NYS Route 590 under evening peak hour conditions. The distance is just under 2 ¼ miles. The total estimate of vehicle hours of delay is 93.8 hours. That represents a 60% increase over the morning peak hour.

2.1.7 Safety Considerations, Crash History, and Analysis

Crash reports were obtained from New York State Accident Location Information System (ALIS) data for the five-year period between January 1, 2015 and December 31, 2019. The I-490/I-590/NYS Route 590 crash study limits include the following roadway limits, not including the adjacent local roadway network:

- I-490 – Pedestrian Bridge over I-490 to Penfield Road Bridge over I-490
- I-590 / NY 590 – Highland Avenue Bridge over I-590 to NY 590 Bridge over Blossom Road
- All interchange ramps between I-490 / I-590 / NYS Route 590
- I-490 W Exit Ramp to East Avenue
- East Avenue Entrance Ramp to I-490 eastbound
- Ramps to/from I-490 to Winton Road
- Ramps to/from I-490 to Penfield Road
- Ramps to/from I-590 to Highland Avenue
- Ramps to/from NYS Route 590 to Blossom Road

Crashes are categorized as fatal, injury, property damage only (PDO) or non-reportable (NR). A crash is considered non-reportable if there is no personal injury and either:

a) No motorist report was filed,
b) No dollar value of vehicular damage was entered into the report, or
c) The amount of vehicular damage did not exceed $1,000.

A total of 1,139 crashes were received for the I-490/I-590/NYS Route 590 interchange. Crashes that fell outside the crash study limits, including those at ramp termini, were screened out; therefore, a total of 1,049 crashes were documented during the 5-year study period.

Note – New York State Department of Motor Vehicles (NYSDMV) Report of Motor Vehicle Accident (MV-104) forms were not reviewed. The ALIS data set does not provide the same level of detail as the MV-104 reports and accuracy is a function of the officer's coding of the crash. It is suggested that future actions review MV-104 reports, tabulate the results, and develop crash diagrams.

A. Interchange Overview

The number of crashes occurring within the I-490/I-590/NYS Route 590 Interchange by year is summarized in Exhibit 2.1.7-1. The number of crashes by roadway location is illustrated in Exhibit 2.1.7-2. A breakdown of crashes by severity is included in Exhibit 2.1.7-3.

Exhibit 2.1.7-1
I-490 / I-590 / NYS Route 590 Interchange
Crash Summary by Year

Year	Total	Percent
2015	253	24%
2016	211	20%
2017	202	19%
2018	184	18%
2019	199	19%
TOTAL	1,049	100%

Exhibit 2.1.7-2
I-490 / I-590 / NYS Route 590 Interchange
Crashes by Location

Location	Total	Percent
I-490 EB	262	25%
I-490 EB to NYS Route 590 NB Ramp (Ramp EN)	28	3%
I-490 EB to I-590 SB Ramp (Ramp ES)	7	<1%
I-490 WB	271	26%
I-490 WB to NYS Route 590 NB Ramp (Ramp WN)	5	<1%
I-490 WB to I-590 SB Ramp (Ramp WS)	19	2%
NYS Route 590 NB	197	19%
I-590 NB to I-490 EB Ramp (Ramp NE)	1	<1%
I-590 NB to I-490 WB Ramp (Ramp NW)	21	2%
I-590 SB	216	21%
NYS Route 590 SB to I-490 EB Ramp (Ramp SE)	16	1%
NYS Route 590 SB to I-490 WB Ramp (Ramp SW)	6	<1%
TOTAL	1,049	100%

Exhibit 2.1.7-3 I-490 / I-590 / NYS Route 590 Interchange Crash Severity		
Severity	Total	Percent
Fatal	2	1%
Injury	178	17%
Property Damage Only (PDO)	652	62%
Non-Reportable (NR)	217	20%
TOTAL	1,049	100%

The majority of crashes occurred on mainline segments throughout the corridor given numerous lanes, higher volumes, and peak period congestion. There were two fatalities during the study period. One fatality was the result of a suicide off an overhead bridge. The second fatality was on I-490 eastbound near Penfield Road and resulted from the vehicle striking the median barrier. Less than 20% of the crashes occurring within the study limits resulted in at least one personal injury. The majority of crashes (>60%) resulted in property damage only.

Exhibit 2.1.7-4 illustrates a breakdown of crashes by type. The predominant crash type by location is summarized in Exhibit 2.1.7-5.

A substantial number of interchange crashes are rear ends, primarily along mainline highways, and are related to peak period queuing (backups). Additionally, the next highest frequency of collisions involves fixed objects, poor roadway conditions, or errant vehicles, which is not unexpected on interchange ramps. Left turn, right turn, and right-angle crashes were reviewed in further detail. Twelve of the 16 crashes were noted as having wet, snowy, or icy road surface conditions, which are likely resulting from vehicles spinning out of control. Other types of crashes were also reviewed in further detail. Of the 120 total crashes, 95 occurred during peak hours, all of which involved 2 or more vehicles. This is indicative of rear-end type crashes.

Exhibit 2.1.7-4 I-490 / I-590 / NYS Route 590 Interchange Crash Types		
Crash Type	Total	Percent
Rear End	389	37%
Fixed Object	309	30%
Overtaking	173	17%
Other	120	11%
Right Angle	12	1%
Right Turn	2	<1%
Head On	3	<1%
Sideswipe	3	<1%
Left Turn	2	<1%
Collision with Pedestrian	1	<1%
Collision with Bicyclist	0	0%
Collision with Animal	35	<1%
TOTAL	1,049	100%

Exhibit 2.1.7-5 I-490 / I-590 / NYS Route 590 Interchange Predominant Crash Type by Location			
Location	Predominant Crash Type	Total	Percent of Crashes at Location
I-490 EB	Rear End	105	40%
I-490 EB to NYS Route 590 NB Ramp (Ramp EN)	Fixed Object	26	93%
I-490 EB to I-590 SB Ramp (Ramp ES)	Fixed Object	3	43%
I-490 WB	Rear End	119	44%
I-490 WB to NYS Route 590 NB Ramp (Ramp WN)	Fixed Object	3	60%
I-490 WB to I-590 SB Ramp (Ramp WS)	Rear End	10	53%
NYS Route 590 NB	Rear End	72	37%
I-590 NB to I-490 EB Ramp (Ramp NE)	Fixed Object	1	100%
I-590 NB to I-490 WB Ramp (Ramp NW)	Fixed Object	5	24%
I-590 SB	Rear End	76	35%
NYS Route 590 SB to I-490 EB Ramp (Ramp SE)	Fixed Object	2	13%
NYS Route 590 SB to I-490 WB Ramp (Ramp SW)	Fixed Object	3	50%

Crash density maps were developed to help pinpoint locations of higher crash experience, per mainline roadway, and appear as Exhibit 2.1.7-6 through Exhibit 2.1.7-9 in Appendix C.

The highest crash density on I-490 is found immediately east of interchange between Ramp SE and Ramp PE. This area has five lanes merging together, a relatively short 950-foot long weave area, a two lane off ramp to Penfield Road, and a lane reduction from four lanes to three in the eastbound direction. The weave between Ramp PW and Ramp WNS on I-490 westbound also exhibited a relatively higher

crash experience. This is an area of known recurring congestion during the evening peak. Ramp EN had more crashes than any other ramp in the interchange. That ramp has a series of tangents and curves, is at the bottom of the interchange, and leads directly to the weave approaching Blossom Road. Another spot with notable crash experience appears on I-490 westbound between Ramp SW and Ramp UAW. This 1,000-foot long weave area experiences congestion during the morning peak.

No notable crash "hot spots" were identified along northbound I-590 or NYS Route 590. One location with a relatively higher crash experience was identified on NYS Route 590 southbound approaching the I-490 interchange. Here vehicles maneuver to get in the correct lane to head south on I-590 or exit to I-490. This location is a known area of recurring of congestion during the morning peak hour.

B. In-depth Analysis

An in-depth analysis of the crashes was also completed in order to help correlate crash patterns with congestion, substandard geometry, and/or safety deficiencies. The complete set of crash data for the interchange was filtered for peak conditions, morning peak, evening peak, off peak, rear end type crashes, run-off-road type crashes, and those involving wet/snowy road surface conditions.

During the evening peak period, crash type frequency increased from 37% rear ends to 62% rear ends. This increase is attributable to evening congestion as previously noted. Exhibit 2.1.7-10 illustrates the revised breakdown by crash type. Additionally, as shown in Exhibit 2.1.7-11, the primary crash type becomes "fixed object" during off-peak periods. This would be typical of off peak periods where roadway conditions and other factors have a higher probability of causing an incident, as opposed to interactions with other vehicles.

To review crash type by location, the data were filtered for the evening peak period and rear end crash types, as shown in Exhibits 2.1.7-12 and Exhibit 2.1.7-13. This shows that on I-490 westbound and I-490 eastbound, 68% of the crashes are rear-ends during the evening peak period. Additionally, on I-590 northbound and I-590 southbound, over 50% of the crashes are rear-ends. This is indicative of congestion. Interchange ramps have a low occurrence of crashes during the evening peak period, indicating that under higher volumes, they operate more safely. Nearly all crashes are associated with mainline I-490 (58%) and mainline I-590 (39%).

There were no unique circumstances within the data for the interchange suggesting an unusual safety issue. Additionally, no notable crash patterns (locations) were identified during a review of wet/snowy road surface condition crashes. Fixed object type crashes occurred at a higher rate under wet road conditions, which is to be expected.

Exhibit 2.1.7-10 I-490 / I-590 / NYS Route 590 Interchange Crash Types – PM Peak Period		
Crash Type	Total	Percent
Rear End	219	62%
Fixed Object	37	11%
Overtaking	47	13%
Other	43	12%
Right Angle	1	<1%
Right Turn	2	1%
Head On	1	<1%
Sideswipe	0	0%
Left Turn	1	<1%
Collision with Pedestrian	0	0%
Collision with Bicyclist	0	0%
Collision with Animal	1	<1%
TOTAL	352	100%

Exhibit 2.1.7-11 I-490 / I-590 / NYS Route 590 Interchange Crash Types – Off-Peak Periods		
Crash Type	Total	Percent
Rear End	67	16%
Fixed Object	199	48%
Overtaking	91	22%
Other	19	5%
Right Angle	7	2%
Right Turn	0	0%
Head On	2	<1%
Sideswipe	2	<1%
Left Turn	0	0%
Collision with Pedestrian	1	<1%
Collision with Bicyclist	0	0%
Collision with Animal	29	7%
TOTAL	417	100%

Exhibit 2.1.7-12 I-490 / I-590 / NYS Route 590 Interchange Predominant Crash Type by Location – PM Peak Period			
Location	Predominant Crash Type	Total	Percent of Crashes at Location
I-490 EB	Rear End	96	68%
I-490 EB to NYS Route 590 NB Ramp (Ramp EN)	Fixed Object	1	100%
I-490 EB to I-590 SB Ramp (Ramp ES)	Rear End	3	67%
I-490 WB	Rear End	104	68%
I-490 WB to NYS Route 590 NB Ramp (Ramp WN)	Rear End	3	33%
I-490 WB to I-590 SB Ramp (Ramp WS)	Rear End	3	33%
NYS Route 590 NB	Rear End	87	56%
I-590 NB to I-490 EB Ramp (Ramp NE)	Rear End	0	0%
I-590 NB to I-490 WB Ramp (Ramp NW)	Fixed Object	1	100%
I-590 SB	Rear End	49	57%
NYS Route 590 SB to I-490 EB Ramp (Ramp SE)	Fixed Object	3	67%
NYS Route 590 SB to I-490 WB Ramp (Ramp SW)	Rear End	2	50%
TOTAL		352	

Exhibit 2.1.7-13 I-490 / I-590 / NYS Route 590 Interchange Predominant Crash Type by Location – Rear Ends		
Location	Total	Percent
I-490 EB	105	27%
I-490 EB to NYS Route 590 NB Ramp (Ramp EN)	0	0%
I-490 EB to I-590 SB Ramp (Ramp ES)	2	1%
I-490 WB	119	31%
I-490 WB to NYS Route 590 NB Ramp (Ramp WN)	1	0%
I-490 WB to I-590 SB Ramp (Ramp WS)	10	3%
NYS Route 590 NB	72	19%
I-590 NB to I-490 EB Ramp (Ramp NE)	0	0%
I-590 NB to I-490 WB Ramp (Ramp NW)	0	0%
I-590 SB	76	20%
NYS Route 590 SB to I-490 EB Ramp (Ramp SE)	3	1%
NYS Route 590 SB to I-490 WB Ramp (Ramp SW)	1	0%
TOTAL	389	

Crash density maps were developed for these special conditions to correlate crash patterns with congestion or specific locations. Comparing the off peak versus morning peak period maps, the overall crash experience increases along NYS Route 590 southbound, approaching the split to I-490. Additional crashes occur on I-490 westbound approaching the I-590/NYS Route 590 split and NYS Route 590 southbound near the on-ramp from I-490 westbound. Comparing the off peak versus evening peak

period maps, the overall crash experience is shown to increase on I-590 NB approaching I-490, I-490 westbound approaching the I-590/NYS Route 590 split, and NYS Route 590 northbound north of the interchange. These increases are indicative of peak hour congestion. Refer to Exhibit 2.1.7-14 through Exhibit 2.1.7-16 in Appendix C.

C. Known Safety Concerns

The NYSDOT identifies three categories of locations on its system where safety is a concern based on a statistical analyses of accident history. The categories are:

a) Priority Investigation Location (PIL) – Location where there is a 99.9% level of confidence a problem exists. These locations have high crash rates. Typically, the rate is approximately two and one-half to three times greater than the statewide average rate for similar facilities. If the location is a specific intersection fulfilling the above criteria it is characterized as a Priority Investigation Intersection (PII).

b) Safety Deficient Location (SDL) – Location where there is a 90.0% level of confidence a problem exists. These locations have high crash rates that exceed the statewide average for similar locations. The only definitive difference between a site being characterized as an SDL and PIL is the level of confidence that a problem exists.

c) High Accident Location (HAL) – This is a combination of PIL and SDL locations.

NYSDOT Safety Information Management System (SIMS) reports for the I-490/I-590/NYS Route 590 interchange were reviewed for the year 2019. The report listed no Priority Investigation Intersection (PIIs), Safety Deficient Locations (SDLs), or high accident locations (HALs) in the study area. Priority Investigation Locations (PILs) and Specialty PILs are summarized in Exhibit 2.1.7-17.

Exhibit 2.1.7-17
I-490 / I-590 / NYS Route 590 Interchange
Priority Investigation Locations

Year	Location (Reference Markers)		Reason(s)
	Begins At	Ends At	
2019	490I 4302 3001	490I 4302 3003	General
2019	490I 4302 3005	490I 4302 3008	General
2019	490I 4302 3010	490I 4302 3012	General
2019	490I 4302 3012	490I 4302 3015	General
2019	590 4301 1003	590 4301 1005	General
2019*	490I 4301 2066	490I 4301 2068	Run Off the Road / Fixed Object
2019*	490I 4301 2068	490I 4301 3001	Run Off the Road / Fixed Object
2019*	490I 4301 3001	490I 4301 3003	Run Off the Road / Fixed Object
2019*	590 4301 1000	590 4301 1003	Run Off the Road / Fixed Object
2019*	490I 4301 2068	490I 4301 3001	Wet Road
2019*	490I 4301 3011	490I 4301 3014	Wet Road
2019*	590 4301 1000	590 4301 1003	Wet Road
*Specialty Priority Investigation Location (PIL) - Unusually high concentrations of specific crash types. Data provided by NYSDOT did not break up PILs by direction.			

2.2 NYS Route 104 / NYS Route 590 Interchange

2.2.1 General Description

The NYS Route 104/NYS Route 590 interchange is located at the northeast corner of the City of Rochester and adjacent to the Town of Irondequoit. Originally envisioned as the northeastern corner of what was to become Rochester's Outer Loop, it now functions as a gateway to growing communities in the Village of Webster, Town of Webster, eastern Monroe County, and Wayne County to the east of Irondequoit bay. The interchange study area is illustrated in Appendix A, Exhibit 2.2.1-1 and Exhibit 2.2.1-2. It covers NYS Route 104 from the Culver Road overpass to the Irondequoit Bay Bridge. It also includes NYS Route 590 from Norton Street to Orland Road. The Ridge Road interchange falls completely inside the study area. It has NYS Route 590 at its core and is straddled by the eastbound and westbound lanes of NYS Route 104.

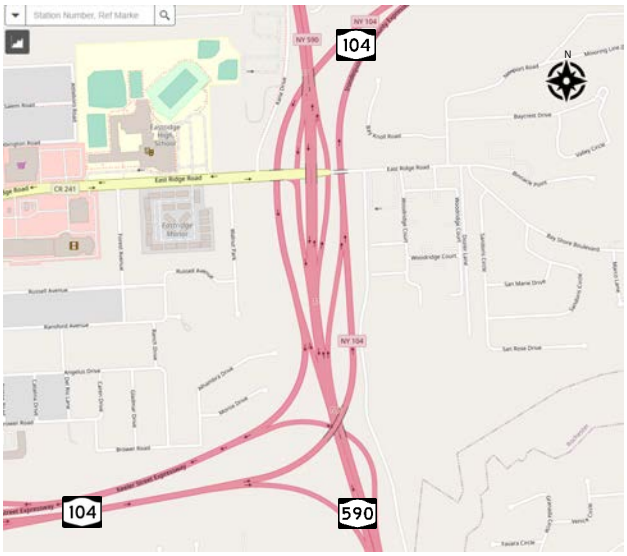


Exhibit 2.2.1-3: NYS Route 104/NYS Route 590 Interchange and Ridge Road, Source: NYSDOT Traffic Data Viewer

The NYS Route 104/NYS Route 590 interchange is a "system interchange" connecting fully access controlled roadways. The Ridge Road interchange is a service interchange that provides access to the local roadway system. Additional identifying information is provided in Exhibit 2.2.1-4.

NYS Route 104 and NYS Route 590 south of Ridge Road are functionally classified as an Urban Principal Arterial Expressway and listed as Qualifying Highways. NYS Route 590 is classified as an Urban Minor Arterial north of Ridge Road and is neither an Access Highway nor a Qualifying Highway. It is; however, within one mile of a Qualifying Highway which means that special dimension vehicles may still be expected. All portions of these roadways are included on the NHS.

Exhibit 2.2.1-4 NYS Route 104 / NYS Route 590 Interchange – General Description			
Segment	NYS Route 104: Culver Road to Irondequoit Bay Bridge	NYS Route 590: Norton Street to Ridge Road	NYS Route 590: Ridge Road to Orland Road
Route Number	NYS Route 104	NYS Route 590	NYS Route 590
Reference Markers	104 43035200 to 104 43035217	590 43013015 to 47 43013026	47 43013026 to 47 43013029
Ownership & Maintenance Jurisdiction	NYSDOT	NYSDOT	NYSDOT
Access Control	Full	Full	Full
Functional Classification	Urban Principal Arterial Expressway	Urban Principal Arterial Expressway	Urban Minor Arterial
NHS	Yes	Yes	Yes
Qualifying or Access Highways	Qualifying	Qualifying	None

2.2.2 Geometry

The NYS Route 104/NYS Route 590 interchange is made up of a series of mainline segments and ramps. The cross section of each mainline roadway varies as one travels from west to east and south to north through the study area. NYS Route 104 west of the interchange, NYS Route 104 east of the interchange, and NYS Route 590 south of the interchange all currently have a minimum of three through travel lanes in each direction. NYS Route 590 north of Ridge Road has two through travel lanes in each direction. Ramps connecting NYS Route 104 and NYS Route 590 generally have two through travel lanes, except for the ramp from NYS Route 590 northbound to NYS Route 104 eastbound which has one. The ramps between NYS Route 590 and Ridge Road each consist of a single lane.

Lane arrangements throughout the interchange, in areas where roadways meet or separate (merge and diverge areas), are shown in Appendix B, Exhibit 2.2.2-1. Each ramp is identified by a code taken from available NYSDOT record plans. All mainline travel lanes are 12 feet wide. Ramp travel lanes are 12 feet wide or wider. Shoulders are relatively wide, as is typical for expressways, but do vary depending on location.

Exhibit 2.2.2-2: NYS Route 104 at Ramp S-E: Temporary Two-Lane Condition, Source: Google Street View

Exhibit 2.2.2-1 shows lane arrangements in one of the study's two preset focus areas. This includes a portion of NYS Route 590 northbound, the EB Connector (NYS Route 104 eastbound), and Ramp S-E (joining NYS Route 590 northbound with NYS Route 104 eastbound). This is the area where the NYSDOT made temporary striping modifications to accommodate a scheduled closure of the bridge carrying the EB Connector over NYS Route 590. The revised configuration allowed two lanes to exit NYS Route 590 northbound toward NYS Route 104 eastbound. NYS Route 104 eastbound was also reduced to one lane

beyond the bridge. These lanes joined to form the three lane section on NYS Route 104 headed toward the Irondequoit Bay Bridge.

The overall shape of the interchange is illustrated in Exhibit 2.2.1-1 and Exhibit 2.2.1-2. The EB Connector is at the top of the interchange. NYS Route 590 is at the mid-level, and Ramps S-W is at the bottom. NYS Route 590 passes over Ridge Road and NYS Route 104 eastbound. Ridge Road passes over both NYS Route 104 eastbound and westbound. Grades throughout the interchange are relatively long and flat. The EB Connector has a radius of approximately 1,100 feet.

2.2.3 Relevant Physical Features

A. Bridges

There is total of 12 bridges within the I-490/I-590/NYS Route 590 interchange study area. All 12 carry vehicular traffic. Below is a list of the bridges along with the corresponding Bridge Identification Number (BIN) and original year of construction:

- BIN 1051290 – Bay View Road (Norton Street) over NYS Route 590 NB/SB (1957)
- BIN 1052221 – NYS Route 104 over Culver Road (1967)
- BIN 1052222 – NYS Route 104 over Culver Road (1967)
- BIN 1051289 – NYS Route 590 over Ramp S-W (1968)
- BIN 1036470 – NYS Route 104 EB over NYS Route 590 (1968)
- BIN 1063969 – Ridge Road over NYS Route 104 EB (1968)
- BIN 1014841 – NYS Route 590 NB over Ridge Road (1957)
- BIN 1014842 – NYS Route 590 SB over Ridge Road (1957)
- BIN 1052140 – Ridge Road over NYS Route 104 WB (1970)
- BIN 1052241 – NYS Route 590 NB over NYS Route 104 EB (1970)
- BIN 1052242 – NYS Route 590 SB over NYS Route 104 EB (1970)

B. Drainage Systems

Stormwater is typically removed from the interchange via sheet flow and a closed drainage system consisting of catch basins, field inlets, and underground storm sewer pipes. At this time, there are no known specific drainage or flooding concerns related to the interchange.

C. Lighting

The interchange is lit during hours of darkness by a combination of single and dual cobra head luminaries mounted on truss arms connected to individual poles. Single cobra head luminaries are typically found along the right side of mainline roadways and interchange ramps. Dual cobra head luminaries are generally located between the NYS Route 590 northbound and southbound lanes.

D. Roadside Barrier

Roadside barriers within the study area include heavy post blocked-out corrugated beam guiderail, box beam guiderail, and bridge rail. The barriers vary in condition from poor to good depending on the location. Barriers were generally not checked for conformance with current standards; however, there are some median barriers with turned down end terminals rather than attenuating terminals within the study limits. This condition would not meet current standards. Some sections of guiderail were missing end treatments, possibly due to previous damage.

2.2.4 Traffic Control

A. Speeds

Measurements of operating speed were not made for this study nor were spot speed study results obtained from the New York State Traffic Data Viewer. The posted speed limit on all roadways through the interchange is 55 miles per hour (mph). Posted ramp advisory speeds are summarized in Exhibit 2.2.4.A-1.

Exhibit 2.2.4.A-1
NYS Route 104 / NYS Route 590 Interchange – Ramp Advisory Speeds

Ramp Designation	Description	Advisory Speed (mph)
Ramp W-S	NYS Route 104 eastbound to NYS Route 590 southbound	50
Ramp S-W	NYS Route 590 northbound to NYS Route 104 westbound	40
EB Connector	NYS Route 104 eastbound	50
WB Connector	NYS Route 104 westbound	45
Ramp E-S	NYS Route 104 westbound to NYS Route 590 southbound	None
Ramp S-E	NYS Route 590 northbound to NYS Route 104 eastbound	None
Ramp V	Ridge Road to NYS Route 590 southbound	None
Ramp W	NYS Route 590 northbound to Ridge Road	None
Ramp R	Ridge Road to NYS Route 590 northbound	None
Ramp S	NYS Route 590 southbound to Ridge Road	None

B. Pavement Markings

Pavement markings on NYS Route 104 and NYS Route 590 were in fair to good condition and visible as of the date of field observation in February of 2021. They are replaced on a regular cycle under NYSDOT pavement marking maintenance programs. Marking patterns generally appear to be in compliance with current *Manual on Uniform Traffic Control Devices* and *New York State Supplement* (MUTCD) standards. It is worth noting that a number of marking and signing changes were made by the NYSDOT in this area after construction of Sea Breeze Drive to the north. In addition, the remnants of the temporary marking pattern on Ramp S-E are still visible today as a result of the pavement marking removal methods.

C. Guide Signs

Major mainline and ramp guide signs in the NYS Route 104/NYS Route 590 interchange study area were inventoried and are shown in Exhibits 2.2.4.C-1 and Exhibit 2.2.4.C-2. The signs are in generally good to fair condition with some fading and peeling of legends in select areas. There are no diagrammatic or arrow-per-lane legends on any of the guide signs in this interchange.

D. Intelligent Transportation Systems (ITS)

There are limited Intelligent Transportation Systems (ITS) features near the interchange. There is a series of overhead Closed Circuit Television (CCTV) cameras covering Culver Road and NYS Route 104, NYS Route 104 where it crosses NYS Route 590, NYS Route 590 north of Ridge Road, and both sides of the Irondequoit Bay Bridge.

2.2.5 Traffic Volumes

A. Daily Traffic Volumes

Daily traffic data within the NYS Route 104/NYS Route interchange study area are depicted in Exhibit 2.2.5.A-1. Historic average annual daily traffic volumes (AADT) were obtained from the NYSDOT Traffic Data Viewer. No new 24-hour continuous traffic counts were taken as part of this study. NYS Route 590 carried nearly 93,000 vehicles per day (vpd) south of the interchange, just over 14,000 vpd between NYS Route 104 and Ridge Road, and around 8,000 vpd north of the interchange in 2019. This is in contrast to the 68,000 to 70,000 vpd carried by NYS Route 104. Ramp S-E carried approximately 16, 600 vehicles per day.

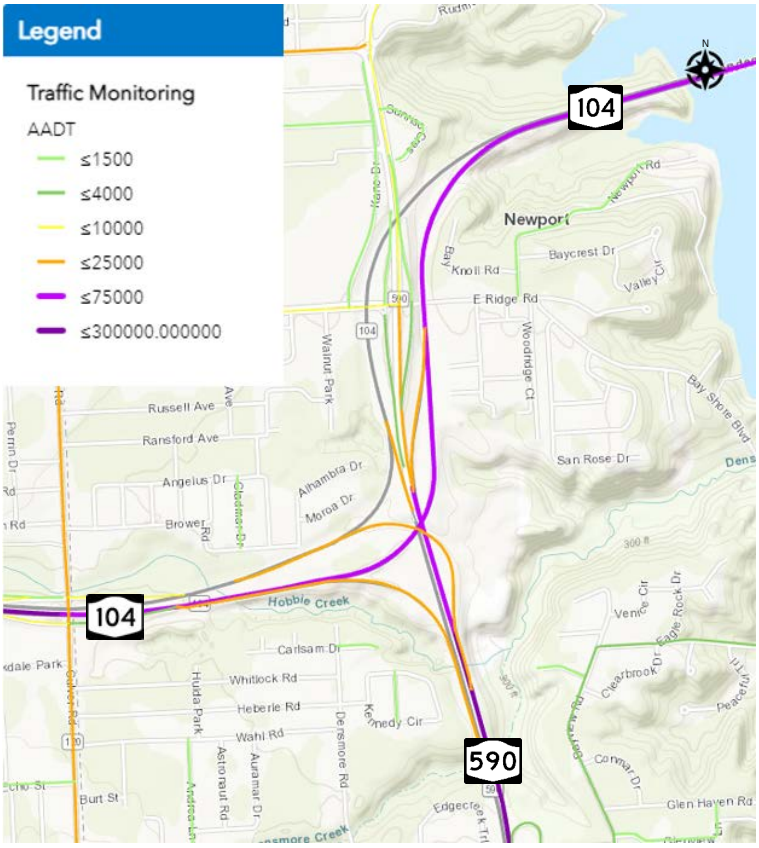


Exhibit 2.2.5.A-1: Daily Traffic Volumes at NYS Route 104/NYS Route 590, Source: NYSDOT Traffic Data Viewer

B. Peak Hour Traffic Volumes

Average weekday morning and evening peak hour volumes were developed for the interchange study area using data gathered from a number of available sources, providing necessary information for traffic microsimulation models. The volumes are measured in vehicles per hour (vph) and represent the typical morning and evening peak hour periods prior to the pandemic in 2020. The morning peak

period generally occurs between 7:00 AM and 8:00 AM. The evening peak period generally occurs between 4:00 PM and 5:00 PM. The morning and evening peak hour volumes throughout the interchange are shown on Exhibit 2.2.5.B-1 in Appendix C.

Exhibit 2.2.5.B-1 shows volumes in the NYS Route 104/NYS Route 590 focus area. Both ramps carry similar volumes during the morning peak (i.e., 1,070 vph and 1,140 vph) and Ramp S-E carries approximately 2,000 vpd fewer vehicles than the EB Connector in the evening peak (1,840 vph versus 2,040 vph, respectively).

C. Reliability

Inrix data were also obtained for the NYS Route 104/NYS Route 590 interchange. As shown on Exhhibit Exhibit 2.2.5.C-1, majority of mainline roadways in the study area had a travel time index less than or equal to one, denoting no slowdowns and adequate capacity to handle all motor vehicle traffic demand. Only the southbound NYS Route 590 departure from the interchange had a travel time index greater than 1.0 (1.3 to 1.6), suggesting a 30% to 60% increase in travel time. This likley represents the tail end of slowdowns and congestion that affect the roadway between NYS Route 104 and I-490 as motorists complete their regular commutes to work and school.

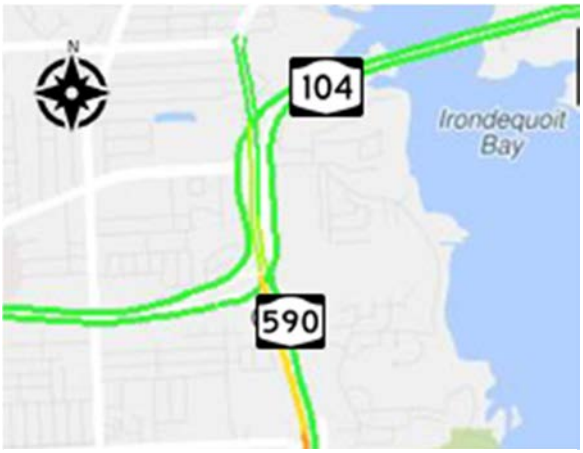


Exhibit 2.2.5.C-1: April 2019 Morning Peak Travel Time Index: NYS Route 104/NYS Route 590

The interchange also has adequate capacity to handle the evening peak hour traffic as shown in Exhibit 2.2.5.C-2. The majority of mainline segments had a travel time index of 1.0 or lower. Northbound NYS Route 590 headed toward the interchange and eastbound NYS Route 104 headed away from the interchange had a travel time index between 1.1 and 1.3, suggesting minor slowdowns related to the heavy volumes using these links to reach Rochester's eastern suburbs and beyond.

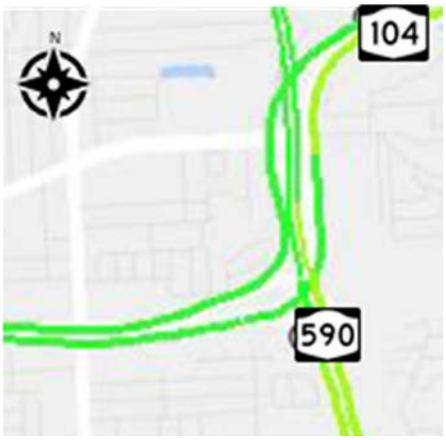


Exhibit 2.2.5.C-2: April 2019 Evening Peak Travel Time Index: NYS Route 104/NYS Route 590

2.2.6 Traffic Operations

VISSIM (Version 11) was used to model the NYS Route 104/NYS Route 590 interchange. Measures of effectiveness including density, LOS, average vehicular speed, travel time, and total hours of vehicle delay were extracted from the microsimulation runs and averaged. Refer to Section 2.1.6 for a description of VISSIM and the measures of effectiveness.

Exhibit 2.2.6.-1: Screen Shot of the NYS Route 104/NYS Route 590 VISSIM Model

A. Existing Morning Peak Hour

Tabulated results of the traffic operations analysis of existing, pre-pandemic, morning peak hour conditions within the Route 104/Route 590 interchange are available in Appendix C, Exhibit 2.2.6.A-1. The NYSDOT *Highway Design Manual*, Chapter 5, indicates that LOS D is generally considered the minimum acceptable condition for motor vehicle facilities for an area with an urban character. The majority of the areas within the interchange currently operate at LOS B or better during the morning peak hour. There are limited locations with slightly more congestion, operating at Level of Service C, including the following:

- NYS Route 104 westbound is generally operating at LOS C through the interchange with a density of approximately 20 to 21 pc/mi/ln and operating speeds around 65 mph.
- NYS Route 590 northbound, to the south of the Ramp S-W diverge, and NYS Route 590 southbound, to the south of the Ramp W-S merge, are both operating at LOS C with densities in the 20 to22 pc/mi/ln and full speeds near 65 mph.

On average it takes a vehicle in the model just under 2 minutes to travel through the interchange study area on Route 104 and just under 1.5 minutes to travel through the interchange area on Route 590 under morning peak hour conditions. The distance is just over 2 miles on Route 104 and just over 1.5 miles on Route 590. The total estimate of vehicle hours of delay is 8.2 hours.

B. Existing Evening Peak Hour

Tabulated results of the traffic operations analysis of existing, pre-pandemic, evening peak hour conditions within the Route 104/Route 590 interchange are available in Appendix C, Exhibit 2.2.6.B-1. As during the morning, the majority of the areas within the interchange are operating at LOS C or better. Locations with a poorer level of service or specific operational issues are summarized briefly below.

- The Ramp S-E currently connecting NYS Route 590 northbound with NYS Route 104 eastbound operates at LOS D with a density of approximately 32.4 pc/mi/ln and speeds of 58 mph during the evening peak. This single lane ramp carries approximately 1,900 vehicles from, nearing the hourly capacity of a single travel lane.

Overall travel times are consistent with the morning peak hour. On average it takes a vehicle in the model just under 2 minutes to travel through the interchange study area on NYS Route 104 and just under 1.5 minutes to travel through the interchange area on NYS Route 590 under evening peak hour conditions. The total estimate of vehicle hours of delay is 12.3 hours. That represents a 50% increase over the morning peak hour.

2.2.7 Safety Considerations, Crash History, and Analysis

Crash reports were obtained from New York State Accident Location Information System (ALIS) data for the period between January 1, 2015 and December 31, 2019. The NYS Route 104/NYS Route 590 crash study limits include the following roadway limits, not including the adjacent local roadway network:

- NYS Route 104 –Culver Road to the Irondequoit Bay Bridge (west approach)
- NYS Route 590 – Norton Street to Orland Road
- All interchange ramps connecting NYS Route 104 with NYS Route 590
- Ramps to and from NYS Route 590 to Ridge Road

Crashes are categorized as fatal, injury, property damage only (PDO) or non-reportable (NR). A crash is considered non-reportable if there is no personal injury and either:

a) No motorist report was filed,
b) No dollar value of vehicular damage was entered into the report, or
c) The amount of vehicular damage did not exceed $1,000.

A total of 814 crashes were received for the NYS Route 104/NYS Route 590 interchange. Crashes that fell outside the crash study limits, including those at ramp termini, were screened out; therefore, a total of 683 crashes were documented during the 5-year study period.

Note – New York State Department of Motor Vehicles (NYSDMV) Report of Motor Vehicle Accident (MV-104) forms were not reviewed. The ALIS data do not provide the same level of detail as the MV-104 reports and its accuracy is a function of the officer's coding of the crash. Future studies or design projects should include a review MV-104 reports in detail, tabulate the results, and develop crash diagrams.

A. Interchange Overview

The number of crashes occurring within the NYS Route 104/NYS Route 590 Interchange by year is summarized in Exhibit 2.2.7-1. The number of crashes by roadway location is illustrated in Exhibit 2.2.7-2. A breakdown of crashes by severity is included in Exhibit 2.2.7-3.

Exhibit 2.2.7-1
NYS Route 104 / NYS Route 590 Interchange
Crash Summary by Year

Year	Total	Percent
2015	107	16%
2016	148	22%
2017	132	19%
2018	146	21%
2019	150	22%
TOTAL	683	100%

Exhibit 2.2.7-2
NYS Route 104 / NYS Route 590 Interchange
Crashes by Location

Location	Total	Percent
NYS Route 104 EB	171	25%
NYS Route 104 EB – NYS Route 590 SB Ramp (Ramp W-S)	7	1%
NYS Route 104 WB	179	26%
NYS Route 590 NB	185	27%
NYS Route 590 NB – NYS Route 104 EB Ramp (Ramp S-E)	2	<1%
NYS Route 590 NB – NYS Route 104 WB Ramp (Ramp S-W)	14	2%
NYS Route 590 SB	125	18%
TOTAL	683	100%

Exhibit 2.2.7-3 NYS Route 104 / NYS Route 590 Interchange Crash Severity		
Severity	Total	Percent
Fatal	1	<1%
Injury	123	18%
Property Damage Only (PDO)	432	63%
Non-Reportable (NR)	127	19%
TOTAL	683	100%

The majority of the crashes occurred on mainline segments throughout the corridor given their numerous lanes, higher volumes, and peak period congestion. There was one fatality during the study period. The fatality was a result of a wrong way driver during inclement weather on NYS Route 590 near Norton Street. Less than 20% of the crashes occurring within the study limits resulted in at least one personal injury. The majority of crashes (>60%) resulted in property damage only.

Exhibit 2.2.7-4 illustrates a breakdown of crashes by type. The predominant crash type by location is summarized in Exhibit 2.2.7-5.

A substantial number of interchange crashes involve collisions with fixed objects. These take place along both mainline and interchange ramps. Based on a review of available crash reports this pattern is likely due to a combination of motor vehicle speed, roadway geometry, roadside features, and poor surface conditions (e.g., wet, snowy, or icy pavement). Left turn, right turn, and right-angle crashes were reviewed in further detail. Three of the 4 crashes were noted as having wet, snowy, or icy road surface conditions, all of which occurred on ramps, which are likely resulting from vehicles spinning out of control. The predominant crash type on NYS Route 590, primarily northbound, is a rear end collision related to peak period slowdowns. Other crash types were also reviewed in further detail. Of the 57 total crashes, 38 were in peak hours, all of which involved 2 or more vehicles. This is indicative of rear-end type crashes.

Exhibit 2.2.7-4 NYS Route 104 / NYS Route 590 Interchange Crash Types		
Crash Type	Total	Percent
Fixed Object	238	35%
Rear End	168	25%
Overtaking	108	16%
Collision with Animal	98	14%
Other	57	8%
Head On	4	<1%
Sideswipe	4	<1%
Right Angle	3	<1%
Collision with Bicyclist	2	<1%
Left Turn	1	<1%
Right Turn	0	0%
Collision with Pedestrian	0	0%
TOTAL	683	100%

Exhibit 2.2.7-5 NYS Route 104 / NYS Route 590 Interchange Predominant Crash Type by Location			
Location	Predominant Crash Type	Total	Percent of Crashes at Location
NYS Route 104 EB	Fixed Object	78	46%
NYS Route 104 EB – NYS Route 590 SB Ramp (Ramp W-S)	Fixed Object	6	86%
NYS Route 104 WB	Fixed Object	98	55%
NYS Route 590 NB	Rear End	82	44%
NYS Route 590 NB – NYS Route 104 EB Ramp (Ramp S-E)	Fixed Object	2	100%
NYS Route 590 NB – NYS Route 104 WB Ramp (Ramp S-W)	Fixed Object	7	50%
NYS Route 590 SB	Rear End	41	33%

Crash density maps were developed to help pinpoint locations of higher crash experience, per mainline roadway, and appear as Exhibit 2.2.7-6 through Exhibit 2.2.7-9 in Appendix C.

Notable crash "hot spots" include the EB Connector bridge carrying NYS Route 104 over NYS Route 590. Crash reports suggest the majority of incidents occurred under wet or snowy roadway surface conditions during the winter months. The end result is a collision with a fixed object. Under dry conditions, vehicles maneuvering to get in the correct lane for their destination upstream of the exit ramps during peak traffic periods is a likely cause of the rear-end crashes.

B. In-depth Analysis

An in-depth analysis of the crashes was also completed in order to correlate crash patterns with congestion, substandard geometry, and/or safety deficiencies. Crash data for the interchange were filtered for peak conditions, morning peak, evening peak, off peak, rear end type crashes, run-off-road type crashes, and those involving wet/snowy road surface conditions.

During the evening peak period, crash type frequency increased from 25% rear ends to 46% rear ends. This increase is attributed to evening congestion as previously noted. Exhibit 2.2.7-10 illustrates the revised breakdown by crash type. Additionally, as shown in Exhibit 2.2.7-11, the crash pattern changes to predominately fixed object type crashes during off-peak periods. This would be typical of off peak periods where roadway conditions and other factors have a higher probability of affecting operations, as opposed to vehicular interaction.

Reviewing the predominant crash type by location, the data were filtered for the evening peak period and rear end crash types, as shown in Exhibits 2.2.7-12 and Exhibit 2.2.7-13. During the evening peak period, it shows that on NYS Route 590 northbound, 63% of the crashes are rear-ends. This is indicative of congestion. All of the ramps have a very low occurrence of crashes during the evening peak period, indicating that under higher volumes of traffic, they operate more safely. Almost 50% of rear end crashes are associated with NYS Route 590 northbound.

There were no unique circumstances within the data for the interchange suggesting an unusual safety issue. Additionally, no notable crash patterns (locations) were identified during a review of wet/snowy road surface condition crashes. Fixed object type crashes occurred at a higher rate under wet road conditions, which is to be expected.

Exhibit 2.2.7-10
NYS Route 104 / NYS Route 590 Interchange
Crash Types – PM Peak Period

Crash Type	Total	Percent
Rear End	84	46%
Fixed Object	28	15%
Overtaking	27	15%
Other	28	15%
Right Angle	0	0%
Right Turn	0	0%
Head On	0	0%
Sideswipe	3	2%
Left Turn	0	0%
Collision with Pedestrian	0	0%
Collision with Bicyclist	0	0%
Collision with Animal	13	7%
TOTAL	183	100%

Exhibit 2.2.7-11 NYS Route 104 / NYS Route 590 Interchange Crash Types – Off-Peak Periods		
Crash Type	Total	Percent
Rear End	45	12%
Fixed Object	174	46%
Overtaking	54	14%
Other	19	5%
Right Angle	2	1%
Right Turn	0	0%
Head On	3	1%
Sideswipe	1	<1%
Left Turn	1	<1%
Collision with Pedestrian	0	0%
Collision with Bicyclist	0	0%
Collision with Animal	77	20%
TOTAL	376	100%

Exhibit 2.2.7-12 NYS Route 104 / NYS Route 590 Interchange Predominant Crash Type by Location – PM Peak Period			
Location	Predominant Crash Type	Total	Percent of Crashes at Location
NYS Route 104 EB	Rear End	30	37%
NYS Route 104 EB – NYS Route 590 SB Ramp (Ramp W-S)	Fixed Object	1	100%
NYS Route 104 WB	Fixed Object	32	31%
NYS Route 590 NB	Rear End	96	63%
NYS Route 590 NB – NYS Route 104 EB Ramp (Ramp S-E)	NA	0	0%
NYS Route 590 NB – NYS Route 104 WB Ramp (Ramp S-W)	Rear End	5	40%
NYS Route 590 SB	Rear End	19	37%
TOTAL		183	

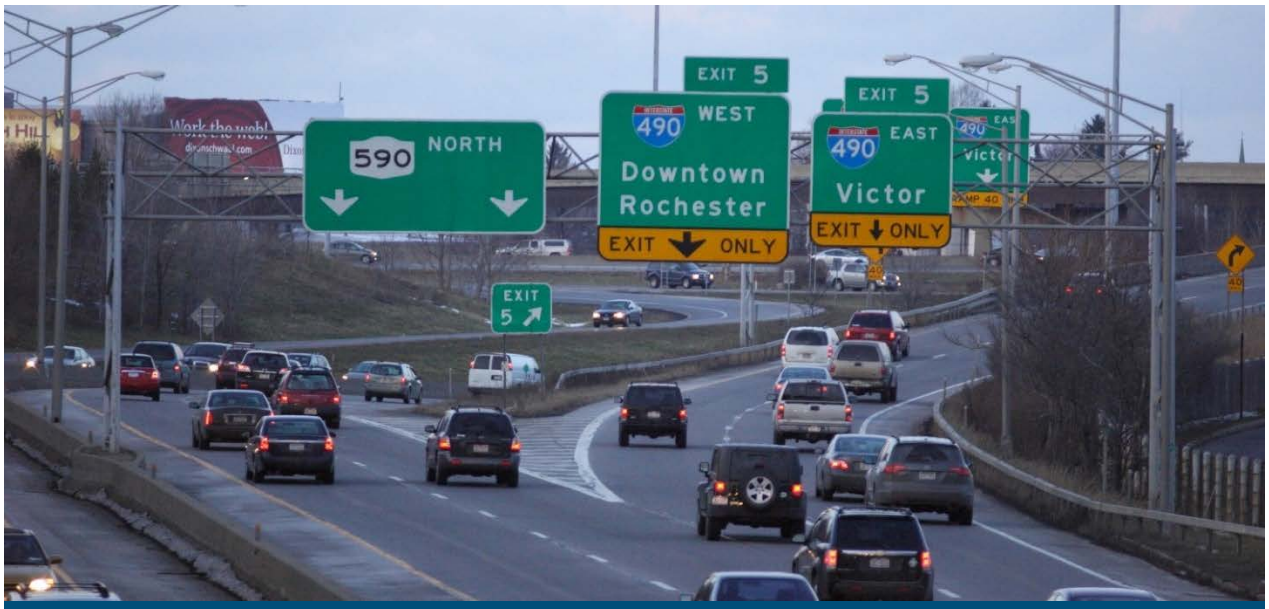
Exhibit 2.2.7-13 NYS Route 104 / NYS Route 590 Interchange Predominant Crash Type by Location – Rear Ends		
Location	Total	Percent
NYS Route 104 EB	19	11%
NYS Route 104 EB – NYS Route 590 SB Ramp (Ramp W-S)	0	0%
NYS Route 104 WB	21	13%
NYS Route 590 NB	82	49%
NYS Route 590 NB – NYS Route 104 EB Ramp (Ramp S-E)	0	0%
NYS Route 590 NB – NYS Route 104 WB Ramp (Ramp S-W)	5	3%
NYS Route 590 SB	41	24%
TOTAL	168	

Crash density maps were developed to help correlate crash patterns with congestion. Comparing the off peak versus evening peak period maps, the overall crash experience increases along NYS Route 590 NB, approaching the split to NYS Route 104. These increases are indicative of peak hour congestion. Comparing the off peak to both the morning and evening peak period maps, there was only one potentially notable area – NYS Route 104 eastbound horizontal curve within the interchange. Refer to Exhibit 2.2.7-14 through Exhibit 2.2.7-16 in Appendix C.

C. Known Safety Concerns

NYSDOT Safety Information Management System (SIMS) reports for the NYS Route 104/NYS Route 590 interchange were reviewed for the year 2019. The report listed no Priority Investigation Intersection (PIIs), Safety Deficient Locations (SDLs), or high accident locations (HALs) in the study area. Priority Investigation Locations (PILs) and Specialty PILs are summarized in Exhibit 2.2.7-17.

Exhibit 2.2.7-17 NYS Route 104 / NYS Route 590 Interchange Priority Investigation Locations (PILs) Summary			
Year	Location (Reference Markers)		Reason(s)
	Begins At	Ends At	
2019	590I 4301 3015	590I 4301 3016	General
2019*	104 4303 5202	104 4303 5205	Run Off the Road / Fixed Object
2019*	104 4303 5208	104 4303 5211	Run Off the Road / Fixed Object
2019*	104 4303 5213	104 4303 5224	Run Off the Road / Fixed Object
2019*	47 4301 3018	47 4301 3024	Run Off the Road / Fixed Object
2019*	47 4301 3028	18 4303 5011	Run Off the Road / Fixed Object
2019*	47 4301 3020	47 4301 3022	Wet Road
*Specialty Priority Investigation Location (PIL) - Unusually high concentrations of specific crash types. Data provided by NYSDOT did not break up PILs by direction.			



Section 3: Needs Assessment

The needs assessment portion of this study presents an analysis of anticipated future traffic operations in the absence of any geometric changes to the I-490/I-590/NYS Route 590 and NYS Route 104/NYS Route 590 interchanges. It also includes a needs analysis based on overlapping issues, including safety, identified during the existing conditions inventory and the results of the future no-build traffic analyses.

3.1 Estimated Time of Completion and Growth Rates for Forecasting

It is assumed, for the purposes of this study, that improvements at both interchanges will be complete within 10 years; therefore, 2031 was selected as the estimated time of completion (ETC). A design year of 2051 (ETC+20) was selected for traffic forecasting purposes, consistent with guidance in Chapter 5, Section 5.2.2.3 of the NYSDOT *Highway Design Manual*, since one or more future projects could involve physical alterations to either interchange.

Two growth scenarios were considered to account for possible changes in development patterns, employment, and personal behavior, post COVID-19:

- A “low growth” scenario assuming an average annual traffic growth rate of 0.25% per year. This represents a scenario where motor vehicle traffic volumes do not grow at the same rate one would have expected to see prior to events in the year 2020.

- A “normal growth” scenario assuming an average annual growth rate of 0.5% per year, consistent with a review of available historic traffic data, consideration of Monroe County Department of Transportation (MCDOT) recommended growth rates for neighboring towns, and discussion with the GTC and NYSDOT Region 4.

All calculations involved straight line growth (i.e., uncompounded growth) per NYSDOT Region 4 and MCDOT. Together, these two scenarios present a lower and upper bound to assess projected future traffic operations at each interchange and eventually test the feasibility of potential future alterations that address identified issues.

3.2 I-490 / I-590 / NYS Route 590 Interchange

3.2.1 No-Build Traffic Volumes

A. Daily Traffic Volumes

Daily traffic estimates within the I-490/I-590/NYS Route 590 interchange study area are summarized in Exhibit 3.2.1.A-1.

Exhibit 3.2.1.A-1
I-490 / I-590 / NYS Route 590 Interchange
Projected Future Daily Volumes

Roadway	Base Data	Low Growth Scenario		Normal Growth Scenario	
	2019 (Estimated)	2031 (ETC)	2051 (ETC+20)	2031 (ETC)	2051 (ETC+20)
I-490	76,000	78,300	82,100	80,550	88,150
I-590	101,000	104,000	109,100	107,100	117,150
NYS Route 590	120,000	123,600	129,600	127,200	139,200

B. Peak Hour Traffic Volumes

Average weekday morning and evening peak hour volumes were developed for 2031 (ETC) and 2051 (ETC+20) for both the low and normal growth scenarios. Volumes throughout the interchange are shown on Exhibit 3.2.1.A-2 through Exhibit 3.2.1.A-5 in Appendix C.

3.2.2 No-Build Traffic Operations

VISSIM (Version 11) was used to model the I-490/I-590/NYS Route 590 interchange under future no-build conditions in ETC and ETC+20 for both the low and normal growth scenarios. Measures of effectiveness including density, LOS, average vehicular speed, travel time, and total hours of vehicle delay were extracted from the microsimulation runs and averaged for comparison among each growth scenario. Densities were converted to LOS based on HCM definitions.

A. Morning Peak Hour

Tabulated results of traffic operations analyses for 2031 and 2035 no-build morning peak hour conditions within the I-490/I-590/NYS Route 590 interchange under the low and normal growth scenarios are available in Appendix C, Exhibit 3.2.2.A-1 through Exhibit 3.2.2.A-4. Congestion is projected to increase over time on southbound NYS Route 590 approaching the I-490 interchange and on I-590 approaching the merge with Ramp WS. Traffic densities are anticipated to exceed capacity on approach to Ramp WS by 2031 under the normal growth scenario and by 2051 under both the low and normal growth scenarios. The remainder of the interchange is generally projected to continue to provide acceptable operations (LOS D or better).

B. Evening Peak Hour

Tabulated results of traffic operations analyses for 2031 and 2035 no-build evening peak hour conditions within the I-490/I-590/NYS Route 590 interchange under the low and normal growth scenarios are available in Appendix C, Exhibit 3.2.2.B-1 through Exhibit 3.2.2.B-4. As during the morning, many areas throughout the interchange are projected to operate at LOS D or better. Higher densities (LOS E, at capacity) are projected to continue on I-490 eastbound west of the Winton Road underpass, northbound between Highland Drive and the Ramp NEW diverge, and on NYS Route 590 through the weave connecting Ramp WN and Ramp BRN, culminating with densities that exceed capacity (LOS F) in the latter two areas by 2051 under the normal growth scenario.

C. Travel Times and Vehicle Hours of Delay

Exhibit 3.2.2.C-1 through Exhibit 3.2.2.C-4 in Appendix C summarize anticipated travel times along I-490 and I-590/NYS Route 590 in 2031 and 2051 under the low and normal growth scenarios. As illustrated in Exhibit 3.2.2.C-5, the following trips are likely most affected by increasing congestion within the interchange over time, in order of increasing impact:

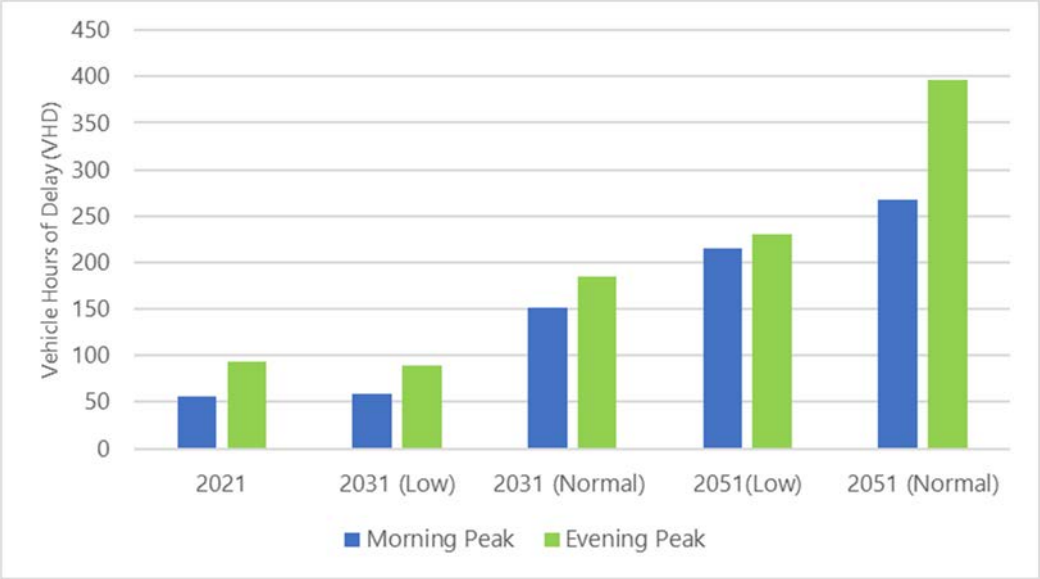
- I-490 eastbound during the evening peak hour
- NYS Route 590 northbound during the evening peak hour
- NYS Route 590/I-590 southbound during the morning peak hour

Exhibit 3.2.2.C-5
I-490 / I-590 / NYS Route 590 Interchange
No-Build - Projected Changes in Travel Time

Morning Peak	Year and Growth Scenario			
	2031 (Low)	2031 (Normal)	2051 (Low)	2051 (Normal)
I-490 Eastbound	0%	0%	0%	0%
I-490 Westbound	0%	0%	0%	0%
I-590/NYS Route 590 Northbound	0%	0%	0%	0%
NYS Route 590/I-590 Southbound	+40%	+40%	+60%	+90%
Evening Peak	2031 (Low)	2031 (Normal)	2051 (Low)	2051 (Normal)
I-490 Eastbound	0%	+25%	+25%	+50%
I-490 Westbound	0%	0%	0%	0%
I-590/NYS Route 590 Northbound	0%	+20%	+20%	+70%
NYS Route 590/I-590 Southbound	0%	0%	0%	0%

Exhibit 3.2.2.C-6 summarizes the anticipated change in vehicle hours of delay throughout the interchange for each year and growth scenario. The anticipated increases in delay are generated by those areas experiencing more congestion and longer trips.

Exhibit 3.2.2.C-6: I-490/I-590/NYS Route 590 Interchange
Projected Changes in Vehicle Hours of Delay



3.2.3 Needs Assessment

Together Exhibit 3.2.3-1 and Exhibit 3.2.3-2 summarize identified issues at the I-490/I-590/NYS Route 590 interchange based on the existing conditions inventory and future no-build traffic analyses. Four key areas stand out as deserving of further consideration in the concept development phase of this study to address operational considerations:

- I-590 southbound approaching the merge with Ramp WS and the lane addition at Ramp ES
- NYS Route 590 northbound approaching the weave between Ramp WN and Ramp BRN
- I-490 eastbound west of the Winton Road overpass
- NYS Route 590 southbound approaching the I-490 interchange

North

Blossom Rd

590

Winton Rd

CSX Railroad

East Ave

Highland Ave

Penfield Rd

INTERSTATE 490

INTERSTATE 590

INTERSTATE 490

1 2 3 4 5 6 7 8 9 10 11 12 13 14

Crash Hot Spot 2015-2019

NYSDOT PIL for run off the road and fixed object collisions

Note: Refer to Exhibit 3.2.3-2 for additional information

Exhibit 3.2.3-2 I-490 / I-590 / NYS Route 590 Interchange – Summary of Identified Issues	
Location	Description
1	This location covers NYS Route 590 southbound approaching ramps SW and SE. This was the site of a crash hot spot in 2015-2019. Congestion is believed to be a factor in rear-end crashes. The current travel time index is in the range of 1.6 to 1.9 and is indicative of congestion. Morning peak hour traffic densities are currently at capacity (LOS E) and anticipated to remain so throughout 2051 under all growth scenarios.
2	This location covers NYS Route 590 southbound approaching ramp WS. It was the site of a crash hot spot in 2015-2019 and overlaps with a NYSDOT Priority Investigation Location (PIL) associated with an unusual number of fixed object and run off the road incidents between reference markers 590 4301 1000 and 590 4301 1003. Congestion is believed to be a factor in rear-end crashes. The current travel time index is in the range of 2.0 to 2.5 and is indicative of congestion in the morning peak. Morning peak hour motorists typically move into the left lane in order to avoid conflicts with merging vehicles downstream. This may also be influencing upstream operations in Location 1.
3	This location covers I-590 southbound at the merge with Ramp WS. The current travel time index is 1.6 to 2.0 and is indicative of congestion in the morning peak. This may also be influencing upstream operations in Locations 1 and 2. Approximately 1,300 to 1,400 vehicles per hour are projected to merge with 3,600 to 4,000 vehicles per hour during the morning peak by 2051. The combined total is between 4,900 and 5,400 vehicles per hour or an average of 2,450 to 2,700 vehicles per lane, which exceeds a theoretical capacity of 2,300 vehicles per lane. Morning peak hour traffic densities are currently at capacity (LOS E). Demand is expected to exceed capacity (LOS F) under the normal growth scenario by 2031 and under all growth scenarios by 2051.
4	This location covers I-590 southbound approaching the merge with Ramp ES. The current travel time index is 1.6 to 2.0 and is indicative of congestion in the morning peak. This may also be influencing upstream operations in Locations 1, 2, and 3. Between 4,900 and 5,400 vehicles per hour are expected in this segment during the morning peak by 2051. Traffic densities are anticipated to reach capacity (LOS E) by 2031 and remain at that level throughout 2051 under all growth scenarios.
5	This location covers I-590 northbound approaching Ramp NEW (to I-490 eastbound and westbound). The current travel time index is 1.6 to 2.0 and is indicative of evening peak hour congestion. This area currently has densities at capacity (LOS E) during the evening peak hour and is expected to continue to do so throughout 2051 under all growth scenarios.
6	The NYSDOT has identified a PIL on NYS Route 590 associated with an unusual number of run off the road and fixed object collisions in the 3/10-mile long segment between reference markers 590 4301 1000 and 590 4301 1003. Congestion is believed to be a factor in rear-end crashes. This area overlaps with a stretch expected to reach capacity (LOS E) by 2051 under a low growth scenario and exceed capacity (LOS F) under a normal growth scenario. This PIL also overlaps with the area described in Location 7.

Exhibit 3.2.3-2 I-490 / I-590 / NYS Route 590 Interchange – Summary of Identified Issues	
Location	Description
7	This is the 1,150-foot long weaving area along NYS Route 590 between Ramp WN and Ramp BRN. This segment overlaps with a portion of the PIL identified in Location 6. Congestion is believed to be a factor in rear-end crashes. The current travel time index is 1.1 to 1.3. This area currently operates at capacity (LOS E) during the evening peak hour. Congestion may also be influencing Location 5. It is anticipated to remain at LOS E through 2051 under a low growth scenario; however, under the normal growth scenario it is projected to exceed capacity (LOS F) by 2051. This weaving area is projected to carry just over 8,600 vehicles per hour during the evening peak by 2051 which equates to an average of 2,150 vehicles per lane . The effects of poor operation here are also expected to be felt upstream, contributing to LOS E and LOS F conditions identified in Location 6.
8	The segment of NYS Route 590 north of Ramp BRN to Blossom Road anticipated to operate at LOS E by the year 2051 in the evening peak hour under all growth scenarios. This three-lane section would be carrying between 7,300 and 8,200 vehicles per hour during that timeframe. Poor operations may also impact flow in Locations 5, 6, and 7.
9	I-490 westbound has four travel lanes between Ramp PW from Penfield Road and Ramp WNS to I-590 and NYS Route 590. At the end of this 1,275-foot long segment the second lane from the right allows vehicles to either continue on I-490 or exit toward I-590 southbound. This area currently has a travel time index between 1.3 and 2.0 during the evening peak and is a familiar point of congestion for area commuters. It was the site of a crash hot spot in 2015-2019. Some congestion may also be influenced by slowdowns on Ramp WN. Congestion is believed to be a factor in rear-end crashes. Traffic densities on this link are projected to reach capacity (LOS E) by 2051 under a normal growth scenario.
10	Ramp WN is anticipated to reach capacity (LOS E) and to continue to operate at that level throughout 2051 under all growth scenarios. This could be a byproduct of congestion in the downstream weaving area on NYS Route 590 (Locations 7 and 8).
11	There was a crash hot spot on I-490, just beyond the merge with Ramp SW, in 2015 to 2019. This falls within the 1,100-foot long weave between Ramp SW and Ramp UAW. This location also overlaps with a PIL identified in Location 12.
12	NYSDOT has identified a Priority Investigation Location (PIL) on I-490 associated with an unusual number of run off the road and fixed object collisions in the 7/10-mile long segment between reference markers 490I 4310 2066 and 490I 4301 3003. This overlaps with the crash hot spot identified in the westbound direction at Location 11.

Exhibit 3.2.3-2 I-490 / I-590 / NYS Route 590 Interchange – Summary of Identified Issues	
Location	Description
13	I-490 eastbound currently operates at capacity (LOS E) in the area west of the Winton Road overpass during the evening peak hour. All vehicles in this area destined for I-590 or NYS Route 590 must position themselves in the right-hand lane. This causes them to mix with any traffic exiting to Winton Road. LOS E conditions are anticipated to continue through 2031 under both a low and normal growth scenario. Densities are expected to exceed capacity (LOS F) by 2051 under any growth scenario. Evening peak hour volumes are projected in the range of 5,900 to 6,700 vehicles per hour in this area.
14	There was a crash hot spot on I-490 eastbound between the merge with Ramp SE from NYS Route 590 southbound and Ramp PE to Penfield Road. This is a 950-foot long weaving area.

3.3 NYS Route 104 / NYS Route 590 Interchange

3.3.1 No-Build Traffic Volumes

A. Daily Traffic Volumes

Daily traffic estimates within the NYS Route 104/NYS Route 590 interchange study area are summarized in Exhibit 3.3.1.A-1.

Exhibit 3.3.1.A-1 NYS Route 104 / NYS Route 590 Interchange Projected Future Daily Volumes					
Roadway	Base Data	Low Growth Scenario		Normal Growth Scenario	
	2019 (Estimated)	2031 (ETC)	2051 (ETC+20)	2031 (ETC)	2051 (ETC+20)
NYS Route 104	70,000	72,100	75,600	74,200	81,200
NYS Route 590 (South of NYS Route 104 Interchange)	93,000	95,800	100,450	98,600	107,900
NYS Route 590 (Ridge Road Interchange)	14,000	14,450	15,150	14,850	16,250
NYS Route 590 (North of Ridge Road)	8,000	8,250	8,650	8,500	9,300

B. Peak Hour Traffic Volumes

Average weekday morning and evening peak hour volumes were developed for 2031 (ETC) and 2051 (ETC+20) for both the low and normal growth scenarios. Volumes throughout the interchange are shown on Exhibit 3.3.1.A-2 through Exhibit 3.3.1.A-5 in Appendix C.

3.3.2 No-Build Traffic Operations

VISSIM (Version 11) was used to model the NYS Route 104/NYS Route 590 interchange under future no-build conditions in ETC and ETC+20 under both the low and normal growth scenarios. Measures of effectiveness including density, LOS, average vehicular speed, travel time, and total hours of vehicle delay were extracted from the microsimulation runs and averaged for comparison to the existing values and among each growth scenario. Densities were converted to LOS based on HCM definitions.

A. Morning Peak Hour

Tabulated results of traffic operations analyses for 2031 and 2035 no-build morning peak hour conditions within the NYS Route 104/NYS Route 590 interchange under the low and normal growth scenarios are available in Appendix C, Exhibit 3.3.2.A-1 through Exhibit 3.3.2.A-4. Traffic densities are projected to remain at or below LOS C throughout the year 2051 under all growth scenarios.

B. Evening Peak Hour

Tabulated results of traffic operations analysis for 2031 and 2035 no-build evening peak hour conditions within the NYS Route 104/NYS Route 590 interchange under the low and normal growth scenarios are available in Appendix C, Exhibit 3.3.2.B-1 through Exhibit 3.3.2.B-4. As during the morning, most areas are anticipated to continue to have adequate, if not more than enough, capacity to handle the projected motor vehicle demand at LOS D or better. Densities over capacity (LOS F) are projected to occur on the northbound NYS Route 590 approach to the Ramp S-W diverge in 2051 under the normal growth scenario. The 2-lane segment beween Ramp S-W and Ramp S-E is projected to operate at capacity with LOS E in the same scenario.

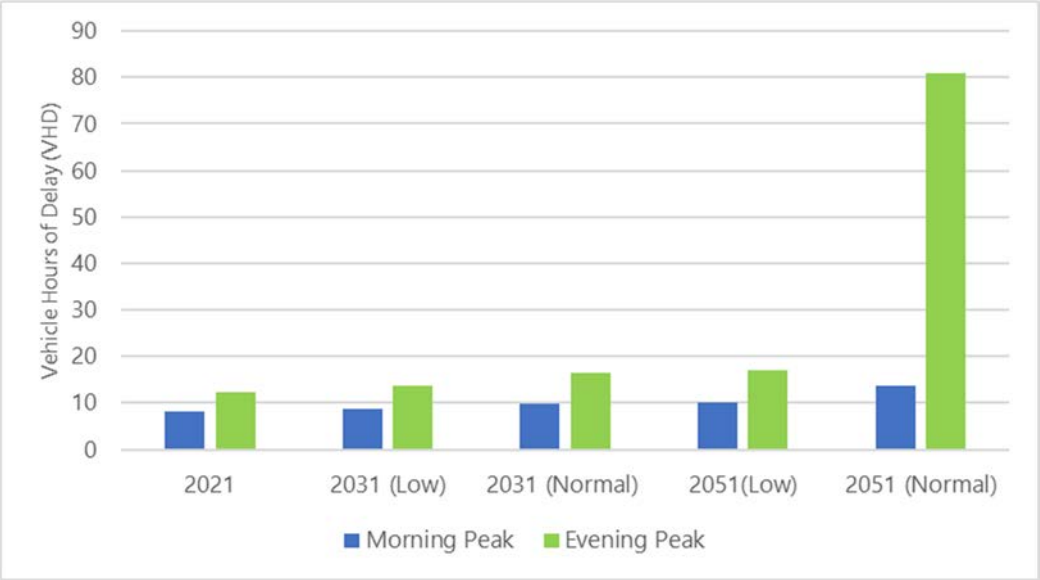
C. Travel Times and Vehicle Hours of Delay

Exhibit 3.3.2.C-1 through Exhibit 3.3.2.C-4 in Appendix C summarize anticipated travel times along I-490 and I-590/NYS Route 590 in 2031 and 2051 under the low and normal growth scenarios. As illustrated in Exhibit 3.3.2.C-5, no changes in relative travel time are anticipated until 2051 on northbound NYS Route 590 under the normal growth scenario. These trips would pass through the area expected to operate at or above capacity.

Exhibit 3.3.2.C-6 summarizes the anticipated change in vehicle hours of delay throughout the interchange for each year and growth scenario. Nominal changes in delay are projected with the exception of the 2051 evening peak hour. This would be as a result of the at or over capacity operations on NYS Route 590 approaching and through the Ramp S-W diverge.

Exhibit 3.3.2.C-5 NYS Route 104 / NYS Route 590 Interchange No-Build - Projected Changes in Travel Time				
Morning Peak	Year and Growth Scenario			
	2031 (Low)	2031 (Normal)	2051 (Low)	2051 (Normal)
NYS Route 104 Eastbound	0%	0%	0%	0%
NYS Route 104 Westbound	0%	0%	0%	0%
NYS Route 590 Northbound	0%	0%	0%	0%
NYS Route 590 Southbound	0%	0%	0%	0%
Evening Peak	2031 (Low)	2031 (Normal)	2051 (Low)	2051 (Normal)
NYS Route 104 Eastbound	0%	0%	0%	0%
NYS Route 104 Westbound	0%	0%	0%	0%
NYS Route 590 Northbound	0%	0%	0%	+33%
NYS Route 590 Southbound	0%	0%	0%	0%

Exhibit 3.3.2.C-6: NYS Route 104/NYS Route 590 Interchange
Projected Changes in Vehicle Hours of Delay



3.3.3 Needs Assessment

Together Exhibit 3.3.3-1 and Exhibit 3.3.3-2 summarize identified issues at the NYS Route 104/NYS Route 590 interchange based on the existing conditions inventory and future no-build traffic analyses. One key area stands out as deserving of further consideration in the alternative development phase of this study to address operational considerations:

- NYS Route 590 northbound approaching Ramp S-W and Ramp S-E

North

MATCH LINE

6

7

2

1

104

590

Overhead sign with peeling legend

Culver Rd

Norton St

Crash Hot Spot 2015-2019

NYSDOT PIL for run off the road and fixed object collisions

Note: Refer to Exhibit 3.3.3-2 for additional information

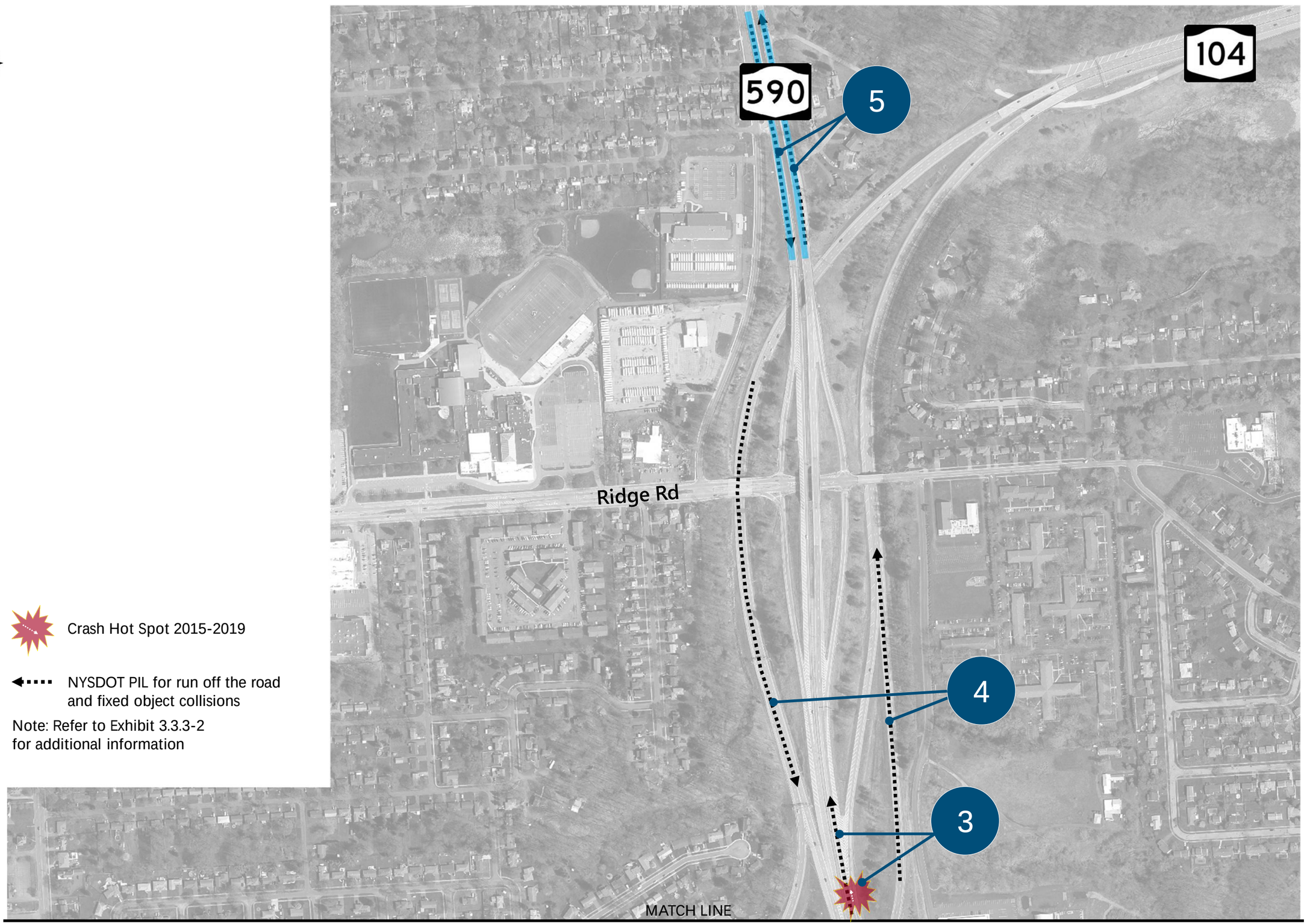
GTC | NEW YORK STATE OF OPPORTUNITY. Department of Transportation | BERGMANN ARCHITECTS ENGINEERS PLANNERS

EXHIBIT 3.3.3-1: NYS ROUTE 104/NYS ROUTE 590 INTERCHANGE: IDENTIFIED ISSUES (SOUTH)

UPWP 7952: Ramp Reconfiguration Study

June 2021

North



Crash Hot Spot 2015-2019

NYSDOT PIL for run off the road and fixed object collisions

Note: Refer to Exhibit 3.3.3-2 for additional information

Exhibit 3.3.3-2 NYS Route 104 / NYS Route 590 Interchange – Summary of Identified Issues	
Location	Description
1	This location covers NYS Route 590 on approach to the diverge with Ramp S-W to NYS Route 104 westbound. This was the site of a crash hot spot in 2015-2019. It is also the site of a PIL covering reference markers 47 4301 3018 to 47 4301 3024 with an unusually high concentration of run off the road and fixed object incidents. Congestion is believed to be a factor in rear-end crashes. Evening peak hour traffic densities are anticipated to exceed capacity (LOS F) in 2051 under a normal growth scenario. Over 5,400 vehicles per hour are anticipated in the three-lane segment (before a fourth lane is added) for an average of about 1,350 vehicles per lane. Vehicular speeds are predicted to fall to the range of 30 miles per hour during the peak. Motorists destined for NYS Route 104 westbound must move into the right lane, motorists headed for NYS Route 104 eastbound typically get into the center lane, and any traffic headed toward Sea Breeze Drive can use the far left or center lane, resulting in numerous lane changes.
2	Location 2 is also on NYS Route 590 northbound, within and just north of the diverge with Ramp S-W to NYS Route 104 westbound. Traffic densities are anticipated to be at capacity (LOS E) under a normal growth scenario in 2051. The projected volume is just over 3,500 vehicles per hour for an average of 1,750 vehicles per lane across the existing two-lane segment. The right lane actually carries heavier volume as 60% (+/- 1,900 vph) of the traffic approaching the diverge during the evening peak hour is destined for NYS Route 104 while the other 40% heads north on NYS Route 590. This area also overlaps with the PIL discussed in Location 1.
3	Location 3 includes the diverge between NYS Route 590 and Ramp S-E to NYS Route 104 eastbound. It covers the northern end of the PIL spanning Locations 1 and 2. Congestion is believed to be a factor in rear-end crashes. It also includes a crash hot spot from 2015-2019. More than 60% of evening peak hour traffic exits NYS Route 590 and heads east on NYS Route 104 while the remaining 40% continues north toward the Ridge Road interchange or Sea Breeze Drive. Volumes on the single lane ramp are near capacity.
4	Location 4 is a PIL on NYS Route 104 between reference markers 104 4303 5208 and 104 4303 5211. It features an unusually high concentration of run off the road and fixed object crashes. In the eastbound direction this covers the approach to the major merge between NYS Route 104 eastbound and Ramp S-E. In the westbound direction this includes the curvilinear segment of NYS Route 104 westbound from the NYS Route 590 overpass, under Ridge Road, and to the NYS Route 104/NYS Route 590 split. Drivers must choose the proper lane for their destination while negotiating the curve. Those wanting to stay on NYS Route 104 westbound must also decelerate in preparation to negotiate the upcoming clockwise turn marked with an advisory speed of 45 miles per hour and slippery when wet signage.

Exhibit 3.3.3-2 NYS Route 104 / NYS Route 590 Interchange – Summary of Identified Issues	
Location	Description
5	Peak hour volumes drop substantially on NYS Route 590, north of the NYS Route 104 interchange. This area is noted as Location 5. The roadway generally has two through travel lanes in each direction. While the road retains a freeway-like character, this is also a transition zone between the interstate class roadways to the south and Sea Breeze Drive, a boulevard, to the north. There is one at-grade, right-in and right-out intersection in each direction with no access across the median. In the northbound direction the next intersection is the Titus Avenue roundabout where the left lane must turn left and traffic in the right lane can continue straight or turn right. This area includes a PIL with an unusually high concentration of run off the road and fixed object incidents between reference markers 47 4301 3028 and 18 4303 5011. Traffic densities are projected to remain low throughout 2051 under all growth scenarios, resulting in LOS A or LOS B conditions even during peak periods.
6	The NYSDOT has identified a PIL on NYS Route 104 associated with an unusual number of run off the road and fixed object collisions in the 3/10-mile long segment between reference markers 104 4303 5202 and 104 4303 5205. In the eastbound direction this includes the approach to Ramp E-S. In the westbound direction it includes the approach to the Culver Road exit. Peeling legends were noted on the overhead sign at the Ramp E-S gore during field investigations in early 2021.
7	Location 7 is a crash hot spot in 2015-2019 located on the horizontal curve on NYS Route 104 as it passes over NYS Route 590. This connector is projected to carry approximately 1,300 and 2,350 vehicles per hour in the morning and evening peak hours, respectively, under normal growth conditions. This area is also on approach to the PIL identified in Location 4.

Section 4: Conceptual Alternatives

This portion of the study focused on the development of conceptual alternatives to address identified needs at the I-490/I-590/NYS Route 590 and NYS Route 104/NYS Route 590 interchanges. The goal was to develop and assess changes to portions of each interchange as opposed to coming up with ideas requiring full reconfiguration. Comments made by the GTC, NYSDOT, and steering committee were considered and addressed during alternative development.

4.1 Conceptual Alternatives

4.1.1 Overview

A total of 8 different conceptual alternatives were developed in response to specific requests in the study's scope (as described in the bullets below) and locations with substantial overlapping operational and safety needs identified in Section 3 of this report.

- Reconfiguring merging conditions where Ramp ES from I-490 eastbound and Ramp WS from I-490 westbound meet mainline NYS Route 590 at the I-490/I-590/NYS Route 590 interchange; and
- Reconfiguring the number of lanes on Ramp S-E and the EB Connector at the NYS Route 104/NYS Route 590 Interchange from one to two and two to one, respectively.

Horizontal geometry and lane layout were developed using design criteria contained in the NYSDOT *Highway Design Manual* (HDM), Chapter 2. The conceptual alternatives are illustrated in Exhibit 4.1.1-1 through Exhibit 4.1.1-6. They can also be found in Appendix E. Each graphic summarizes operational considerations that precipitated development, a brief description, notes regarding potential constructability and environmental considerations for future design, and a planning level cost estimate. The construction cost estimates were developed to facilitate future project programming activities. They include a contingency for unknown or unforeseen elements of work and other foreseeable costs including work zone traffic control, survey, contractor mobilization, etc. Construction cost estimates do not cover environmental mitigation or remediation, permitting, property acquisitions, reimbursable utility relocations, or engineering activities. A summary of the construction cost estimates can be found in Appendix E.

North

A new auxiliary lane would begin at the end of the Culver Road on-ramp to I -490 EB.

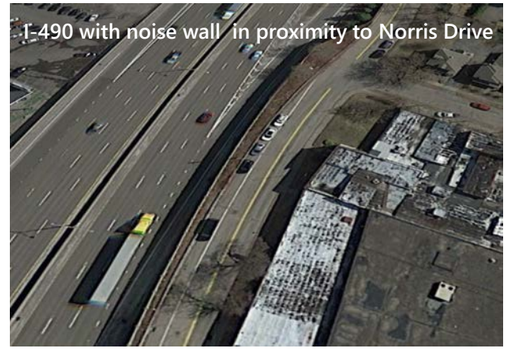
Reconstruction or replacement of a portion of the existing pedestrian overpass is likely needed. An existing pier south of I-490 would be impacted by roadway widening.

Impacts to an existing noise wall and parking lane along the northern edge of Norris Drive are also anticipated. Coordination with the City of Rochester would be necessary.

Norris Dr

INTERSTATE 490

MATCH BELOW



MATCH ABOVE

University Ave

INTERSTATE 490

Norris Dr

New parallel deceleration lane for Winton Road off ramp.

Winton Rd

The new auxiliary lane would end at the off-ramp to I-590 southbound.

Impacts to the existing noise wall and a portion of Norris Drive are anticipated. This segment of Norris Drive could potentially be changed to one-way if there isn't adequate room to maintain two-way travel.

INTERSTATE 590

1 Auxiliary lane along I-490 eastbound from Culver Road to I-590

Operational Considerations: Eastbound I-490 currently operates at capacity (LOS E) during the evening peak hour. All vehicles destined for I-590 or NYS Route 590 must use the right lane, mixing with traffic exiting to Winton Road. LOS E conditions are anticipated to continue through 2031 and degrade to LOS F by 2051 under both the low and normal growth scenarios.

Conceptual Alternative: This concept would add a full auxiliary lane to I-490 eastbound. After construction, this area would continue to operate at or below capacity (LOS E or LOS D) during the evening peak throughout the year 2051 under all growth scenarios.

Constructability Considerations: There is limited space between I-490 eastbound and Norris Drive from Hillside Avenue to Winton Road. An existing pedestrian overpass, noise wall, overhead sign structure, and Norris Drive itself would be impacted by the proposed widening. The loss of parking along Norris Drive or the conversion of a segment of that roadway to one-way eastbound travel could be a concern for adjacent residents and businesses. Coordination with the City of Rochester and utility companies would be necessary to progress this alternative.

Environmental Considerations: No appreciable concerns unless property were needed from Cobbs Hill Park. That would invoke Section 4(f). Cobbs Hill Park is not on the Section 6(f) list, but the designer should consult with NYSORP. Any noise impacts to the park could also be of concern.

Planning-Level Construction Cost Estimate: $18.5 million

2 Switch the merge along I-590 southbound from Ramp WS to Ramp ES

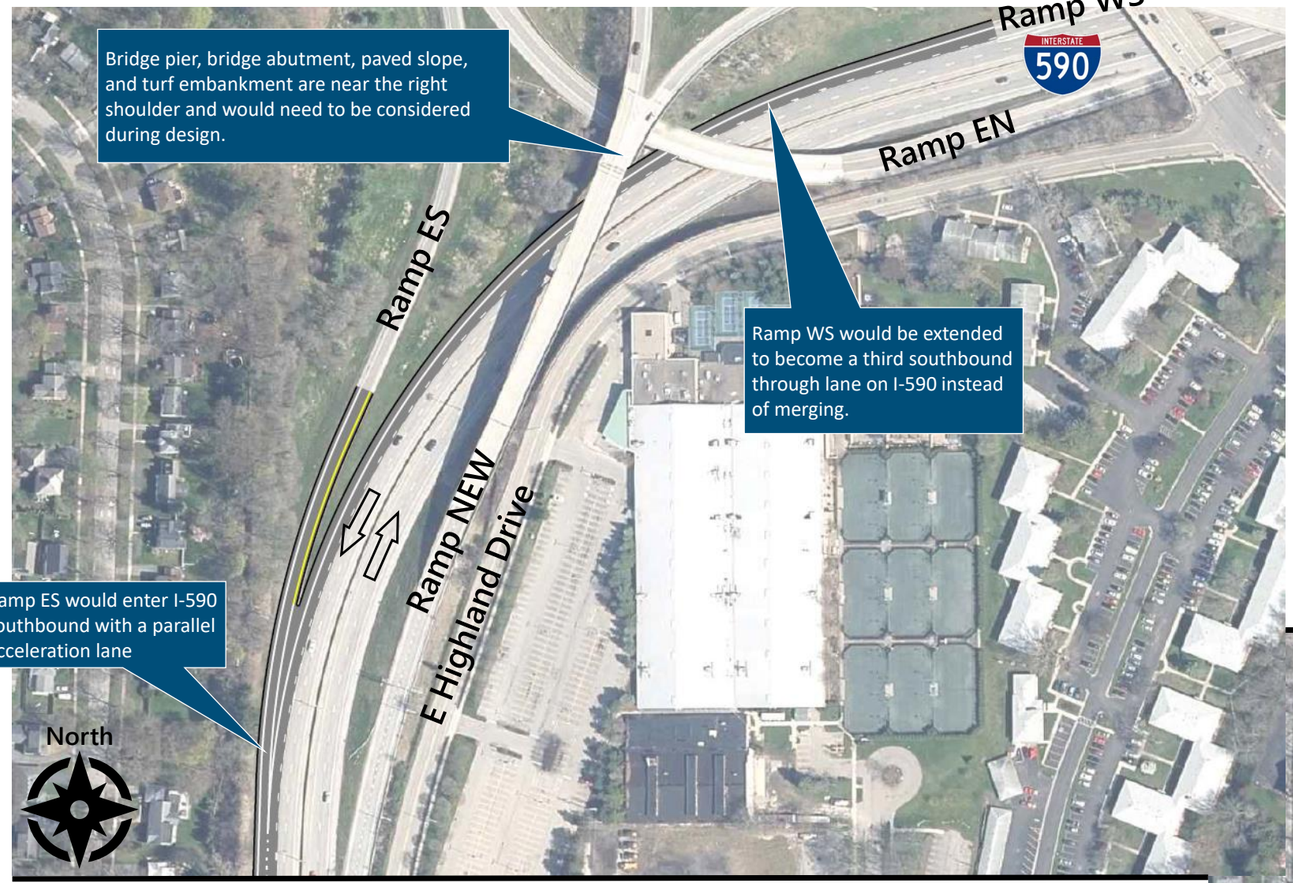
Operational Considerations: Morning peak hour congestion occurs on I-590 southbound as drivers approach the Ramp WS merge from I-490 westbound. Upstream motorists on I-590 tend to move into the center lane to avoid up to 1,200 merging vehicles over a typical morning peak hour. That volume is more than twice the volume entering on Ramp ES during the same timeframe (550 vph). The merge currently operates at capacity (LOS E) and is expected to exceed capacity (LOS F) as volumes grow throughout 2031 to 2051.

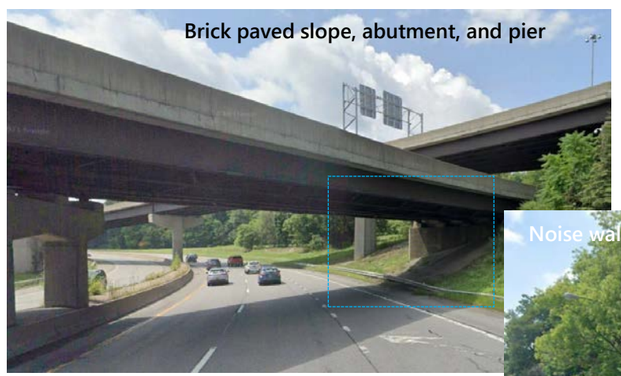
Conceptual Alternative: This concept provides vehicles entering I-590 from I-490 westbound (Ramp WS) their own travel lane. Ramp ES would feed into a 1,000-foot parallel acceleration lane, ending just north of the Highland Avenue overpass. This change would provide adequate capacity (LOS D) throughout 2051 under all growth scenarios. I-590 traffic approaching Ramp WS would no longer have to move into the center lane, reducing upstream lane changing and congestion.

Constructability Considerations: Today Ramp WS begins to taper into I-590 southbound beneath Ramps EN and NEW. There is a paved slope, bridge abutment, and a bridge pier located near the right shoulder. There is also a grade difference between I-590 southbound and Ramp ES as they approach each other. New barrier, possibly combined with a short retaining wall, may be needed in these areas. In addition, there is an existing noise wall between I-590 and the adjacent Hillside Avenue neighborhood that should be evaluated for possible structural and/or functional impacts in conjunction with widening to install a new parallel acceleration lane for Ramp ES.

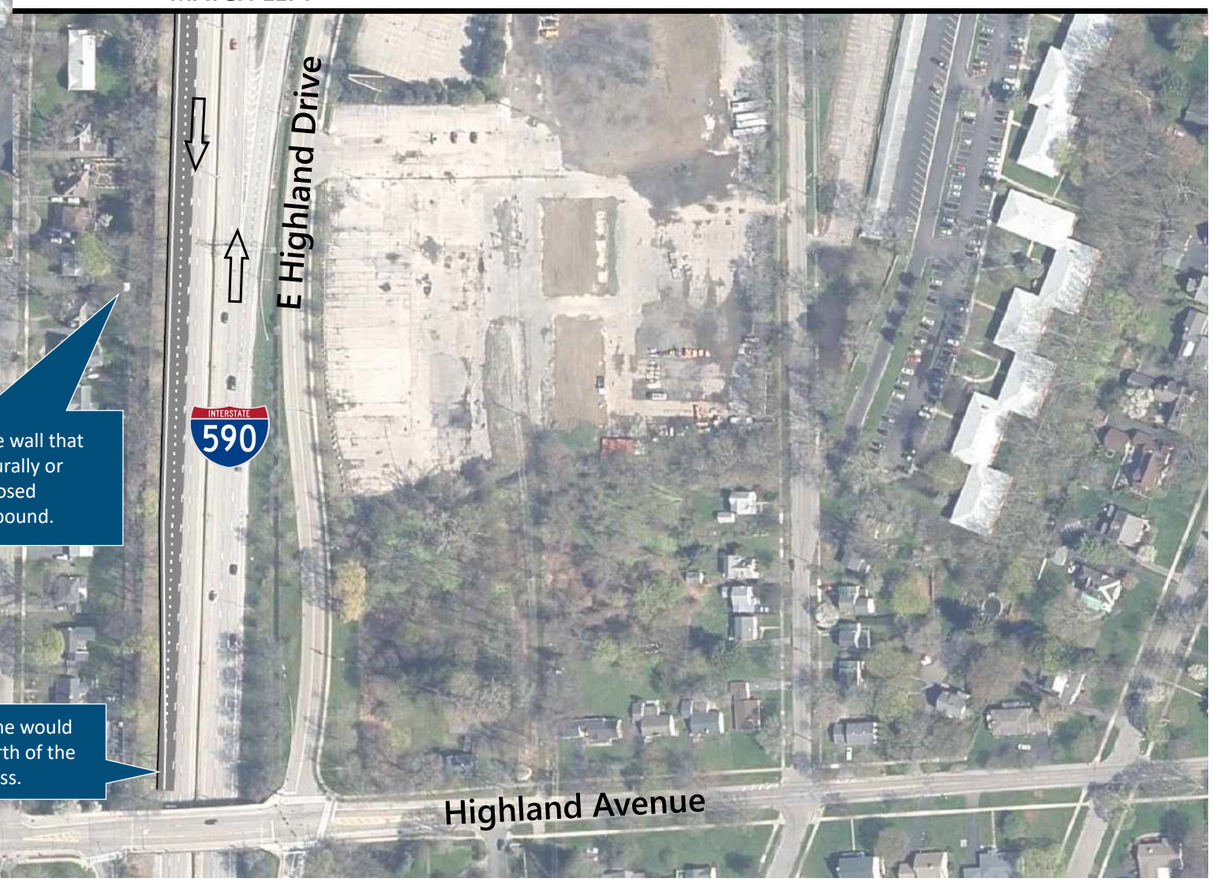
Environmental Considerations: Homes along the west side of I-590 are eligible for inclusion on the National Register of Historic Places, but they are currently separated from the highway by noise barriers.

Planning-Level Construction Cost Estimate: $5.30 million





MATCH LEFT



3 Additional southbound lane from Browncroft Boulevard to the I-490/NYS Route 590 split

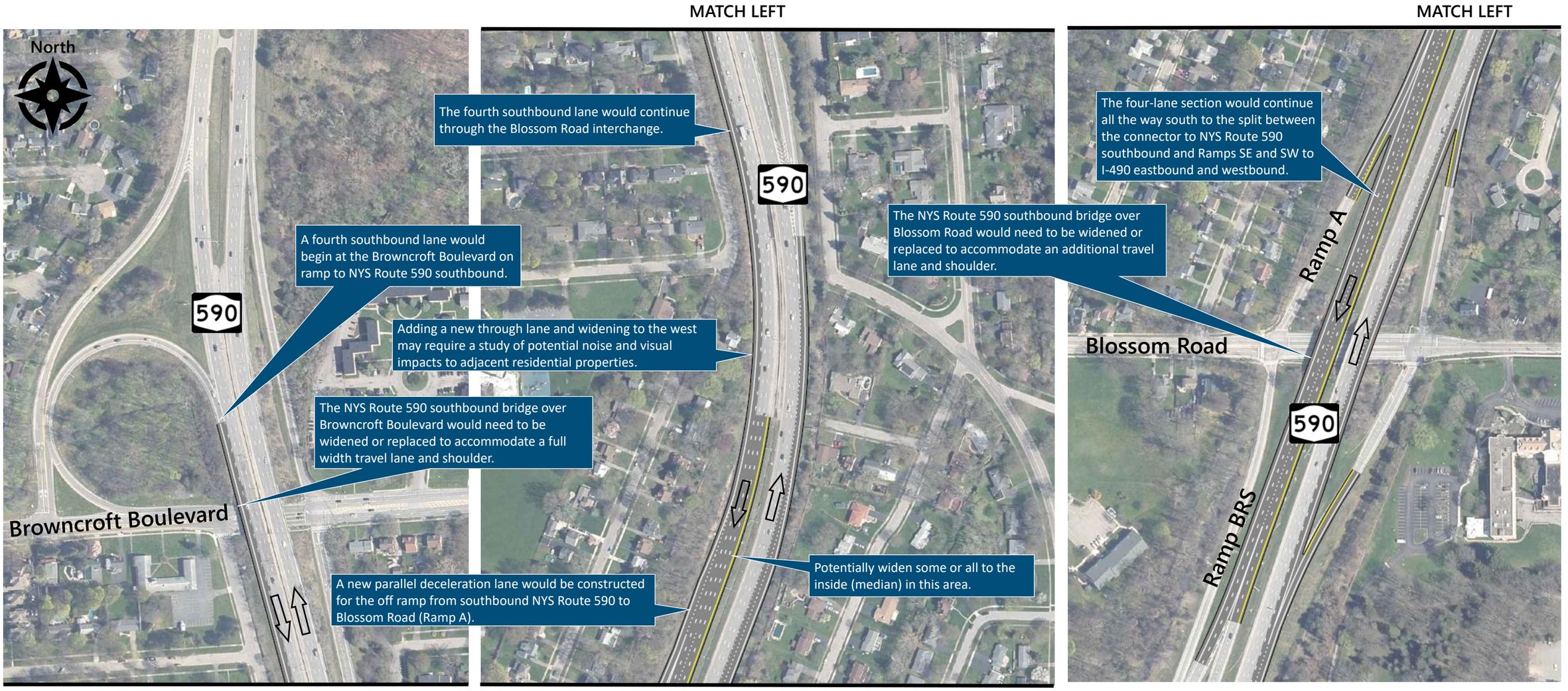
Operational Considerations: This segment of NYS Route 590 features recurring morning peak hour congestion. Traffic densities are currently at capacity (LOS E) and are projected to exceed capacity (LOS F) by 2031 and into 2051.

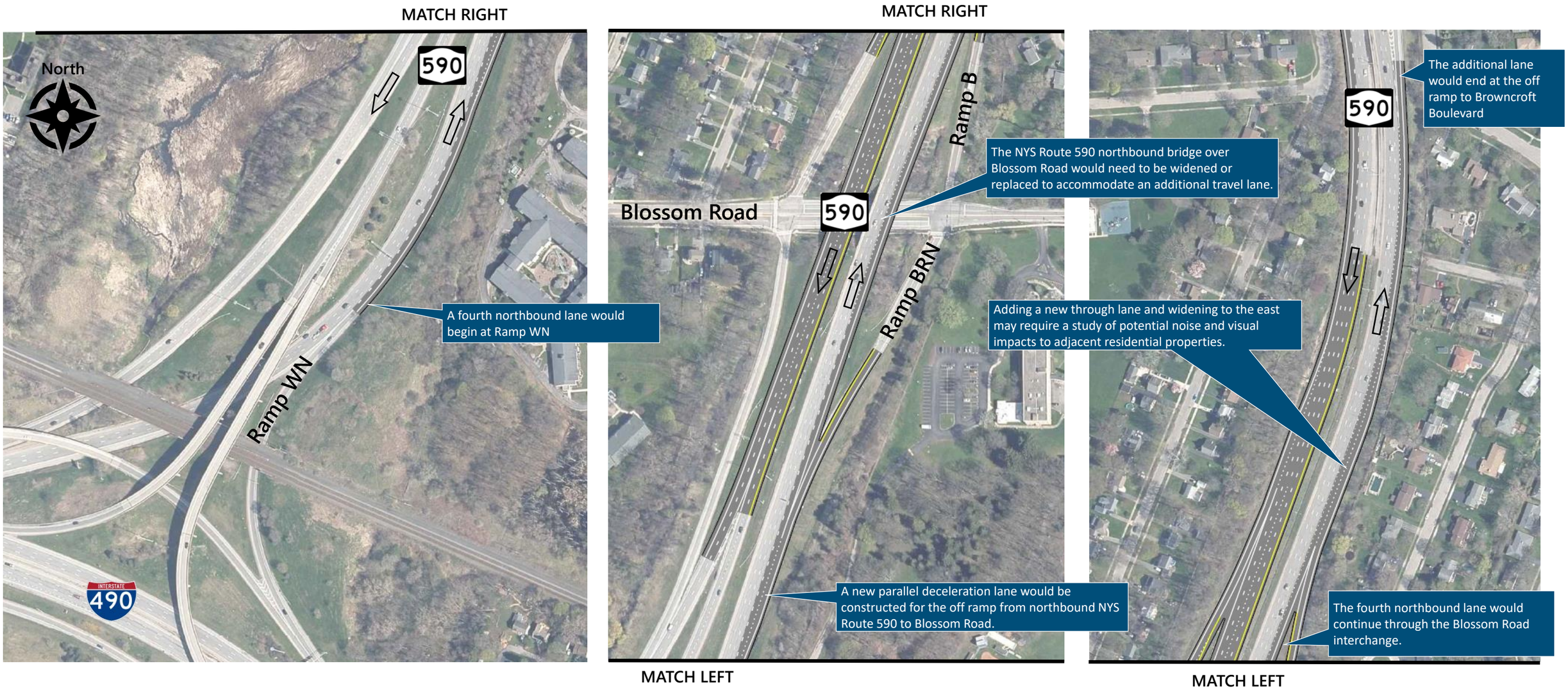
Conceptual Alternative: Concept 3 would add a fourth southbound travel lane to NYS Route 590 from the Browncroft Boulevard on-ramp to the I-490/NYS Route 590 split. The concept would also involve the construction of a new parallel deceleration lane for Ramp A connecting NYS Route 590 southbound to Blossom Road. The addition of this lane would improve operations throughout the year 2051 under all growth scenarios to LOS D or better (below capacity) during the morning peak hour.

Constructability Considerations: The existing NYS Route 590 bridges over Blossom Road and Browncroft Boulevard would need to be widened (rehabilitated or replaced) to accommodate a fourth southbound lane and full width shoulder.

Environmental Considerations: Widening NYS Route 590 to the west and adding a fourth lane could trigger the need to study potential noise and visual impacts to adjacent residential properties and possible mitigation.

Planning-Level Construction Cost Estimate: $26.6 million





4+5 Additional NYS Route 590 northbound lane from Ramp WN to the Browncroft Boulevard off-ramp

Operational Considerations: During the evening peak hour, the segment of NYS Route 590 northbound approaching Ramp WN is expected to reach capacity (LOS E) by 2051 under the low growth scenario and exceed capacity (LOS F) under a normal growth scenario. The 1,150-foot weaving area just downstream, between Ramp WN and Ramp BRN, also currently operates at capacity (LOS E) during the evening peak hour and is expected to exceed capacity (LOS F) by 2051 under the normal growth scenario. Congestion in this area tends to affect both the segments of NYS Route 590 and Ramp WN immediately upstream causing speeds as low as 20 miles per hour and stop and go travel. The segment of NYS Route 590 from Ramp BRN north to the Blossom Road overpass is also operating at capacity (LOS E).

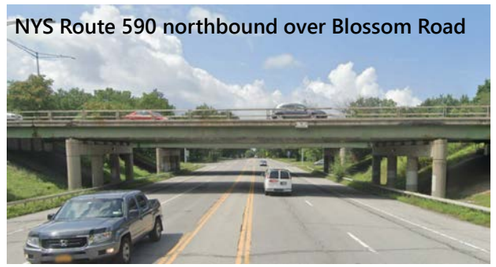
Conceptual Alternative: Concept 5 grew out of Concept 4. Concept 4 would extend the weaving lane between Ramps WN and BRN across the bridge over Blossom Road and end it with a taper prior to the entrance of Ramp B. This would not eliminate projected LOS F (over capacity) conditions in the northbound direction, during the evening peak hour, from south of Ramp WN through the Blossom Road interchange. A congestion causing bottleneck would remain at the taper. Extending the lane through the Blossom Road interchange, adding a new parallel acceleration lane for Ramp B, and connecting the lane to the Browncroft Boulevard off ramp (Concept 5) is projected to provide operations at or below capacity (LOS E or better) throughout 2051 under the normal growth scenario. Anticipated peak hour speeds would improve to 40 miles per hour or higher.

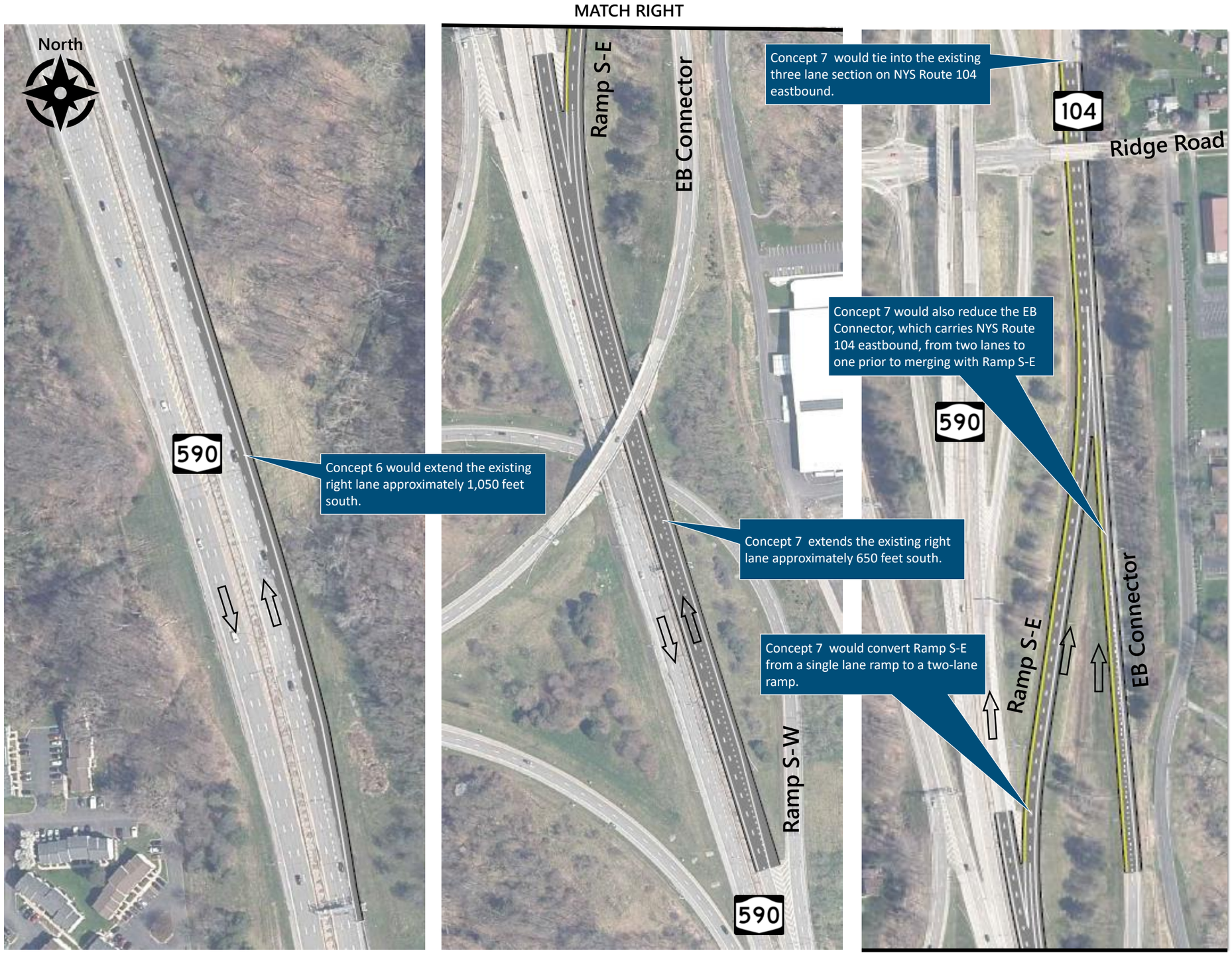
Constructability Considerations: The existing NYS Route 590 bridge over Blossom Road would need to be widened (rehabilitated or replaced) to accommodate a fourth northbound lane and full width shoulder.

Environmental Considerations: Widening NYS Route 590 to the east and adding a fourth lane may trigger the need to study potential noise and visual impacts to adjacent residential properties and the feasibility of mitigation.

Planning-Level Construction Cost Estimate: Concept 4: $10.7 million, Concept 5: $17.9 million

NYS Route 590 northbound over Blossom Road





6+7 Two lanes on Ramp S-E and one lane on NYS Route 104 eastbound

Operational Considerations: The approach to the diverge between NYS Route 590 northbound and Ramp S-W is projected to operate over capacity (LOS F) in 2051 during the evening peak hour under a normal growth scenario. Vehicular speeds are expected to drop into the range of 30 miles per hour.

The NYSDOT temporarily modified the pavement markings on NYS Route 590 northbound, Ramp S-E, and the EB Connector in 2019 providing two lanes on Ramp S-E and one lane on the EB Connector. This was done as part of a construction project involving the bridge carrying NYS Route 104 eastbound over NYS Route 590. The study team was charged with testing if this change could and should be made permanent given existing traffic patterns and continuing growth to the east. As shown below, projected volumes on the two roadways are expected to be and remain similar during the evening peak hour from the year 2031 through 2051.

Roadway	Typical Vehicles Per Hour
Ramp S-E	1950-2150
EB Connector	2150-2400

Conceptual Alternative: Concept 6 would extend the right lane as far south as possible without impacting the Norton Street off-ramp. This would provide additional space for drivers to select the proper lane before reaching the exit to NYS Route 104 westbound (Ramp S-W).

Concept 7 would extend the right lane as far south as possible without impacting the diverge to Ramp S-W. This would provide additional space for drivers to select the proper lane before reaching the exit to NYS Route 104 eastbound. Concept 7 would also convert Ramp S-E from one lane to two lanes. The EB Connector would be reduced from two lanes to one using an 660-foot merging taper to tie directly into the existing three-lane section on NYS Route 104 eastbound.

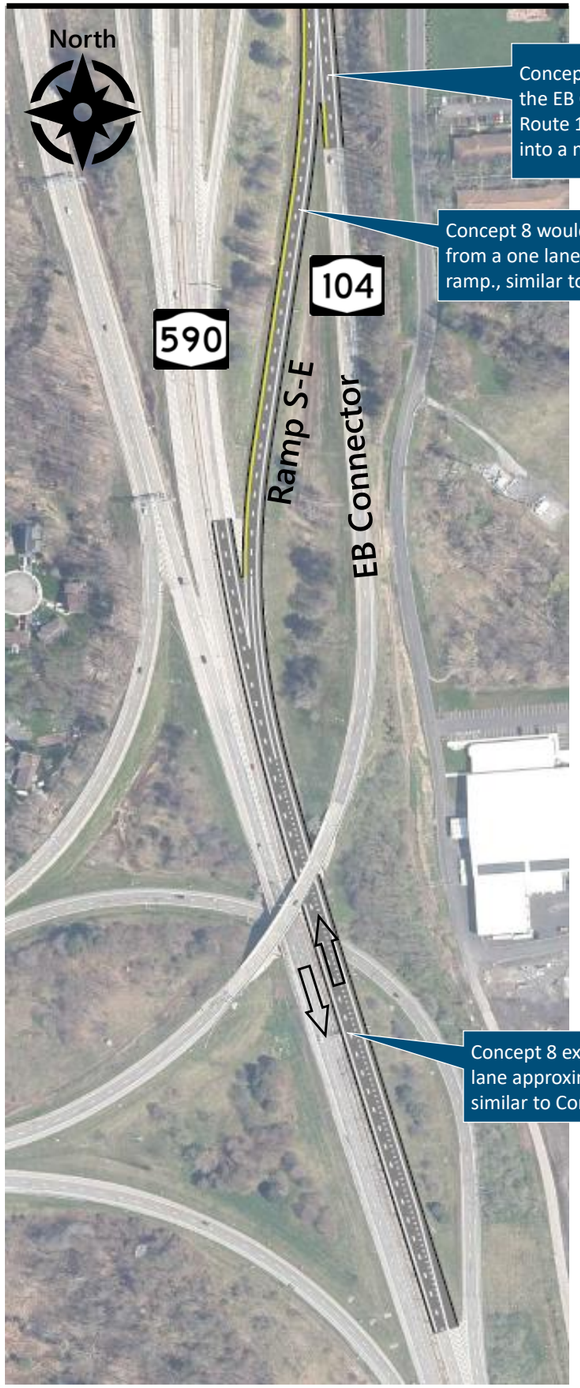
Both the diverge to Ramp S-W and Ramp S-E would operate below capacity (LOS D or better) during the evening peak hour in the year 2051 under normal growth conditions with Concepts 6 and 7 in place; however, reducing NYS Route 104 eastbound (the EB connector) to a single lane would result in operations at capacity (LOS E). That LOS E led to the development of Concept 8.

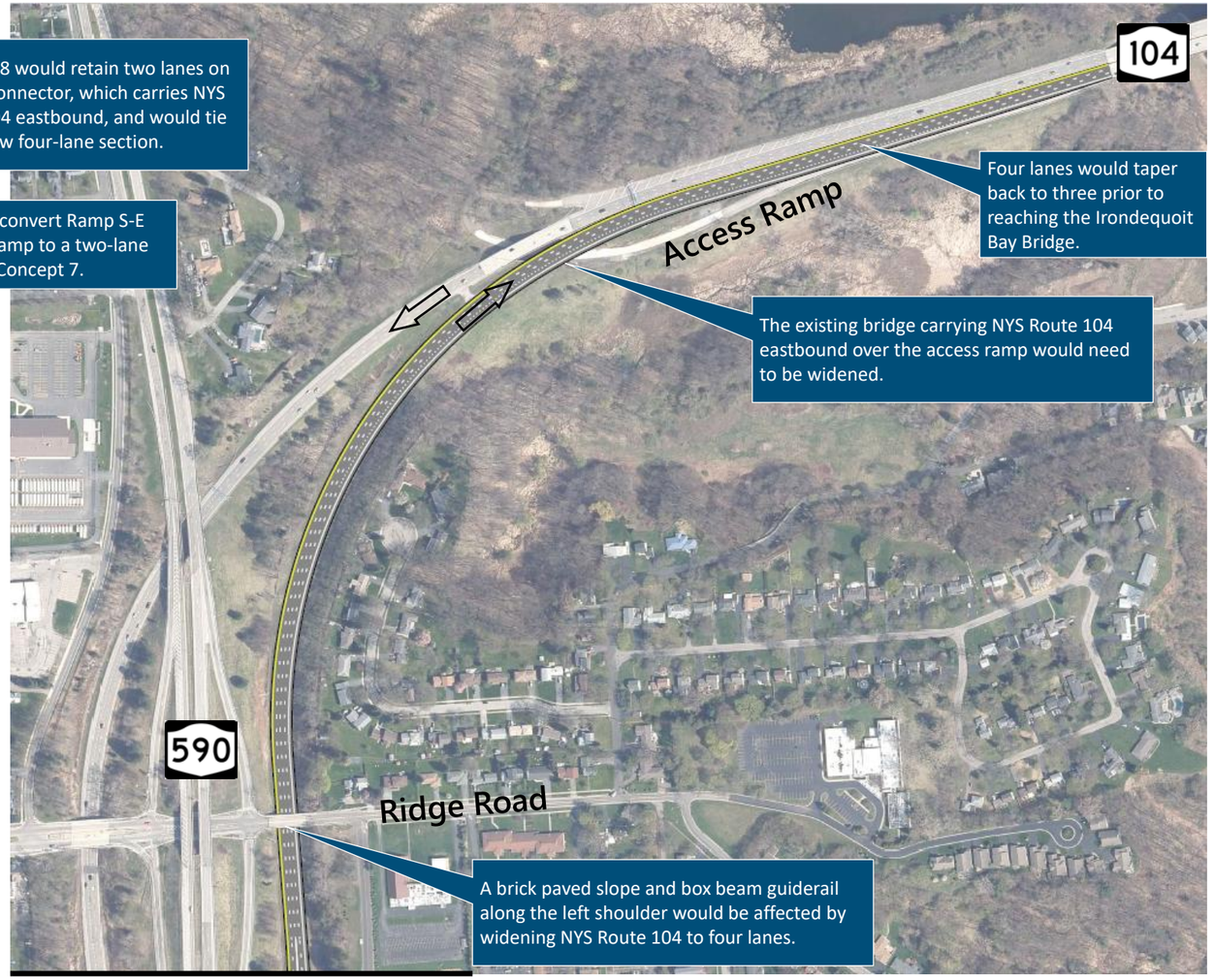
Constructability Considerations: Concept 6's proposed widening requires extending a box culvert and a steep, tall embankment.

Environmental Considerations: The surrounding area is in a coastal zone and the Town of Irondequoit Local Waterfront Revitalization Plan boundary. Some federal and state coordination may necessary during design. Previously undisturbed areas around the roadway are also classified as archaeologically sensitive.

Planning-Level Construction Cost Estimate: Concept 6: $2.2 million
Concept 7: $1.2 million

MATCH RIGHT





MATCH LEFT

8 Two lanes on Ramp S-E and two lanes on NYS Route 104 eastbound

Operational Considerations: Concept 7 examined the potential effects of changing Ramp S-E to two lanes and reducing the EB Connector (NYS Route 104) to one lane, tying directly into the downstream three-lane section. That change is projected to result in operations at capacity (LOS E) on the EB connector in the evening peak hour under normal growth conditions by the year 2051.

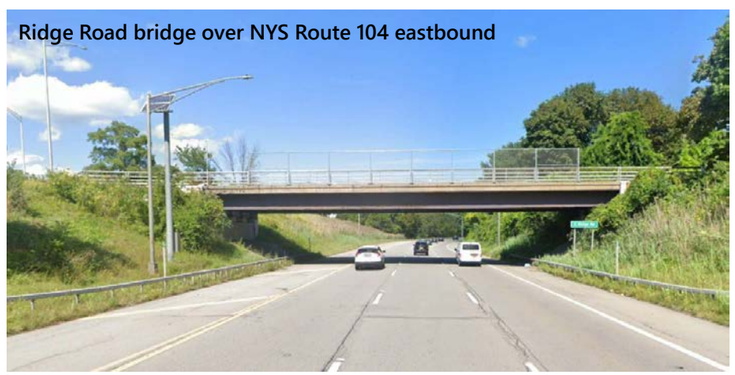
Conceptual Alternative: Concept 8 would retain the current two-lane configuration on NYS Route 104 eastbound (the EB Connector) and modify NYS Route 104 downstream to carry four lanes until it tapers back to three at the Irondequoit Bay Bridge. The result would be greatly improved operations at LOS C or better throughout 2051 during the evening peak hour.

Constructability Considerations: NYS Route 104 would need to be widened beneath the Ridge Road overpass in order to carry a fourth travel lane and full width left shoulder. The existing brick paved slope and box beam guiderail would be impacted. The abutment would need to be checked for potential structural impacts. The existing bridge carrying NYS Route 104 eastbound over the maintenance ramp and the connection to that ramp would also be impacted by the proposed widening.

Environmental Considerations: The surrounding area is in a coastal zone and the Town of Irondequoit Local Waterfront Revitalization Plan boundary. Some federal and state coordination may necessary during design. Previously undisturbed areas around the roadway are also classified as archaeologically sensitive.

Planning-Level Construction Cost Estimate: $9.3 million

Ridge Road bridge over NYS Route 104 eastbound



NYS Route 104 eastbound over the access ramp

4.1.2 Traffic Analysis

The conceptual alternatives developed for this study would not change regional or local travel patterns; therefore, the same traffic volume data used to assess future no-build operations (included in Appendix C) were used to study the potential operational impacts of the alternatives. This includes morning and evening peak hour volumes at the estimated time of completion (ETC) 2031 and in the design year (ETC+20) 2051. Likewise, the same growth scenarios described in Section 3 were considered to account for possible changes in development patterns, employment, and personal behavior, post COVID-19:

- A "low growth" scenario assuming an average annual traffic growth rate of 0.25% per year; and
- A "normal growth" scenario assuming an average annual growth rate of 0.5% per year

Similar to the no-build analyses, VISSIM (Version 11) was used to model each interchange under future build conditions (ETC and ETC+20) and both the low and normal growth scenarios. Measures of effectiveness including density, LOS, average vehicular speed, travel time, and total hours of vehicle delay were extracted from the microsimulation runs and averaged for comparison to the no-build results. The exhibits listed in Exhibit 4.1.2-1, included in Appendix C, summarize the results of the traffic operations analyses for the conceptual alternatives at each study interchange.

Exhibit 4.1.2-1
List of Exhibits in Appendix C Comparing No-Build and Build Capacity Analyses

Exhibit	Interchange	Peak Hour	Year	Growth Scenario
Exhibit 4.1.2-2	I-490/I-590/NYS Route 590	Morning	2031	Low
Exhibit 4.1.2-3	I-490/I-590/NYS Route 590	Evening	2031	Low
Exhibit 4.1.2-4	I-490/I-590/NYS Route 590	Morning	2031	Normal
Exhibit 4.1.2-5	I-490/I-590/NYS Route 590	Evening	2031	Normal
Exhibit 4.1.2-6	I-490/I-590/NYS Route 590	Morning	2051	Low
Exhibit 4.1.2-7	I-490/I-590/NYS Route 590	Evening	2051	Low
Exhibit 4.1.2-8	I-490/I-590/NYS Route 590	Morning	2051	Normal
Exhibit 4.1.2-9	I-490/I-590/NYS Route 590	Evening	2051	Normal
Exhibit 4.1.2-10	NYS Route 104/NYS Route 590	Morning	2031	Low
Exhibit 4.1.2-11	NYS Route 104/NYS Route 590	Evening	2031	Low
Exhibit 4.1.2-12	NYS Route 104/NYS Route 590	Morning	2031	Normal
Exhibit 4.1.2-13	NYS Route 104/NYS Route 590	Evening	2031	Normal
Exhibit 4.1.2-14	NYS Route 104/NYS Route 590	Morning	2051	Low
Exhibit 4.1.2-15	NYS Route 104/NYS Route 590	Evening	2051	Low
Exhibit 4.1.2-16	NYS Route 104/NYS Route 590	Morning	2051	Normal
Exhibit 4.1.2-17	NYS Route 104/NYS Route 590	Evening	2051	Normal
Exhibit 4.1.2-18	I-490/I-590/NYS Route 590	Both*	2031	Low
Exhibit 4.1.2-19	I-490/I-590/NYS Route 590	Both*	2031	Normal
Exhibit 4.1.2-20	I-490/I-590/NYS Route 590	Both*	2051	Low
Exhibit 4.1.2-21	I-490/I-590/NYS Route 590	Both*	2051	Normal

Exhibit 4.1.2-1 List of Exhibits in Appendix C Comparing No-Build and Build Capacity Analyses				
Exhibit 4.1.2-22	NYS Route 104/NYS Route 590	Both*	2031	Low
Exhibit 4.1.2-23	NYS Route 104/NYS Route 590	Both*	2031	Normal
Exhibit 4.1.2-24	NYS Route 104/NYS Route 590	Both*	2051	Low
Exhibit 4.1.2-25	NYS Route 104/NYS Route 590	Both*	2051	Normal

* Travel time loop summaries include both peak hours in one exhibit.

4.1.2.1 I-490/I-590/NYS Route 590 Interchange

A. Morning Peak Hour

Morning peak hour congestion is projected to increase over time on southbound NYS Route 590 approaching the I-490 interchange and on I-590 approaching the merge with Ramp WS as described in Section 3 of this report. Conceptual alternatives 2 and 3 would collectively improve the level of service provided on southbound NYS Route 590 and I-590 from LOS E (at capacity) and LOS F (heavy congestion and stop and go traffic) to LOS D or better throughout the year 2051 under all growth scenarios. Traffic densities would drop to around 30 passenger cars per hour per lane (pc/h/ln) and vehicular speeds are projected to be near the posted limit (55 miles per hour (mph)).

B. Evening Peak Hour

High traffic densities (LOS E, at capacity) are projected to occur on I-490 eastbound west of the Winton Road underpass under the no-build scenario. This condition could be mitigated (LOS D or better) with the introduction of Concept 1, which would install a full auxiliary lane between the Culver Road on-ramp and the I-590/NYS Route 590 off ramps.

The short weaving section on NYS Route 590 northbound, conecting Ramp WN and Ramp BRN, is projected to operate at LOS F during the evening peak hour by 2051 under the normal growth scenario with no action. Densities would be in the range of 60 to 70 pc/h/ln and speeds would fall to 20 to 30 mph. Congestion caused by differential speeds and lane changes would negatively affect upstream operations. Concept 5 would construct an additional lane between Ramp WN and the Browncroft Boulevard off ramp, where over 1,200 vehicles per hour (vph) exit. This change would improve operations to capacity (LOS E) with densities in the range of 40 to 50 pc/h/ln and with operating speeds in the range of 40 mph in the year 2051 with the normal growth scenario.

C. Travel Times and Vehicle Hours of Delay

Exhibit 4.1.2-18 through Exhibit 4.1.2-21 in Appendix C summarize anticipated travel times along I-490 and I-590/NYS Route 590 in 2031 and 2051 under the low and normal growth scenarios with alternative concepts 1,2,3 and 5. The effects on travel times in three key areas show up in Exhibit 4.1.2.1.C-1 and are described below.

- I-490 eastbound during the evening peak hour: no projected increase in travel time over existing;

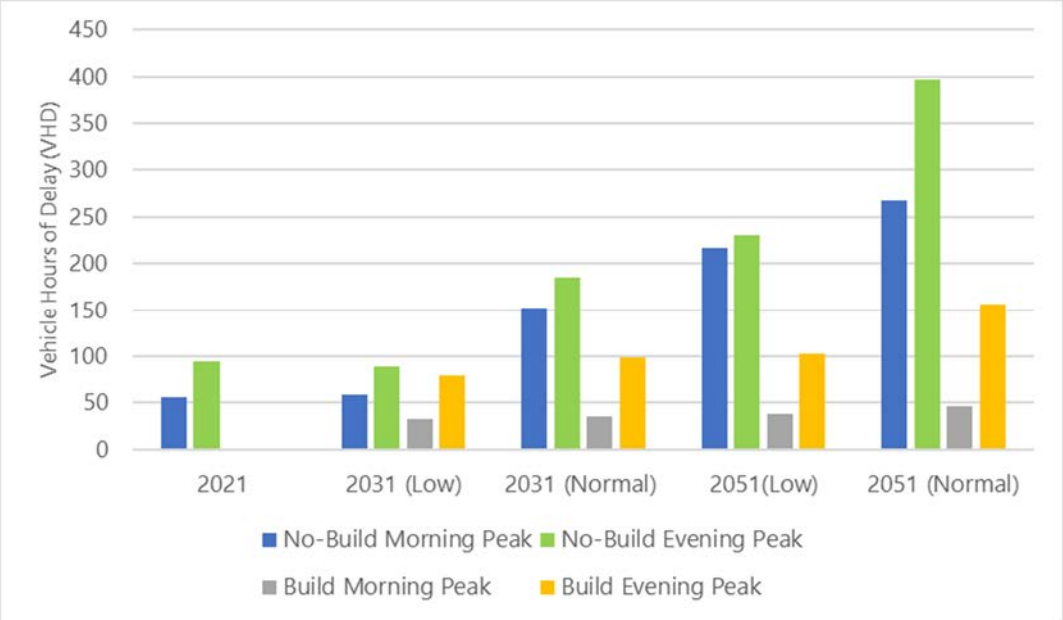
- I-590/NYS Route 590 northbound during the evening peak hour: substantially reduces the projected increase in travel time in comparison to no-build; and
- NYS Route 590/I-590 southbound during the morning peak hour: projected to result in a slight decrease in travel time in comparison to existing.

Exhibit 4.1.2.1.C-1 I-490 / I-590 / NYS Route 590 Interchange No-Build vs. Build - Projected Changes in Travel Time				
Morning Peak	Year and Growth Scenario			
	2031 (Low)	2031 (Normal)	2051 (Low)	2051 (Normal)
I-490 Eastbound	0%/0%	0%/0%	0%/0%	0%/0%
I-490 Westbound	0%/0%	0%/0%	0%/0%	0%/0%
I-590/NYS Route 590 Northbound	0%/0%	0%/0%	0%/0%	0%/0%
NYS Route 590/I-590 Southbound	+40%/-14%	+40%/-14%	+60%/-13%	+90%/-11%
Evening Peak	2031 (Low)	2031 (Normal)	2051 (Low)	2051 (Normal)
I-490 Eastbound	0%/0%	+25%/0%	+25%/0%	+50%/0%
I-490 Westbound	0%/0%	0%/0%	0%/0%	0%/0%
I-590/NYS Route 590 Northbound	0%/0%	+20%/0%	+20%/0%	+70%/+12%
NYS Route 590/I-590 Southbound	0%/0%	0%/0%	0%/0%	0%/0%

Key: % / % = change from existing to no-build / change from existing to build

Exhibit 4.1.2.1.C-2 summarizes the anticipated change in vehicle hours of delay throughout the interchange for each year and growth scenario. It also compares the no-build condition to the build condition.

Exhibit 4.1.2.1-C-2: I-490/I-590/NYS Route 590 Interchange
Projected Changes in Vehicle Hours of Delay – No Build and Build



As shown, together the alternative concepts 1,2,3, and 5 would slightly reduce the total morning peak hour vehicle hours of delay throughout the interchange and substantially reduce the anticipated growth in delay during the evening peak through the year 2051.

4.1.2.2 NYS Route 104/NYS Route 590 Interchange

A. Morning Peak Hour

No notable operational concerns were highlighted at the NYS Route 104/NYS Route 590 interchange during the morning peak hour through the year 2051 under the no-build condition.

B. Evening Peak Hour

Densities over capacity (LOS F) are projected to occur on the northbound NYS Route 590 approach to the Ramp S-W diverge in 2051 under the normal growth scenario. The segments immediately north of the exit are projected to operate at capacity with LOS E in the same scenario. Congestion on the single lane Ramp S-E is would affect flow on NYS Route 590 back to the ramp to Norton Street.

Concept 6 extends the right lane on NYS Route 590 south to provide additional capacity and space for changing lanes. Concept 7 would result in two lanes on ramp S-E and a single lane on the EB Connector which carries NYS Route 104 eastbound. This would result in acceptable operations (LOS D or better) along NYS Route 590 but degrade operations to LOS E on NYS Route 104 eastbound. Concept 7 should not be considered a feasible alternative for this reason. Concept 8 would provide two lanes on both Ramp S-E and the EB connector. Under that combination, all parts of the interchange would operate at LOS D or better during the evening peak hour throughout the year 2051 under the normal growth scenario.

C. Travel Times and Vehicle Hours of Delay

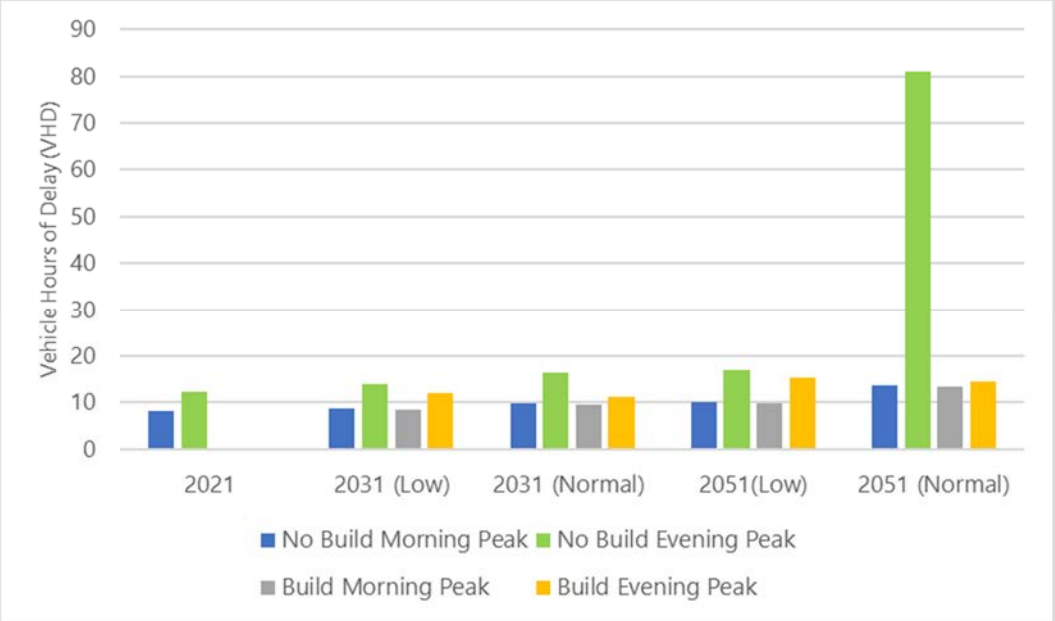
Exhibit 4.1.2-22 through Exhibit 4.1.2-25 in Appendix C summarize anticipated travel times along NYS Route 104 and NYS Route 590 in 2031 and 2051 under the low and normal growth scenarios. As illustrated in Exhibit 4.1.2.2.C-1, the combination of alternative concepts 6 and 8 would allow for no appreciable change in travel time from the existing condition through year 2051 under the normal growth scenario.

Exhibit 4.1.2.2.C-2 summarizes the anticipated change in vehicle hours of delay throughout the interchange for each year and growth scenario. It also compares the no-build condition to the build condition. The introduction of Concepts 6 and 8 would eliminate the anticipated increase in vehicle hours of delay projected in 2051 under the no-build, normal growth scenario.

Exhibit 4.1.2.2.C-1 NYS Route 104 / NYS Route 590 Interchange No-Build vs. Build - Projected Changes in Travel Time				
Morning Peak	Year and Growth Scenario			
	2031 (Low)	2031 (Normal)	2051 (Low)	2051 (Normal)
NYS Route 104 Eastbound	0%/0%	0%/0%	0%/0%	0%/0%
NYS Route 104 Westbound	0%/0%	0%/0%	0%/0%	0%/0%
NYS Route 590 Northbound	0%/0%	0%/0%	0%/0%	0%/0%
NYS Route 590 Southbound	0%/0%	0%/0%	0%/0%	0%/0%
Evening Peak	2031 (Low)	2031 (Normal)	2051 (Low)	2051 (Normal)
NYS Route 104 Eastbound	0%/0%	0%/0%	0%/0%	0%/0%
NYS Route 104 Westbound	0%/0%	0%/0%	0%/0%	0%/0%
NYS Route 590 Northbound	0%/0%	0%/0%	0%/0%	+33%/0%
NYS Route 590 Southbound	0%/0%	0%/0%	0%/0%	0%/0%

Key: % / % = change from existing to no-build / change from existing to build

Exhibit 4.1.2.2.C-2: NYS Route 104/NYS Route 590 Interchange
Projected Changes in Vehicle Hours of Delay – No Build and Build



4.1.3 Roadway Safety Considerations

As noted in Section 2, there are safety issues within each interchange as presented in the crash density maps, crash data summaries, and Priority Investigation Locations (PILs). Section 3 correlated safety issues with known locations of congestion. Particularly at the I-490/I-590/NYS Route 590 interchange, a majority of the crash experience can be attributed to peak periods (60% of the crashes), of which at minimum 45%

of the crashes are rear end type crashes. These types of crashes are likely related to the congestion experienced; therefore, congestion mitigation should provide a safety benefit for each of the interchanges.

Rear end type crashes and congestion occur at the same locations during the PM peak period at the I-490/I-590/NYS Route 590 interchange: I-490 eastbound, I-490 westbound, and NYS Route 590 northbound. Concept 1 (I-490 eastbound) and Concept 5 (I-490 westbound and NYS Route 590 northbound) would mitigate the congestion at these locations, thereby reducing the potential for crashes. Similarly, during the morning peak hour, NYS Route 590 approaching I-490 experiences congestion and a relatively high crash experience. If Concepts 2 and 3 are constructed, congestion in these locations would be reduced, decreasing the chance for crashes to occur.

The evening peak period experiences congestion on northbound NYS Route 590 at the NYS Route 104/NYS Route 590 interchange. Rear end type crashes account for 63% of the crashes during this peak period at this location. For the interchange overall, approximately 50% of the rear end type crashes occur at this location. Concepts 6 and 8 propose to improve operations and reduce congestion in the northbound direction. Therefore, it can be expected that there should also be a reduction in the peak hour crash experience on NYS Route 590 given improved operations.

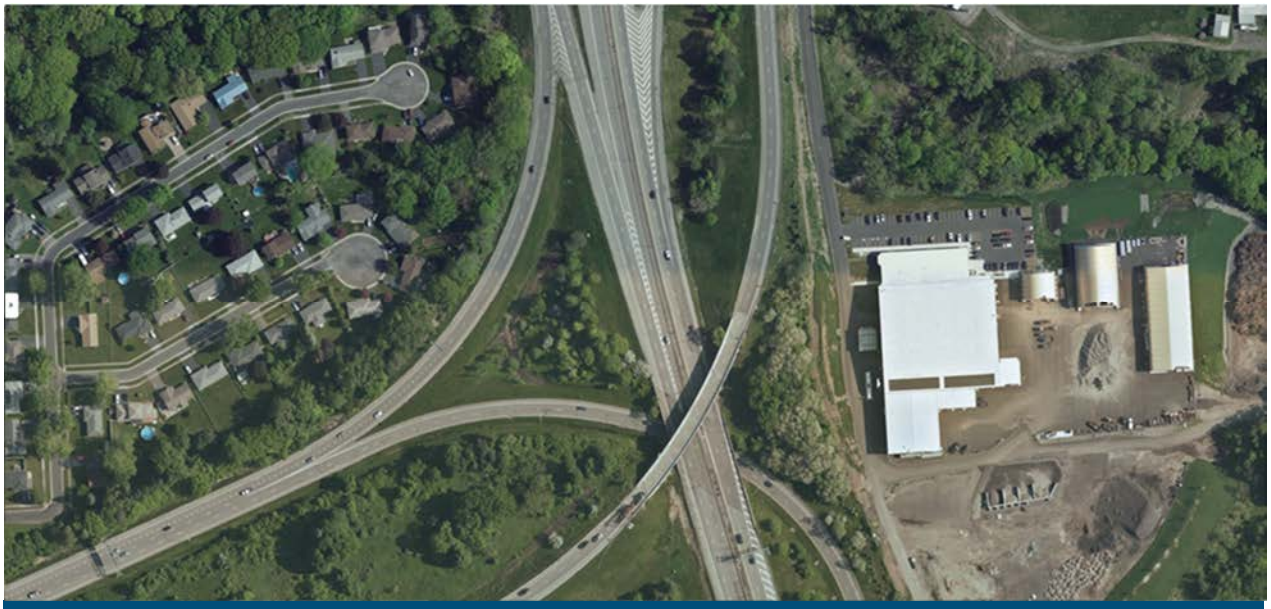
The primary off-peak crash type is “fixed object” which suggests departure from the travel way and a collision with a roadside feature. These types of crashes are more common when speeds are higher. Causative features may be related to ramp geometry or pavement condition. Detailed examinations of those were beyond the scope of this study and could be covered in more detail during a subsequent phase of study or design.

4.1.4 Preliminary Signing Concepts

As noted in Section 2, mainline and ramp guide signs in each interchange area were reviewed as part of this study. Signs were found to be generally in good to fair condition. It was also noted that some overhead sign panels at the I-490/I-590/NYS Route 590 interchange feature a diagrammatic legend in contrast to an arrow-per-lane design found elsewhere around Rochester.

Properly designed and located guide signs not only assist motorists with navigation but enhance safety. A preliminary signing concept was developed for each interchange, consistent with the *National Manual on Uniform Traffic Control Devices* (MUTCD) and the *New York State Supplement*, and giving consideration to the revised geometry proposed for the conceptual alternatives described in Section 4.1.1.

A preliminary signing concept for the I-490/I-590/NYS Route 590 interchange is included in Appendix E as Exhibit 4.1.4-1. A preliminary signing concept for the NYS Route 104/NYS Route 590 interchange is also included in Appendix E as Exhibit 4.1.4-2. Actual signing work at each interchange will need to extend back to the first guide sign in each series. It is anticipated that preliminary and detailed signing design would take place in conjunction with a future signing, roadway rehabilitation, or interchange reconstruction contract.



Section 5: Summary and Conclusion

The Genesee Transportation Council (GTC) and New York State Department of Transportation (NYSDOT) commissioned this study of the I-490/I-590/NYS Route 590 interchange and the NYS Route 104/NYS Route 590 interchange to inform decisions on future capital projects. The study involved:

- Completing an existing conditions inventory;
- Assessing needs at each interchange;
- An examination of potential alternative concepts; and
- The identification of topics for future study or design.

Two specific locations were selected for examination when the study was scoped:

- Reconfiguring the merge where Ramp ES from I-490 eastbound and Ramp WS from I-490 westbound meet mainline NYS Route 590 at the I-490/I-590/NYS Route 590 interchange; and

- Reconfiguring the number of lanes on Ramp S-E and the EB Connector at the NYS Route 104/NYS Route 590 Interchange from one to two and two to one, respectively.

It was assumed, for the purposes of this study, that improvements at both interchanges would be complete within 10 years; therefore, 2031 was selected as the estimated time of completion (ETC). A design year of 2051 (ETC+20) was selected for traffic forecasting purposes, consistent with guidance in Chapter 5 of the NYSDOT *Highway Design Manual*.

Two growth scenarios were considered to account for possible changes in development patterns, employment, and personal behavior, post COVID-19:

- A “low growth” scenario assuming an average annual traffic growth rate of 0.25% per year. This represents a scenario where motor vehicle traffic volumes do not grow at the same rate one would have expected to see prior to events in the year 2020.

- A "normal growth" scenario assuming an average annual growth rate of 0.5% per year, consistent with a review of available historic traffic data, consideration of Monroe County Department of Transportation (MCDOT) recommended growth rates for neighboring towns, and discussion with the GTC and NYSDOT Region 4.

Traffic data were obtained from New York State Department of Transportation's Traffic Data Viewer and a number of other available sources. No new counts were taken. Average weekday morning and evening peak hour volumes were estimated and used along with geometry and traffic control data to develop microsimulation models, using VISSIM Version 11, to examine existing, no-build, and build condition operations. VISSIM provided both a set of quantitative results and a visual microsimulation for each case studied. VISSIM models can be requested from the GTC from the project file. The results of the VISSIM analyses for each conceptual alternative are tabulated in Appendix C.

A review and analysis of available crash information was also completed. Crash data were obtained from the NYSDOT Accident Location Information System (ALIS) for each interchange over a five-year period ending in late 2019. A review of individual New York State Department of Motor Vehicles (NYSDMV) crash reports (MV-104) was beyond the scope of this study. The analysis revealed a large number of rear end crashes on mainline roadways at each interchange during peak travel periods, which may be due in part to stop and go traffic and lane changes caused by congestion. The crash pattern changes predominantly to "fixed object" during off peak periods when traffic is light. There were no clearly discernable crash patterns on the ramps that would suggest targeted mitigation at this level of detail. Congestion mitigation should provide a safety benefit during the peak periods. Further investigation of the potential connection between geometry, pavement surface condition, and the off-peak "fixed object" crash pattern should be investigated further as part of a future study or design project.

Key operational issues identified, and the conceptual alternatives developed to address areas with overlapping operational and safety issues, include the following. Note that Concepts 4 and 7 were dismissed and replaced with Concepts 5 and 8 as part of the study process.

- Evening peak hour congestion and delays on I-490 eastbound between the Culver Road interchange and I-590/NYS Route 590.

    - *Concept 1: Auxiliary lane along I-490 eastbound from Culver Road to I-590:* This would add a full auxiliary lane to I-490 eastbound. After construction, this area would operate at or below capacity (LOS E or LOS D) during the evening peak throughout the year 2051 under all growth scenarios. I-490 is very close to Norris Drive in this area and potential impacts to an existing pedestrian overpass, noise wall, overhead sign structure, and the local roadway are of note. Cobbs Hill Park is also in close proximity to the proposed work. The planning level construction cost estimate is $18.5 million.

- Morning peak hour congestion and delays on NYS Route 590 southbound approaching the entrances from I-490 eastbound and westbound (Ramp SE and SW).

    - *Concept 2: Switch the merge along I-590 southbound from Ramp WS to Ramp ES:* This would provide vehicles entering I-590 from I-490 westbound (Ramp WS) with their own travel lane. Ramp ES would connect to a 1,000-foot parallel acceleration lane and taper in prior to reaching the Highland Avenue overpass. This change would result in peak hour operation below capacity (LOS D) during the morning peak hour throughout 2051 under all growth scenarios. Existing bridge pier, bridge abutment, paved slope, roadside barrier, roadside slopes, and an adjacent noise barrier may be impacted by the proposed work. There are homes along the west side of I-590 that are eligible for inclusion on the National Register of Historic Places, but they are currently separated from the highway by the existing noise barrier. The planning level construction cost estimate is $5.3 million.

- Recurring morning peak hour congestion and delays on NYS Route 590 southbound from the Browncroft Boulevard interchange to the I-490/NYS Route 590 split.

    - *Concept 3: Additional southbound lane from Browncroft Boulevard to I-490:* This would add a fourth southbound travel lane to NYS Route 590 within the limits described above. The addition of this lane would improve morning peak hour operations throughout the year 2051 under all growth scenarios to below capacity (LOS D or better). The existing bridges over Blossom Road and Browncroft Boulevard would need to be wider to accommodate this alternative. Moving the roadway closer to adjacent residential properties may trigger the need for noise studies. The planning level construction cost estimate is $26.6 million.

- Evening peak hour congestion and delays on NYS Route 590 northbound approaching, within, and just beyond the weave between the on ramp from I-490 westbound (Ramp WN) and the off ramp to Blossom Road (Ramp BRN).

    - *Concept 5: Additional NYS Route 590 northbound lane from Ramp WN to the Browncroft Boulevard off-ramp:* This would extend the weaving lane between the on ramp to NYS Route 590 northbound and the off ramp to Blossom Road up to the off ramp to Browncroft Boulevard. This is expected to provide operations at or below capacity (LOS E or better) throughout 2051 during the evening peak hour under all growth scenarios. The existing bridge over Blossom Road would need to be wider to accommodate this alternative. Moving the roadway closer to adjacent residential properties may trigger the need for noise studies. The planning level construction cost estimate is $17.9 million.

- Evening peak hour congestion and delays on NYS Route 590 northbound approaching the NYS Route 104 interchange.

    - *Concepts 6 and 8: Extension of the right lane on approach to both Ramp S-W and S-E along with two lanes on Ramp S-E and the EB Connector (NYS Route 104):* This would extend the right lane on approach to the NYS Route 590 northbound exits to both

NYS Route 104 westbound and NYS Route 104 eastbound as far as possible without impacting the upstream ramp. This would provide additional space for drivers to select the proper lane. It would also retain the current two-lane section on the EB Connector (NYS Route 104 eastbound) while reconfiguring the ramp from NYS Route 590 northbound to NYS Route 104 eastbound to also carry two lanes. This would require a four lane section on NYS Route 104 headed east which would end before reaching the Irondequoit Bay Bridge. This would result in operations at LOS C or better throughout 2051 during the evening peak hour under all growth scenarios.

Concept 6's proposed widening would require extending a box culvert and a steep, tall embankment. Concept 8 would impact an existing paved slope and guiderail beneath the Ridge Road overpass. The existing bridge carrying NYS Route 104 over a maintenance ramp would need to be wider to accommodate this alternative. The surrounding area is in a coastal zone and is within the Town of Irondequoit's Local Waterfront Revitalization Plan boundary. Previously undisturbed areas around the roadway are also classified as archaeologically sensitive. Planning level construction cost estimates for concepts 6 and 8 are $2.2 million and $9.3 million, respectively.

Each alternative concept is illustrated in Appendix E. NYSDOT design criteria from the *Highway Design Manual* (HDM) were used to develop the horizontal geometry and lane layouts shown. Appendix E also contains graphics illustrating a preliminary guide sign concept for each interchange assuming incorporation of the conceptual alternatives. Properly designed and located guide signs would assist motorists with navigation and contribute to a safer roadway environment.

As tabulated in Section 4, travel times through the I-490/I-590/NYS Route 590 interchange on NYS Route 590/I-590 southbound in the morning and I-590/NYS Route 590 northbound in the evening would be substantially reduced in comparison to the no-build condition with all conceptual alternatives in place. Evening peak hour travel time increases on NYS Route 590 northbound would also be eliminated throughout 2051 at the NYS Route 104/NYS Route 590 interchange with Concepts 6 and 8 in place. The total vehicle hours of delay at the I-490/I-590/NYS Route 590 interchange would be reduced by 60% during the evening peak hour and 80% during the morning peak hour in comparison to the no-build condition by 2051. The total vehicle hours of delay at the NYS Route 104/NYS Route 590 interchange would be reduced by 80% in the evening peak hour throughout 2051 under the normal growth scenario.

The scope, funding, and timeline of this study were not intended to allow for an exhaustive review of all related issues, similar to what would be accomplished during the development of a NYSDOT *Design Approval Document* (DAD). The following topics have been noted and should be considered during future stages of study or design:

- Traffic Volumes: Origin and destination data could be obtained, possibly from sources such as StreetLight or Inrix, and used to enhance the accuracy of the VISSIM models. New traffic data, including daily and peak hour volumes, could also be collected and incorporated to better assess how traffic is actually rebounding from the COVID-19 pandemic.

- Crash Analyses: NYSDMV MV-104 crash reports could be obtained and reviewed for the "hot spot" and Priority Investigation Locations (PILs) identified in this study. The PILs could be broken down by direction and studied in greater detail. The relationship between geometry, pavement condition, and the off-peak "fixed object" crash experience could be investigated in greater detail. Collision diagrams could also be developed. This would improve crash location accuracy. A detailed safety analysis could also help identify locations that would benefit from spot safety enhancements and inform design decisions on conceptual alternatives being implemented.

- Blossom Road Interchange and Weave Area: The study team was tasked with developing component-level alternatives as opposed to large-scale interchange reconfigurations. Concept 5 is projected to retain some movements operating at LOS E by 2051 during the evening peak hour. Large scale changes, such as concepts that could impact the CSX railroad (e.g., adding a second lane to Ramp WN) or a grade separated basket weave configuration to separate conflicting movements, could be explored to further improve projected operations in this area. A basket weave concept would be similar to the configuration now present on NYS Route 390 northbound between I-490 and NYS Route 31 (Lyell Avenue).

- Drainage: Members of the steering committee raised concerns related to an existing detention pond in the northwest quadrant of the I-490/I-590/NYS Route 590 interchange. This feature is located west of NYS Route 590 and between I-490, the CSX railroad, and Blossom Road. It was said that the detention pond may not properly control outflows from major storm events, leading to downstream flooding in residential areas. The outlet crosses under NYS Route 590 from west to east. These concerns should be further investigated and addressed during a future design phase.

- Separate Concept Analyses: The study team developed concepts for each interchange and studied them using morning and evening peak hours VISSIM models combining all the suggested concepts. Each concept, or a small collection of concepts for a specific part of an interchange, could be modeled separately to determine if improvements made in one area would enhance, or perhaps degrade, operations in another part of the interchange in the absence of the other improvements.

The areas studied and summarized in this document do not preclude other locations from being studied in greater detail during a future study or design project. For example, the existing ramp connecting NYS Route 590 southbound with I-490 eastbound, Ramp SE, carries a similar volume of traffic to other single lane ramps in the study, yet it did not present itself as having a capacity issue. This and other ramps could be revisited in the future. There are also other areas of note (e.g., I-590 northbound approaching the I-490 split, the weave on I-490 eastbound leading to Penfield Road, and the weave on I-490 westbound between Penfield Road and the I-490/I-590/NYS Route 590 interchange) that did not have overlapping operational and safety concerns and therefore did not see the development of conceptual improvements. These areas could be studied in greater detail. Expanding the footprint of the VISSIM model to include more of the adjacent roadway network could also be done to understand the impact of and on upstream and downstream operations.

It is anticipated that this study will be formally accepted by the Steering Committee, GTC, and NYSDOT in the spring of 2022. At this time, the NYSDOT is planning pavement maintenance projects on I-490, I-590, and NYS Route 590. The recommendations of this study can be considered during the development of future capital projects involving planning, programming, scoping, design, and construction moving forward.