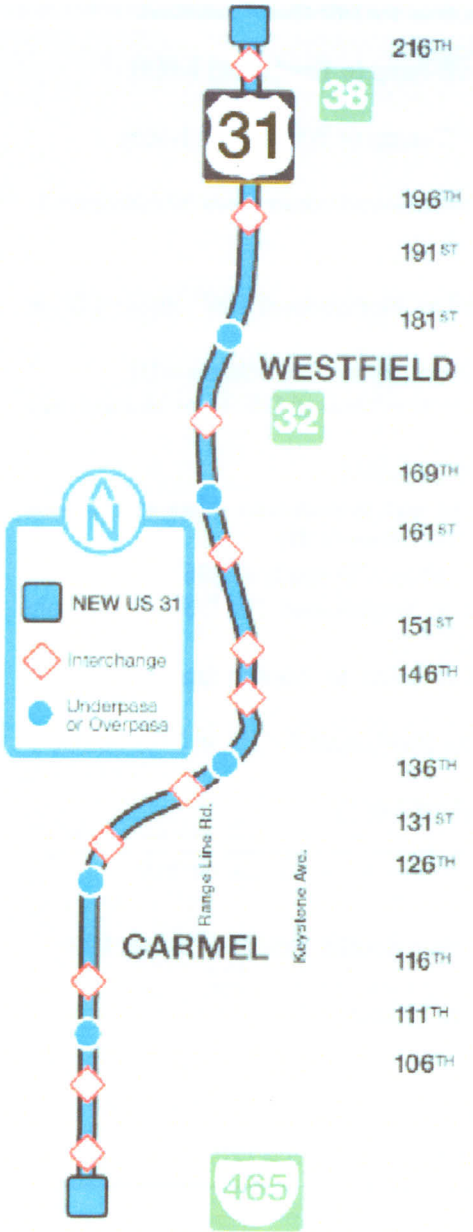
Indiana Department of Transportation

MAJOR MOVES

THE NEW US 31
HAMILTON COUNTY



Capacity Analysis Report
Years 2015 & 2035

February 28, 2008

JACOBS
Edwards and Kelcey

Introduction

In conjunction with a proposed Improvement Project along US 31 from I-465 to SR 38/Sheridan Avenue, INDOT has requested that capacity analyses be performed at locations in Hamilton County using forecasted traffic volumes published in the US 31 Traffic Forecast Report, prepared by Jacobs Edwards and Kelcey, dated January 15, 2008. Capacity analyses were performed for the AM and PM peak hours, for the years 2015 (construction year) and 2035 (design year), using several capacity analysis programs; the methodology of these programs is described in the text below. As directed by INDOT and RW Armstrong, the following locations were analyzed, per the PAMP Configuration (laid out in the Preferred Alternative and Mitigation Package):

1. US 31 (Meridian Street) and 96th Street
2. US 31 (Meridian Street) between 96th Street and off-ramp to Eastbound I-465
    a. Northbound
    b. Southbound
3. US 31 (Meridian Street) and I-465 Interchange
    a. Northbound diverge (Northbound US 31 to off-ramp to Eastbound I-465)
    b. Eastbound merge (I-465)
    c. Northbound diverge (Northbound US 31 to off-ramp to Westbound I-465)
    d. Westbound merge (I-465)
    e. Intersection – US 31 (Meridian Street) & Westbound ramp from Westbound I-465
    f. Westbound diverge (I-465)
    g. Ramp diverge (ramp from Westbound I-465 to Northbound 106th Street CD or Northbound US 31 or intersection 3e.)
    h. Northbound diverge (Northbound US 31 to Northbound 106th Street CD)
    i. Ramp diverge (ramp from Eastbound I-465 to Northbound US 31 or Northbound 106th Street CD)
    j. Northbound merge (Northbound US 31 north of I-465)
    k. Ramp merge (ramps from Northbound US 31 and Westbound I-465 merge with ramp from Eastbound I-465 to Northbound 106th Street CD)
    l. Ramp diverge (ramp from Southbound 106th Street CD south of 106th Street)
    m. Weave – ramps from Southbound US 31 and Southbound 106th Street CD join and split to Westbound I-465 and Eastbound I-465
    n. Weave – before ramp from 106th Street CD splits to Southbound US 31 and Eastbound I-465
    o. Southbound diverge (Southbound US 31 to Eastbound I-465 or Westbound I-465)
    p. Southbound merge (Southbound US 31 north of I-465)
    q. Ramp diverge (ramp from Eastbound I-465 splits to Southbound US 31 and 3i.)
    r. Southbound merge (ramp from Eastbound I-465 to Southbound US 31)
    s. Eastbound diverge (I-465)
    t. Weave – Southbound US 31 south of ramp from Southbound 106th Street CD
    u. Weave – Southbound US 31 south of ramp from Eastbound I-465
4. US 31 (Meridian Street) between 103rd Street and 106th Street
    a. Northbound
    b. Southbound
5. US 31 (Meridian Street) and 106th Street Interchange
    a. Intersection – Northbound ramps & 106th Street

27. SR 431 ramp diverge south of US 31 (Meridian Street) Merge
28. US 31 (Meridian Street) and SR 431 Merge
    a. Northbound merge (US 31)
    b. Southbound diverge (US 31)
29. US 31 (Meridian Street) and 146th Street/Greyhound Pass/151st Street Interchange
    a. Northbound diverge (US 31)
    b. Intersection – Northbound ramps & 146th Street
    c. Intersection – Northbound ramps & Greyhound Pass (RI/RO)
    d. Intersection – Northbound ramps & 151st Street
    e. Northbound merge (US 31)
    f. Southbound diverge (US 31)
    g. Intersection – Southbound ramps & 151st Street
    h. Intersection – Southbound ramps & Greyhound Pass (RI/RO)
    i. Intersection – Southbound ramps & 146th Street
    j. Weave – south of intersection 29i. before split to Southbound US 31 & Southbound SR 431
    k. Southbound merge (US 31)
30. 146th Street and Greyhound Pass
31. 146th Street and Clay Terrace Boulevard/Western Way
32. 151st Street and signalized commercial access (Thatcher Lane)
33. US 31 (Meridian Street) between 151st Street and Southbound off-ramp to Southbound SR 431
    a. Northbound
    b. Southbound
34. Weave – Northbound US 31 between on-ramp from 151st Street and off-ramp to 161st Street
35. US 31 (Meridian Street) between 146th Street/Greyhound Pass/151st Street Interchange & 161st Street Interchange
    a. Northbound
    b. Southbound
36. US 31 (Meridian Street) and 161st Street Interchange
    a. Intersection – Northbound ramps & 161st Street
    b. Northbound merge (US 31)
    c. Southbound diverge (US 31)
    d. Intersection – Southbound ramps & 161st Street
    e. Southbound merge (US 31)
37. 161st Street and Farr Hills Drive
38. 161st Street and Westfield Boulevard/Union Street
39. US 31 (Meridian Street) between 161st Street Interchange & SR 32 Interchange
    a. Northbound
    b. Southbound
40. US 31 (Meridian Street) and SR 32 Interchange
    a. Northbound diverge (US 31)
    b. Intersection – Northbound ramps & SR 32
    c. Northbound merge (US 31)
    d. Southbound diverge (US 31)
    e. Intersection – Southbound ramps & SR 32
    f. Southbound merge (US 31)
41. SR 32 and Sun Park Drive
42. SR 32 and Poplar Street/Shamrock Drive

Roadway Level of Service

Level of Service (LOS) is a measure of roadway congestion ranging from A--least congested--to F--most congested. The six LOS letter grades are as follows:

LOS A represents free flow. The general level of comfort and convenience provided to the motorist, passenger, or pedestrian is excellent.

LOS B is in the range of stable flow, but the presence of other users in the traffic stream begins to be noticeable. The level of comfort and convenience provided is somewhat less than at LOS A.

LOS C is in the range of stable flow, but marks the beginning of the range of flow in which the operation of individual users becomes significantly affected by interactions with others in the traffic stream. The general level of comfort and convenience declines noticeably at this level.

LOS D represents high-density, but stable, flow. Speed and freedom to maneuver are severely restricted, and the driver or pedestrian experiences a generally poor level of comfort and convenience.

LOS E represents operating conditions at or near the capacity level. All speeds are reduced to a low, but relatively uniform value. Comfort and convenience levels are extremely poor, and driver or pedestrian frustration is generally high.

LOS F is used to define forced or breakdown flow. Operations are characterized by stopping and starting. Over and over, vehicles may progress at reasonable speeds for several hundred feet or more, and then be required to stop. Comfort and convenience levels are extremely poor, and driver or pedestrian frustration is generally high.

For each facility type, one or more performance measures serves as the primary determinant of LOS. Many factors/inputs affect the specified performance measures on which HCS LOS ratings are based (lane widths, shoulder widths, speeds, terrain, heavy vehicles, etc.). For intersections, LOS ratings are based on average control delay per vehicle; for basic freeway segments, weaving segments, and merge and diverge areas, LOS ratings are based on density. The tables below summarize the criteria on which LOS ratings are determined for these facility types in HCS.

LOS Criteria for Intersections

LOS	Signalized Intersection	Two-Way Stop-Controlled Intersection	All-Way Stop-Controlled Intersection
	Control Delay (s/veh)	*Control Delay (s/veh)*	*Control Delay (s/veh)*
A	≤ 10	0-10	0-10
B	> 10-20	> 10-15	> 10-15
C	> 20-35	> 15-25	> 15-25
D	> 35-55	> 25-35	> 25-35
E	> 55-80	> 35-50	> 35-50
F	> 80	> 50	> 50

LOS Criteria for Roundabouts (RODEL)

LOS	Average Delay Range (sec)
A	0-10
B	> 10-15
C	> 15-25
D	> 25-35
E	> 35-50
F	> 50

Synchro

Synchro was also used to produce LOS ratings for many locations along the proposed US 31 Corridor, primarily for cross-street corridors (see Capacity Analysis Location Map in the Appendix). Synchro is a software package used for modeling and optimizing traffic signal timings. One of the primary benefits of this software package is its ability to model coordinated systems. While HCS only estimates the effects of system coordination on individual locations, Synchro calculates the effects of coordination and analyzes the system as a whole.

Although Synchro implements many of the same methods as HCS in analyzing capacity, it also implements the Intersection Capacity Utilization (ICU) 2003 method. The ICU is the sum of time required to serve all movements at saturation given a reference cycle length, divided by the reference cycle length. In addition to delay based LOS ratings (like those produced by HCS), Synchro can also produce ICU LOS ratings, which report on the amount of reserve capacity. However, within this report, Synchro LOS output only refers to delay based LOS.

Paramics

Paramics was also used to produce LOS ratings for many locations along the proposed US 31 Corridor. Paramics is an advanced traffic microsimulation software package capable of taking output from regional travel demand models and simulating traffic operations at the individual-vehicle level, taking into account individual driver behavior. The software has the capability to analyze a wide range of transportation projects from individual intersections to corridors and large areas.

Travel demand data is input into Paramics as origin-destination matrices, which permits the software to dynamically route travelers in response to congestion or incidents. The origin-destination structure of the program also allows for increased ease and efficiency when testing multiple geometric alternatives.

Traffic microsimulation models also differ from traditional deterministic models (e.g. HCS, Synchro) in that they include elements of randomness. Elements such as flow rates, driver

analyze the interaction between closely spaced intersections; Synchro cannot adequately address weaving maneuvers and some types of freeway vehicle dynamics; RODEL is an empirical model and aaSIDRA is a deterministic model and neither of them can account for individual vehicle movements and interaction between each vehicle when approaching and circulating in the roundabout.

Microsimulation models (e.g. Paramics, VISSIM, CORSIM) apply stochastic modeling principles to allow variation in individual driver behavior (e.g. gap acceptance, aggressiveness, familiarity, lane changing) and traffic demand inputs (e.g. flow rates, origin-destination paths). This variation allows the microsimulation model to collect statistics from a more disaggregate representation of traffic flow. Microsimulation models allow for the examination of large corridors or areas as a whole with interaction between all parts of the model. Testing of complex non-standard geometry at intersections is possible in microsimulation models because of less rigid input parameters. This freedom to create geometry can also be a detriment, as standardization of inputs to microsimulation models is difficult. Microsimulation models also require significantly more data, time, error-checking, and calibration, which limit their application in smaller studies due to increased cost. Microsimulation models can typically generate traffic operational parameters with the greatest level of detail, but can be restrictive in the extraction of these parameters because of their inherent flexibility. For example, Paramics can provide all of the typical measurements at model link and node levels, such as: link density, link delay, link speed, and node delay. The appropriate statistics can be retrieved and then the appropriate MOE can be generated using HCM LOS criteria.

The different methodologies applied between deterministic and microsimulation models can, in some cases, describe vastly different operating conditions. It is up to the analyst to identify the differences and infer the proper conclusion and recommendations.

Signalization

As directed by RW Armstrong, study intersections were compared to the following criteria in the MUTCD 2000 and the Indiana Supplement to the MUTCD 2000 in order to determine where to locate traffic signals for capacity analysis: Figure 4C-3. "Warrant 3, Peak Hour" or Figure 4C-4. "Warrant 3, Peak Hour (70% Factor)" and Table 4C-1a. "Eight-Hour Vehicular Volume (ADT Equivalent)" when necessary. For the purposes of capacity analysis, signals were located per the process below, as directed by RW Armstrong.

- Compare all intersections to Peak Hour Criteria from the MUTCD 2000 (Figure 4C-3. or Figure 4C-4.) using forecasted DHV volumes for 2015 (construction year) and 2035 (design year).
- If an intersection meets Peak Hour Criteria for a given year (either peak hour), signalize it for purposes of capacity analysis for the given year.
- If an intersection does not meet Peak Hour Criteria for a given year, compare it to Equivalent ADT Criteria from the Indiana Supplement to the MUTCD 2000 (Table 4C-1a.) using the forecasted AADT volumes for the given year.
- If the intersection meets Equivalent ADT Criteria for a given year, signalize it for purposes of capacity analysis for the given year.
- If an intersection does not meet either Peak Hour Criteria or Equivalent ADT Criteria for a given year, consider it unsignalized for the purposes of capacity analysis.

deficient operations in both the northbound and southbound directions are caused by the heavy volumes throughout short weaving distances between the intersection of US 31 (Meridian St.) & 96th St. and access to I-465. In the southbound direction, there are a significant number of vehicles exiting EB I-465 and attempting to make the southbound left-turn at 96th St. In the northbound direction, Paramics has difficulty representing the most efficient motorist behavior and is overemphasizing difficulties.

Options to improve operations in the southbound direction include: removing northbound and southbound left-turn movements at the intersection of US 31 (Meridian St.) & 96th St.; implementation of "jug-handle" operations to serve northbound and southbound left-turns; and/or restricting EB I-465 exiting traffic from making southbound left-turns at the intersection by installing concrete barrier. In the northbound direction, the model's difficulty in properly representing operations indicates that clear and proper signage for the following ramp movements will be essential.

#3b. – EB merge (I-465)

According to completed HCS analyses, this merge area is projected to operate below INDOT LOS standards during both 2015 peak hours and both 2035 peak hours. High volumes eastbound along I-465 and entering I-465 from both northbound and southbound US 31 combine at this merge point; poor operation could be due to heavy ramp volume merging with heavy mainline volume. Options to improve operations at this location include: additional ramp lanes, additional mainline lanes, and/or realigned ramp configurations.

It is also possible that poor operation projections are partly due to limitations within HCS. HCS merge analysis allows for a maximum acceleration lane of 1500' in length. If proposed design allows for longer acceleration lanes (which could improve operations), the merge cannot be modeled accurately with HCS. It should be noted that Paramics analyses for this merge area resulted in acceptable LOS's.

#3d. – WB merge (I-465)

According to completed capacity analyses, this merge area is projected to operate below INDOT LOS standards during the 2015 AM peak hour (HCS), the 2015 PM peak hour (HCS & Paramics), and both 2035 peak hours (HCS & Paramics). High volumes westbound along I-465 and entering I-465 from southbound US 31 combine at this merge point; poor operation could be due to heavy ramp volume merging with heavy mainline volume. Options to improve operations at this location include: additional ramp lanes, additional mainline lanes, and/or realigned ramp configurations.

However, it should be noted that no queuing or failures were observed at this location in the Paramics model. LOS E (LOS result as produced by Paramics) indicates that vehicles have little or no useable gaps for lane changing at this point. Since there are no weaving or diverging movements required immediately downstream of this location, vehicles should operate well at this point. The high density of vehicles within this merge area may reflect the need for an extended five-lane cross-section, although this is beyond the scope of this analysis.

often back up onto the mainline lanes of I-465. Operations can be improved here by addressing the affected area south of this location.

#3s. – EB diverge (I-465)

According to completed HCS and Paramics analyses, this diverge area is projected to operate below INDOT LOS standards during both 2015 peak hours and both 2035 peak hours. The breakdown of traffic at this location is caused by the weaving maneuvers along the downstream section of US 31. Queues observed in the model at this location often back up onto the mainline lanes of I-465. Operations can be improved here by addressing the affected downstream locations.

In addition, diverging operations will be more efficient with advanced signage indicating the appropriate lanes leading to US 31 southbound, US 31 northbound, and the CD to 106th St., respectively.

#3t. – Weave, SB US 31 south of ramp from SB 106th St. CD

According to completed Paramics analysis, this weaving segment is projected to operate below INDOT LOS standards during the 2035 AM peak hour; the weaving segment is projected to operate at LOS F during this period. The breakdown of traffic at this location is caused by the subsequent weaving maneuvers along the downstream section of US 31 approaching 96th St. Observation of this location in the model, during periods when the downstream queue did not reach this location, shows satisfactory operations. Operations can be improved here by addressing the affected area south of this location.

It should be noted that HCS is not equipped to analyze a two-sided Type C weave. Thus, HCS results, though included in this report, should not be considered a barometer for future operations at this location. The Paramics model gives a more accurate representation of the expected operation at this location.

#3u. – Weave, SB US 31 south of ramp from EB I-465

According to completed capacity analyses, this weaving segment is projected to operate below INDOT LOS standards during both 2015 peak hours (Paramics), the 2035 AM peak hour (HCS & Paramics), and the 2035 PM peak hour (Paramics). The deficient operations at this location are caused by the short weaving distance (approximately 450') between access to I-465 and the intersection of US 31 (Meridian St.) & 96th St. As mentioned above, there are a significant number of vehicles exiting EB I-465 and attempting to make the southbound left-turn at the intersection of US 31 (Meridian Street) & 96th Street.

Options to improve operations at this location include: removing northbound and southbound left-turn movements at the intersection of US 31 (Meridian St.) & 96th St.; implementation of "jug-handle" operations to serve northbound and southbound left-turns; and/or restricting EB I-465 exiting traffic from making southbound left-turns at the intersection by installing concrete barrier.

It should be noted that HCS is not equipped to analyze a two-sided Type C weave. Thus, HCS results, though included in this report, should not be considered a barometer for future operations

southbound volumes during the AM period in combination with the resultant queuing downstream of this location. However, observation of this movement in the Paramics model shows no significant breakdown. Thus, operations at this location can most likely be improved by addressing operations downstream on US 31.

#13 – 116th St. & Pennsylvania St.

According to completed Synchro analyses, this intersection (or individual movements on the approaching legs) is projected to operate below INDOT LOS standards during both 2015 peak hours and both 2035 peak hours. The breakdown at this location is caused by a lack of lanes to accommodate heavy northbound and southbound through volumes; in addition, the westbound through/right movement will be over capacity.

Two options have been identified that should alleviate congestion at this location. The first option is to add lanes on each approach to create more capacity, particularly for left-turn movements. There is a need for exclusive right-turn lanes for every approach, for additional exclusive left-turn lanes for the eastbound, northbound, and southbound approaches, and for additional through lanes for the northbound and southbound approaches. The other option is to consider alternatives related to redirecting a portion of volume at this intersection to other potential routes, whether by creating new routes or by modifying current routes to accommodate additional traffic.

#14a. – NB US 31 (Meridian St.) btwn 116th St. & 131st St./Main St.

According to completed Paramics analysis, this freeway segment is projected to operate below INDOT LOS standards during the 2035 PM peak hour; the freeway segment is projected to operate at LOS F during this period. Poor operations for this segment are due mainly to high northbound volumes during the PM period in combination with weaving volumes between the two ramps. However, observation of this movement in the Paramics model shows no significant breakdown. It should also be noted that HCS results show acceptable LOS's at this location.

Operations could be improved at this location by designing for an auxiliary lane connecting the northbound entrance ramp from 116th St. and the northbound exit ramp at 131st St./Main St.

#15b. – Intersection, NB ramps & 131st St./Main St.

According to completed Synchro analysis, the eastbound left-turn movement of this intersection is projected to operate below INDOT LOS standards during the 2035 PM peak hour; the movement is projected to operate at LOS F during this period. Operation of this left-turn movement can be improved by adding a second exclusive eastbound left-turn lane.

#16 – 131st St./Main St. & 126th St./Carmel Dr./Meridian Corners Blvd. (existing roundabout)

According to completed RODEL and Paramics analyses, this roundabout (or individual movements on the approaching legs) is projected to operate below INDOT LOS standards during both 2015 peak hours and both 2035 peak hours. East-west operations along the 131st St. corridor are problematic due to the bottleneck at the northbound US 31 ramps; this, combined with varied capacity around the roundabout and single receiving lanes on all approaches, results in poor operations. For the 2015 peak hours, capacity of the roundabout can be improved by increasing the width of the eastbound approach from one lane to two. For the 2035 peak hours, two-lane

intersection can be improved by providing two exclusive left-turn lanes and two exclusive right-turn lanes along the northbound approach.

#20d. – Intersection, SB ramps & 136th St.

According to completed HCS analysis, this intersection is projected to operate below INDOT LOS standards during the 2035 AM peak hour; the eastbound right-turn movement is projected to operate at LOS F during this period, as is the intersection as a whole. Poor operations at this intersection are due to insufficient capacity for the eastbound right-turn movement from eastbound 136th St. to southbound US 31. Operation of the intersection can be improved with the addition of a second exclusive eastbound right-turn lane, as well as with the addition of an accompanying overlap phase for the eastbound right-turn movement. It should be noted that the addition of an overlap phase would require the restriction of the southbound through movement.

#21 – 136th St. & Rohrer Rd.

According to completed Synchro analysis, the eastbound left-turn movement of this intersection is projected to operate below INDOT LOS standards during the 2015 PM peak hour; the movement is projected to operate at LOS F during this period. Operation of the intersection improves with the addition of a protected/permitted phase for the eastbound left-turn movement.

#23 – 136th St. & Oakridge Rd. (existing roundabout)

According to completed capacity analyses, this roundabout (or individual movements on the approaching legs) is projected to operate below INDOT LOS standards during the 2015 AM peak hour (Paramics), the 2015 PM peak hour (RODEL & Paramics), and both 2035 peak hours (RODEL & Paramics). Poor operations at this roundabout are due to insufficient capacity compared to approaching volume; the roundabout is a bottleneck that blocks through traffic along 136th St. For the 2015 peak hours, capacity of the roundabout can be improved by refining the lane geometry of the westbound approach to increase the flare length (L'). For the 2035 peak hours, two-lane westbound and eastbound approaches should be considered, as well as the possibility of refining the lane geometry of the southbound approach (increasing entry width and flare length). The possibility of replacing this roundabout with a signalized intersection should also be considered.

#24 – 136th St. & Memory Ln.

According to completed Paramics analyses, this intersection is projected to operate below INDOT LOS standards during both 2035 peak hours; the intersection is projected to operate at LOS F during both periods. The main cause of congestion at this intersection is the spillback of traffic from the adjacent roundabout; the capacity of the intersection itself may contribute to the congestion, but it is not as critical. Thus, addressing issues at the adjacent roundabout (136th St. & Oakridge Rd.) should improve operations. Operations can also be improved at this location by widening 136th St. in both directions. The possibility of adding a southbound left-turn lane at the intersection should also be considered.

#29j. – Weave, south of intersection #29i. before split to SB US 31 & SB SR 431

According to completed HCS analysis, this weaving segment is projected to operate below INDOT LOS standards during the 2035 AM peak hour; the weaving segment is projected to

traffic from the US 31 northbound ramp terminal at 161st St. and the weaving maneuvers along US 31 between the two ramps. Operations can be improved at this location by solving the congestion issues at the downstream off-ramp; possible mitigation corresponding to the downstream off-ramp is addressed above.

#36a. – Intersection, NB ramps & 161st St.

According to completed HCS, Synchro, and Paramics analyses, this intersection is projected to operate below INDOT LOS standards during the 2035 PM peak hour. Again, this intersection shows difficulty in serving the high forecasted eastbound volume; queuing at this location is caused by back-ups stretching back from Union St./Westfield Blvd. Operations at this location can be improved by adding an east-west travel lane along 161st St. between US 31 and Union St./Westfield Blvd.

#36b. – NB merge (US 31)

According to completed Paramics analysis, this merge area is projected to operate below INDOT LOS standards during the 2035 PM peak hour; the merge area is projected to operate at LOS F during this period. The poor operations at this merge area are caused by back-ups from the SR 32 northbound exit ramps that extend onto the US 31 mainline. This causes friction on the mainline section that makes the merge and subsequent weave difficult for entering traffic. Operations at this location can be improved by addressing capacity issues on eastbound SR 32; an additional travel lane in either direction along SR 32 would address the issue.

#36d. – 161st St. & US 31 SB Ramps

According to completed HCS and Synchro analyses, the southbound left-turn movement of this intersection is projected to operate below INDOT LOS standards during the 2015 AM peak hour and both 2035 peak hours. As directed by RW Armstrong, this intersection was considered to be unsignalized for the purposes of capacity analysis (see Table 1 in the Appendix). However, due to the signalization of the adjacent ramp junction (161st St. & US 31 NB Ramps), and the poor projected operation of the southbound left-turn movement, signalization should be considered; signalization would improve the operation of the southbound left-turn movement.

#38 – 161st St. & Westfield Blvd./Union St.

According to completed Synchro and Paramics analyses, this intersection is projected to operate below INDOT LOS standards during the 2035 PM peak hour. This intersection has difficulty handling the unbalanced heavy traffic in the southbound and eastbound directions. The southbound approach is limited to a single lane, which results in queuing; the single eastbound through lane cannot accommodate the heavy through volumes. Operations at this intersection can be improved by adding and eastbound through lane and an additional southbound lane.

#39a. – NB US 31 (Meridian St.) btwn 161st St. & SR 32

According to completed Paramics analyses, this freeway segment is projected to operate below INDOT LOS standards during the 2015 PM peak hour and the 2035 PM peak hour; the freeway segment is projected to operate at LOS F during both periods. Poor operations for this segment are due to queuing on the northbound exit ramp to SR 32 that extends onto mainline US 31. This back-up is caused by insufficient capacity along SR 32 east of US 31. Operations along this

#47b. – SB US 31 (Meridian St.) btwn SR 38/Sheridan Ave. & 216th St.

According to completed Paramics analysis, this freeway segment is projected to operate below INDOT LOS standards during the 2035 AM peak hour; the freeway segment is projected to operate at LOS F during this period. Poor operations for this segment are due mainly to high southbound volumes in the AM period in combination with weaving volumes between the access point of 216th St. and the off-ramp from southbound US 31 to SR 38/Sheridan Ave. However, observation of this movement in the Paramics model shows no significant traffic breakdown. It should also be noted that HCS results show acceptable LOS's at this location.