FAQ/RULES OF THUMB
Frequently Asked Questions
Rules of Thumb

• **HCS intersection analysis criteria**
  – See LDM Figure 401-14aE
  – Cycle lengths between 60 to 120 seconds
  – No impractical phases, i.e., 1 second green time
  – Yellow + All Red must be no less than 5 seconds
  – It is good practice to include reasonable clearance intervals and allow for pedestrians timing (in an urban core)
  – Use proper lane widths and truck percentages
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**HCS intersection analysis criteria**

- Worst of the east/west approach delay shall be balanced (within 3 seconds) with the worst of the north/south approach delay for both the No Build Condition (to identify capacity constraints) and the Build Condition (to appropriately “size” the intersection)

- After “balancing the intersection” the V/C for major movements should be less than 1.0 (preferably less than 0.93) for the Build Condition
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• **HCS intersection analysis criteria**
  – The previous criteria (Slides 1 & 2) is used for designing the intersection based upon 20 year design traffic, NOT DETERMINING FIELD SIGNAL OPERATIONS
  
  – If the intersection operations cannot be appropriately sized (such as by adding thru or turn lanes) to reduce v/c ratios to less than 1.0, due to ROW impacts, utility impacts, costs, etc., document these impacts and explain why the proposed build condition is an acceptable compromise
How is HCS used to determine the necessity for turn lanes?

- Use Balanced Delays to identify capacity constraints (movements with v/c > 1.0)
- Where capacity needs are identified, adding thru lanes and/or turn lanes can mitigate the capacity deficiencies
- Refer to Section 401.2 of LDM
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• How are the need for turn lanes determined for unsignalized intersections?
  – L&D Manual Figures 401-5(a-c) and 401-6(a-d)
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• **More HCS intersection analysis criteria:**
  
  – Slip right turn lanes
    • ODOT methodology removes volumes from HCS calculation
    • UNLESS If evaluating the no build condition and the thru movement is blocking the slip condition (the slip lane is undersized), then the right turn volumes are included in the signal analysis

  – Short right turn lanes
    • If the right turn lane is approximately 100 feet long then analyze as a shared through right. Through blockage is most likely occurring.
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• **More HCS intersection analysis criteria:**
  – Right turn overlap at diamond interchange intersections
    • At a ramp intersection, if a through movement is physically allowed from the off ramp to the on ramp, this condition must be permitted in the traffic phasing and lane markings
    • i.e., if more than one lane exists on the off ramp, then one of those lanes is typically a thru/turn shared lane.
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• **Additional through lane at signal – how far should it extend downstream of the signal?**
  - A minimum of 300’ plus speed taper, see LDM Figure 402-1E
  - Preferably 1000’ feet plus speed taper. The concern is lane utilization. HCS will default to a uniform distribution. HCS shows better LOS than could be experienced in the real world as HCS assumes the lane is infinite. The reports below is used for guidance.

  - NCHRP Report 780
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• **When HCS may not be enough**
  
  – Intersections
    
    • Closely spaced (under 600 feet) – Might need to utilize more tools to analyze queues/ operations (Synchro)
    
    • 5-legged intersection
  
  – Freeway
    
    • Compound weave
    
    • Complex operations (weaving vs. lane shift)
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- Approximate volumes for sizing lanes (signalized):
  - Single left turn lane
    - 3 leg intersection: 150-300 vph
    - 4 leg intersection: 100-250 vph
  - Dual left turn lane
    - 3 leg intersection: 250-450 vph
    - 4 leg intersection: 200-450 vph
  - Through lane
    - 3 leg intersection: 600-800 vph
    - 4 leg intersection: 400-500 vph
  - Right turn lane
    - Depends on through volumes (typically >300 vph)

Please note these numbers are starting points. HCS analyses should used to determine actual lane needs (see Slides 2 - 4).
Double left turn lane to single lane receiving on arterial or entrance ramp (not recommended if capacity is exceeded on arterial)

300’ parallel speed taper
Frequently Asked Questions
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• Developing turn lanes for ramps
  • Single lane ramp to two lanes, three lanes, four lanes – how are turn lane lengths calculated? For most cases, it is assumed deceleration has occurred upstream of the ramp storage (see L&D 401-9 Condition A)

  1 → 2
  Tapered lane should be minor movement
  SEE LDM Section 503.7

  1 → 3
  The shared lane option should have equal length turn lanes (Left Volume + Right Volume)/3.
  Other designs follow 1 → 2 criteria

  1 → 4
  Turn lanes should be developed with
  1 → 2 → 4 style
  2 lane section should be reasonable length.
  It is not preferred to use 1 → 4 style

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- **Developing turn lanes for dual exit ramps**
  - Dual lane ramp to two lanes, three lanes, four lanes – how are turn lane lengths calculated? (see L&D 401-9 Condition A)
  - Dual lane ramps are roughly needed at 1500 vph

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- **Converting right turn slip lanes (from freeway to arterial) to right turn lanes**
  - The right turn volume must be included in the build HCS signal analyses. There may be need for double rights, if the right turns were heavy. This has been performed for safety reasons in the past (arterial weave or high exit speeds).

- **Converting right turn slip lanes (from arterial to freeway) to right turn lanes**
  - The right turn volume must be included in the HCS analyses. There may be need for double rights, if the right turns were heavy. Dual receiving lanes may be needed to receive the double lanes.
• **When to use Synchro, SimTraffic, VISSIM, and SIDRA in conjunction with HCS**
  - Synchro: Closely spaced intersections (100’ to 600’)
  - SimTraffic: This can verify queue lengths and why less than the LDM method might be acceptable (interchanges/intersections). This is normally because of physical constraints and sizeable impacts.
  - VISSIM: This can be used where Synchro/Simtraffic does not adequately model operations: Unconventional Intersections, Complex Freeway operations, etc. This is a time intensive and expensive process and is not recommended w/out coordinating with ORE first. Is very expensive if just to be used for Public Involvement and therefore not recommended.
  - SIDRA: Multi-lane roundabout
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- **SimTraffic – Preferred settings**
  - SimTraffic used for queuing analyses
  - PHF/Anti-PHF factor settings
  - Interval settings; seed time should be twice the avg. travel time through the network. This example is just the interchange and adjacent signals.

- Depending on the size of the network, multiple runs may have to be preformed. See FHWA Microsimulation Toolbox. The minimum number of runs should be 3.
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- **SimTraffic Model Verification**
  - Check Vehicles Denied Entry
  - Check Queues for max queue
  - SimTraffic report should be included in documentation. 95% queues are acceptable for validation for lack of turn lane storage required from L&D method.
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• Simtraffic Checks
  – In oversaturated conditions, care should be taken when developing the SimTraffic model
    • O-D’s should be checked for interchanges
    • Signals should be optimized for interchange intersections and the corridor
      – With traffic operations, a healthy balance of progression, safety, and operations needs to be met. ODOT prefers ramps not be used as extended storage for the maximizing progression on the corridor. ODOT does not accept queues onto the mainline.
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• **Roundabout software (HCS, Sidra, etc.)**
  - HCS 2010 can be used for single or dual lane roundabouts
  - Sidra can be used for single or multilane roundabouts. ODOT uses and accepts Sidra
  - ODOT does not accept Rodel for roundabout analysis
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• When a Traffic Impact Study (TIS) turns into an Interchange Modification Study (IMS)
  • What is the effect on the traffic (build vs. no build)?
    – The TIS would determine to what extent the developed site “TIS build” would degrade the nearby roadway and what improvements are needed to bring it back to its “TIS no build” operations.
    – The IMS would determine how the “TIS build” traffic would impact the freeway. The “TIS Build” traffic is considered the “IMS No-build” traffic.
  • What is the process within ODOT?
    – These projects have been complex in the past depending on the nearby freeway facility. These projects have typically started as a permit project from the developer and sponsored by the city, county, and/or township.
    – If the freeway is operating at poor LOS, some improvements might not be able to be performed. This impacts what the TIS might determine is the preferred solution. The TIS needs to be performed to determine how much traffic is going to be generated by development. The process can be iterative. Please consult with ODOT if this situation arises.
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• **Ramp metering – guidelines**
  • Ramp metering should be part of a system (Freeway Management System)
  • Office of Traffic Engineering has guidelines for equipment and implementation.
  • Office of Roadway Engineering has draft guidelines for geometric standards
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- **Deliverables**
  - See LDM Section 550.5 for Review Process