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Three Ways to Address Congestion

1) **Add Capacity** (i.e. add lanes)
2) **Reduce Demand**
   a) Demand Management (Carpooling, Mode Choices, Telecommuting)
   b) Placing destinations to where supply exists (ex. TOD)
   c) Contain Sprawl
   d) Spreading demand across a network
3) **Improve Traffic Flow**
   a) Signals (Phases, Cycles, Progression)
   b) Weaving, Merging, Diverging (Flow Friction)

Innovative Geometric Design Focuses on Demand and Traffic Flow
1) One-Way Street Progression
2) Creating Mini-Networks of Smaller Intersections
   a) T-intersections
   b) Intersections with one-way movements
3) More Efficient Signal Phases (when signalized)
4) Conflicts Reduced and Spread Out
Benefits

SAFETY
- Fewer conflict points
- Significant Before/After Crash Reductions

MOBILITY
- Less delay
- Reduced congestion

VALUE
- Less ROW
- Less construction costs
- Implemented quicker
Simple to Synchronize Signals
Variable: Speed determines offset of signal
Speed controlled by signals and/or geometry (i.e. roundabouts)
Simple to Synchronize Signals

Variable: Speed determines offset of signal

Speed controlled by signals and/or geometry (i.e. roundabouts)

Two-way progression relies on:

Speed,

Distance (between signals),

And Cycle Length
Cities Have Full Networks of Small Intersections
Why are Networks Good?
- Spreads out Demand
- Spreads out Conflicts

Why are Small Intersections Good?
- Shorter Clearance Time
- Less Exposure for Pedestrians and Bicycles to Moving Vehicles

So why are we so anti-network outside of cities? i.e. Build larger Intersection vs smaller Intersections?
Signal phasing

Basic two-phase signal operation

Adding “protected” left-turn phases is common as volumes increase.

Adding more phases essentially “steals” time away from the major through movement and can increase intersection delays.
Strategically relocating movements to reduce phases can provide more green time to through traffic.
Fewer phases – GOOD / Left turns - BAD

Photo: 2-Phase operation at a Median U-turn Intersection
Conflict Points Reduced and Spread Out

32 Conflicts
- Diverging
- Merging
- Crossing

8 Conflicts

Source: NCHRP Report 672

www.ats-american.com   www.divergingdiamond.com
The Relationship between Geometry and Traffic Operations (WIIW&HYCUTTFEDDT)

Conflicts Points Reduced and Spread Out

<table>
<thead>
<tr>
<th>Vehicle-Vehicle Conflict Points</th>
<th>Conventional</th>
<th>MUT</th>
<th>RCUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crossing</td>
<td>16</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Merging</td>
<td>8</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Diverging</td>
<td>8</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>32</strong></td>
<td><strong>16</strong></td>
<td><strong>14</strong></td>
</tr>
</tbody>
</table>
# Conflict Points Reduced and Spread Out

## The Relationship between Geometry and Traffic Operations (WIIW&HYCUTTFEDDT)

<table>
<thead>
<tr>
<th></th>
<th>Crossing</th>
<th>Merging</th>
<th>Diverging</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional diamond</td>
<td>10</td>
<td>8</td>
<td>8</td>
<td>26</td>
</tr>
<tr>
<td>Diverging diamond</td>
<td>2</td>
<td>6</td>
<td>6</td>
<td>14</td>
</tr>
</tbody>
</table>

![Diagram showing comparison between conventional and diverging diamond intersections](image)

Conflict points are reduced and spread out in diverging diamond intersections compared to conventional ones.

1) One-Way Street Progression
   a) Lead-Lag Left
   b) Partial Median Openings
   c) Convert to One-Way Pairs when Practical

2) Creating Mini-Networks of Smaller Intersections
   a) Strategic Mini-Network for Access Management
   b) Smaller T-Intersections over one 4-legged
   c) Separate Right Turns

3) More Efficient Signal Phases (when signalized)
   a) T-intersections max out at 3 phases
   b) Eliminate Left Turn Phasing when Possible through other alternatives
   c) Strategize Signal Spacing based on Speeds and Cycle Lengths

4) Conflicts Reduced and Spread Out
   a) Two T-intersections 18 Total Conflict Points, 6 Crossing
   b) Alternative Left Turn Options within an Existing Network (30 conflicts spread out)
Final Thoughts

- Congestion can be addressed by adding capacity, reducing demand, and improving traffic flow.
- Designs work a lot better when we integrate geometry with traffic operations at the same time.
- Can be in the form of an Innovative Intersection.
- Can be in the form of more conventional design with more innovative thought.
- Industry as a whole needs more “cross-training” over “specialization.”
Questions???

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