Designing Arterials for Safe Speeds

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Critical Reasons for Crashes Investigated in the National Motor Vehicle Crash Causation Survey

<table>
<thead>
<tr>
<th>Critical Reason</th>
<th>Estimated (Based on 94% of the NMVCCS crashes)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Recognition Error</td>
<td>845,000</td>
</tr>
<tr>
<td>Decision Error</td>
<td>684,000</td>
</tr>
<tr>
<td>Performance Error</td>
<td>210,000</td>
</tr>
<tr>
<td>Non-Performance Error (sleep, etc.)</td>
<td>145,000</td>
</tr>
<tr>
<td>Other</td>
<td>162,000</td>
</tr>
<tr>
<td>Total</td>
<td>2,046,000</td>
</tr>
</tbody>
</table>
“The critical reason was assigned to the driver in an estimated 94% of crashes.”
Speed is the problem.
Vehicle Speed increases Risk

Pedestrian Fatality / Severe Injury Risk

Tefft (AAA Foundation), 2011
Speed reduces recognition.

20 mph
Speed reduces recognition.

40 mph
Speed extends stop distance.

20 mph

44 ft

New York Ave, DC (Google Maps)
Speed extends stop distance.
While all fatalities are rising...
...Ped & Bike are Growing Fastest

NHTSA, 2017
Auto-Centric Design ≠ Safety

US Nat’l Fatality Rate

FARS data (NHTSA), 2016
Really?
Risk to people walking & biking is systemic.
Most (non-freeway) traffic fatalities...

- Rural Local / Collector: 28%
- Urban Local / Collector: 16%
- Urban Arterials: 30%
- Rural Arterials: 26%

FARS data (NHTSA), 2016
...are on a small % of streets

- Rural Local / Collector: 66%
- Urban Local / Collector: 66%
- Urban Arterials: 4%
- Rural Arterials: 6%

FARS data (NHTSA), 2016
We need to proactively design streets for safe speed.
Passive Approach

Operating Speed → Design Speed → Posted Speed
Observed Operating Speed

85th

31mph
Design Speed

35 mph

85th

35 mph
Posted Speed

85th

SPEED LIMIT
30

35mph
Operating Speed

85th

35mph

SPEED LIMIT 30

35mph
Passive Approach

Operating Speed → Design Speed → Posted Speed
## Rainier Ave, Seattle

<table>
<thead>
<tr>
<th>Location</th>
<th>Speeders</th>
<th>High-End Speeders</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northbound</td>
<td>84%</td>
<td>4%</td>
</tr>
<tr>
<td>Southbound</td>
<td>82%</td>
<td>6%</td>
</tr>
</tbody>
</table>
Proactive Approach

Target Speed = Design Speed = Posted Speed
<table>
<thead>
<tr>
<th>Location</th>
<th>Change: Speeders</th>
<th>Change: High-End</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northbound</td>
<td>-52%</td>
<td>-81%</td>
</tr>
<tr>
<td>Southbound</td>
<td>-28%</td>
<td>-73%</td>
</tr>
</tbody>
</table>
Rainier Ave, Seattle

Before:
9 injury crashes per year

After:
0 injury crashes in 2016
How can proactive street design reinforce safe speed?
Design Toolbox
Design Toolbox

Building Lines

Medians

Signal Progression & Spacing

Street Parking

Street Trees
Reinforcing Target Speed

• Don’t overbuild for vehicle capacity
• Don’t overbuild for large, infrequent vehicles
• Use signals to manage speed(ing)
• Provide comfortable and efficient multi-modal facilities
Design for all day, not just peak hour.
Peak Hour Design

“in urban design, the 30th highest hourly volume can be a reasonable representation of daily peak hour”

“the use of average hourly traffic would result in an inadequate design”

– AASHTO 2.3.2
Peak Hour Design

30th Peak Hour = 0.34% of year
Streets change through the day
Streets change through the day

- 6 AM: 20 mph
- 12 PM: 40 mph
- 6 AM: 20 mph
- 12 AM: 40 mph

MILES PER HOUR (95th Percentile)

MOTOR VEHICLES PER HOUR
Fewer Good Lanes > More Bad Lanes
Fewer Good Lanes > More Bad Lanes

Travel Time:  
Slight improvement

Traffic Volume:  
No change

Speeding (>35):  
75% decrease
Fewer Good Lanes > More Bad Lanes

Total Crashes: 50% decrease
Ped. Injuries: 51% decrease
Design compact intersections.
Speed reduces yield rate

Yielding Rate to Pedestrians by 85\textsuperscript{th} Percentile Speed

Bertulis & Dulaski, 2013
NYC Left Turn Study

1 in 5 Ped / Bike KSIs were hit by left-turning vehicles.

69% of those were on receiving streets >60ft wide.

NYC DOT
Match Design Vehicles to Streets

DL-23

SU-30
Design for effective radius
Design for effective radius
Design for effective radius
Mountable aprons
Test using interim materials
Match Vehicles to Goals

Matching Vehicles to Goals

10 in. shorter
2 in. narrower
25 ft turn radius
Use signals for efficient traffic, not fast traffic.
Use signals to manage speed
Use signals to manage speed
Slow streets unlock space.
Speed consumes linear space

40mph

293 ft
Slow streets unlock linear space

20mph

Bike share / bike parking

67 ft
Safe Places to Bike
Efficient & Accessible Transit
Slow streets unlock linear space

20mph

Green Infrastructure
Unlock space for water
Slow streets unlock linear space

20mph

Street parking & loading

Plazas / Parklet
Vibrant Spaces for People
Jan 16 – Webinar
Integrating Bike Share & Transit

May 31 – Training
Sister Cities Roadshow: Better Street & Bikeways, Columbus, OH
Thank you!

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