Cycling Road Safety Audits

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Presentation Outline

- 1) Cycling as a Viable Transportation Alternative
- 2) Safely Accommodating Cyclists
- 3) Road Safety Risk Assessment
- 4) Edmonton Downtown Bike Network RSA
- 5) Observations
Cycling

- Cycling / Cycling Demand is Increasing

- Critical Element in a City’s Transportation Planning
  - E.g., Edmonton long term plans for bike friendly city (2009)

- Examination of Potential Ridership
  - Current and Future

- Practical Utilization of infrastructure
Cycling

- Benefits beyond transportation
  - Health
  - Economic
  - Environmental
- Many cycling benefits but need to recognize road safety risk
- Vulnerability = Risk
Safe Accommodation of Cyclists

- Wide range of facilities offering very different level of accommodation (Safety vs. Mobility)
Safe Accommodation of Cyclists

- Many planning, design and operation guides available
- Effective and thorough guidance
- Aware of limitations / application bias
  - Analogous to Modern Roundabout Implementation

MassDOT  |  FHWA  |  NACTO  |  TAC
Road Safety Risk Assessment

- Most road safety interventions / investments target existing safety problems (e.g., a ‘high-crash’ location)
  - Objective: REDUCE frequency / severity of collisions (Reactive)

- Safe Systems Approach suggests that it is also necessary to target high-risk / low crash locations
  - Objective: PREVENT collisions from occurring (Proactive)

- A Proactive Approach is particularly important for cyclists and pedestrians (VRUs)
  - Difficult to justify improvements because of the lack of clustering of VRU collisions
Understanding Road Safety Risk

- The magnitude of the road safety risk is not always clear

Road safety risk not not be readily apparent
Understanding Road Safety Risk

- The magnitude of the road safety risk is not always clear

Road safety risk not not be readily apparent

Viewed differently, road safety risk become more evident
Assessing Road Safety Risk

- Road safety risk is expressed as a function of three elements:
  - 1) Exposure: Extent of the opportunity for conflict/collisions

No road users = SAFE

More road users = LESS SAFE
Assessing Road Safety Risk

- Road safety risk is expressed as a function of three elements:
  - 2) Probability: Likelihood of encountering roadway hazards

Greater separation = SAFER
Less Separation = LESS SAFE
Assessing Road Safety Risk

- Road safety risk is expressed as a function of three elements:
  - 3) Consequence: Severity of outcome if hazard is encountered

Off-Road Consequence = LOW Risk

Off-Road Consequence = HIGH Risk

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Risk Elements for Cycling

- Amount of conflicting traffic:
  - vehicles / cyclists / pedestrians

- Conflict points:
  - Intersections, driveways, access, continuity / connectivity

- Visibility and Sightlines
  - Parking, street furniture, trees, lighting,

- Operations / Speed / Behavior
  - vehicle / cyclist
Edmonton Downtown Bike Network

- **Context:**
  - Downtown Growth – increased congestion / safety concerns
  - Vision Zero – Accommodate VRUs (high % of serious collisions)
- Edmonton City Council approved construction of a 7.1 km bike network for the downtown core
- Feasibility study completed by Stantec in 2016
- Implementation by summer 2017
Edmonton Downtown Bike Network

- Feasibility study provided
  - Route assessment and recommendations
  - Design considerations / recommendations
    - Available road width
    - Design criteria for bike lanes / travel lanes / parking
    - Intersection design / traffic control
    - Operational considerations (1-way or 2-way operation)(parking)
Edmonton Downtown Bike Network

- Edmonton City staff prepared the designs for the Downtown Bike Network
  - 2-Way Bike Lane System on 2-Way Street System
- A Road Safety Audit (RSA) was completed on the proposed design to understand the safety impacts for all road users
  - One-Way vs. Two-Way operations for Bike Lanes
  - System-Wide Safety Issues
  - Location-Specific Safety Issues

- Driver expectancy;
- Turning vehicle conflicts;
- Cyclist origin-destinations;
- Curb-side operations (parking, loading, transit stops);
- Connection to existing cycling facilities.

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Downtown Bike Network RSA Results

- System Wide Issues:
  - Vehicles Backing into Bike Lakes
  - Left-turning vehicles across bike lanes
    - With high volumes (cars, bikes, peds)
    - With adjacent on-street parking
  - Operation of bike boxes
    - Limited storage
    - Right-turn thru bike boxes
Downtown Bike Network RSA Results

- Additional signing for left-turns across bike lanes
- Left-turning traffic across bike lanes at intersections
  - Risk thresholds from design guide may impact operations
  - Dedicated signal phase or leading signal phase required
  - Could lead to high-level of non-compliance / poor driver behavior

<table>
<thead>
<tr>
<th>Separated Bike Lane Operation</th>
<th>Motor Vehicles per Hour Turning across Separated Bike Lane</th>
<th>One-way Street</th>
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<tbody>
<tr>
<td></td>
<td>Two-way Street</td>
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</tr>
<tr>
<td></td>
<td>Right Turn</td>
<td>Left Turn across One Lane</td>
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<tr>
<td>Two-way</td>
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</tr>
</tbody>
</table>

Separated Bike Lane Planning and Design Guide, Massachusetts Department of Transportation, 2015.
Downtown Bike Network RSA Results

- Need for bike detection or push buttons for bike actuation
  - Dynamically respond to cycling and traffic demand to improve operational performance of intersection

- Restricted cross-sectional widths for Bike Lanes and Buffer
  - Very minor issue as all cycling facilities are very close to the recommended design standard
Downtown Bike Network RSA Results

- Potential for conflicts between cyclists and pedestrians on the cycling facilities along 104 Avenue
  - High pedestrian demand due to MacEwan University Campus and transit stops on 104 Avenue
  - High pedestrian demand near Rogers arena will make cycling operations difficult
    - Alternate route proposed
Summary / Observations

- Cycling and cycling infrastructure is critical component to an effective urban transportation system
- The vulnerability of cycling means that it is extremely important to consider the safety of these road users
- By explicitly evaluating road safety risk \( \text{Risk} = F_n (E, P,C) \), it is possible to identify and prioritize road safety issues
- A Cycling RSAs allow for the examination of design features that can adversely impact the safety of all road users
  - Cycling RSA for Edmonton’s Downtown Bike Network was beneficial as it identified safety issues and suggested mitigation measures to improve safety