Analysis of Access Category Guidelines in Utah

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Outline

- Introduction
- Purpose and Need
- UDOT Access Management Guidelines
- LiDAR Data
- Access Management Criteria Analysis
- Conclusions
- Questions?
Introduction

Access Management is defined as “the coordinated planning, regulation, and design of access between roadways and land development. It encompasses a range of methods that promote the efficient and safe movement of people and goods by reducing conflicts on the roadway system and at its interface with other modes of travel” (Williams et al. 2014)
Access Management is implemented to reduce conflicts on the roadway:

- Driveway consolidation
- Median treatments
- Left-turn lanes
Introduction

- Access management has been shown to have a positive impact on roadway safety.
- Numerous studies have been conducted on the safety relationship of access management techniques as a function of access spacing, corner clearance, and medians.
- Several of these studies have been conducted in the state of Utah; primarily in urban and suburban settings.
Purpose and Need

Utilize the LiDAR dataset to perform an analysis of the state related to access management, particularly related to driveway spacing and access categories.

- Determined hot spot locations for possible implementation of access management techniques.
- Evaluated driveway spacing and access using Utah access category criteria.
The purpose of this rule is to:

- Maximize public safety
- Provide for efficient highway operations and maintenance of roadways; and
- Utilize the full potential of the highway investment

The rule “serves to establish highway access management procedures and standards to protect Utah’s state highway system”
Utah Department of Transportation R930-6:

- Standards based on highways of similar functions
- 10 categories:
  - Posted speed limit
  - Signal, street, and driveway spacing
  - Urban or rural design
  - Functional class

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
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<tbody>
<tr>
<td>1</td>
<td>I Freeway/Interstate</td>
</tr>
<tr>
<td>2</td>
<td>S-R System Priority-Rural</td>
</tr>
<tr>
<td>3</td>
<td>S-U System Priority-Urban</td>
</tr>
<tr>
<td>4</td>
<td>R-R Regional-Rural</td>
</tr>
<tr>
<td>5</td>
<td>R-PU Regional Priority-Urban</td>
</tr>
<tr>
<td>6</td>
<td>R-U Region-Urban</td>
</tr>
<tr>
<td>7</td>
<td>C-R Community-Rural</td>
</tr>
<tr>
<td>8</td>
<td>C-U Community-Urban</td>
</tr>
<tr>
<td>9</td>
<td>O Other Importance</td>
</tr>
<tr>
<td>10</td>
<td>F-FR Freeway One-Way Frontage Road</td>
</tr>
</tbody>
</table>
LiDAR Data

Light Detection and Ranging (LiDAR):

- Laser pulse:
  - Time recorded between when sent and received

- Mobile LiDAR collection:
  - Highly accurate
  - Reduces worker exposure to traffic hazards
LiDAR Data

UDOT LiDAR Data:
- Mandli Communications Inc.
- Update approximately every two years (2012, 2014, 2015-2016)
- ~20 different asset datasets were collected
Access Management Criteria Analysis

- Datasets utilized
- Initial correlation and hot spots
- Automated Excel workbook
- Access category analysis
Datasets Utilized

UDOT Data Portal:
- Historic AADT
- 2014 Driveways
- 2014 & 2016 Medians
- 2014 Lanes
- 2013 UDOT Access Category ID
- 2015 Speed Limit
- Functional Class
- Urban Code
Datasets Utilized

**UDOT Data Portal:**
- Historic AADT
- 2014 Driveways
- 2014 & 2016 Medians
- 2014 Lanes
- 2013 UDOT Access Category ID
- 2015 Speed Limit
- Functional Class
- Urban Code

**UDOT Traffic and Safety Division:**
- Crash Data
- Crash Location
- Crash Rollup
- Crash Vehicle data (‘02-’14)
Initial Correlations and Hot Spots

- Visualized data with GIS:
  - Found hot spot areas
  - Found correlations between datasets
- Crash data:
  - Density
  - UDOT safety categorical ranking distribution
- Driveway data:
  - Line density
  - Spatial join
- Median data
- Access category

<table>
<thead>
<tr>
<th>UDOT Classification</th>
<th>UDOT Percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most Problematic</td>
<td>0%-5%</td>
</tr>
<tr>
<td>More Problematic</td>
<td>5%-20%</td>
</tr>
<tr>
<td>Some Problematic</td>
<td>20%-80%</td>
</tr>
<tr>
<td>Less Problematic</td>
<td>80%-95%</td>
</tr>
<tr>
<td>Least Problematic</td>
<td>95%-100%</td>
</tr>
</tbody>
</table>
St. George Blvd., Washington County

Access Density

Crash Density

Median Type

Legend
Miles of Access per Sq. Mile
0 - 2
3 - 8
9 - 32
33 - 38
39 - 40

Access per Mile
0 - 5
6 - 21
22 - 70
70 - 99
100 - 104
Roads
Counties

Legend
Crashes per Year
0 - 1.6
1.7 - 6.3
6.4 - 25.0
25.1 - 29.8
29.9 - 31.4
Roads
Counties

Legend
Median Type
No Median
Other
Painted Median
Rail and Transit
Raised Median
Undivided
Roads
Counties

UDOT Access Management Research
Initial Correlations and Hotspots

Field Access Density:

- Question: Do the current roadway characteristics match the current AC?
- Compared field access density with existing AC:
  - Downtown Salt Lake City, UT
  - State St., Orem, UT
- There are differences:
  - Wanted more detailed analysis:
    - Excel workbook used to evaluate
Automated Excel Workbook

- Created in 2015
- VBA programming
- Combines multiple datasets
- Segment data:
  - Homogeneous characteristics
  - Maximum specified length
Modifications to Workbook:

- Roadway Data portion:
  - Addition of new datasets
- Crash Data portion was not changed
- Specified data from each dataset is combined into a single Excel file
Adjustments to Short Segments:

- Short segments: segments <0.5 miles
- Some segments as small as 0.001 miles!
- Three adjustments for short segments:
  - Minimum segment length
  - 10% AADT buffer
  - 0.1 mile length buffer
Automated Excel Workbook

Updated Segmentation User Interface:
- Added segmentation for short segment lengths

Other Adjustments:
- Removed gated/utility driveway types
Automated Excel Workbook

Gated/Utility Driveway Included

Gated/Utility Driveway Removed
Output Used to Identify Segments with Differing AC:

- Segments that do not follow recommended R930-6 guidelines (Field AC are different than the current AC)
- Separated by Access Density, Speed Limit, Both
- Not necessarily a bad thing!
  - Simply: the assigned AC does not meet current roadway characteristics based on this analysis
  - Need more research

<table>
<thead>
<tr>
<th>Access Category</th>
<th>Minimum Driveway Spacing (ft.)</th>
<th>Maximum Access per Mile</th>
<th>Speed Limit (mph)</th>
<th>Urban Code</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>On One Side of Roadway On Both Sides of Roadway</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>N/A - -</td>
<td>≥ 45 -</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1000 5.28 10.56</td>
<td>≥ 45 Rural</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>N/A - -</td>
<td>≥ 40 Urban</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>500 10.56 21.12</td>
<td>≥ 45 Rural</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>350 16.5 33</td>
<td>≥ 45 Urban</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>200 26.4 52.8</td>
<td>≤ 40 Urban</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>150 35.2 70.4</td>
<td>≤ 40 Rural</td>
<td></td>
<td></td>
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<tr>
<td>8</td>
<td>150 35.2 70.4</td>
<td>≤ 40 Urban</td>
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<td></td>
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<tr>
<td>9</td>
<td>150 35.2 70.4</td>
<td>- -</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>N/A - -</td>
<td>- -</td>
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</table>
### Access Category Analysis

#### Segments outside access density criteria:

<table>
<thead>
<tr>
<th>AC</th>
<th>Total Segments</th>
<th>Crash/Mile/Year</th>
<th>Number of Segments</th>
<th>Percentage</th>
<th>Crash/Mile/Year</th>
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<tr>
<td>1</td>
<td>336</td>
<td>21.9</td>
<td>5</td>
<td>1.5%</td>
<td>5.3</td>
</tr>
<tr>
<td>2</td>
<td>331</td>
<td>2.0</td>
<td>7</td>
<td>2.1%</td>
<td>2.2</td>
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<tr>
<td>3</td>
<td>203</td>
<td>18.7</td>
<td>93</td>
<td>45.8%</td>
<td>12.1</td>
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<tr>
<td>4</td>
<td>484</td>
<td>2.4</td>
<td>42</td>
<td>8.7%</td>
<td>3.9</td>
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<tr>
<td>5</td>
<td>313</td>
<td>28.2</td>
<td>119</td>
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<tr>
<td>6</td>
<td>145</td>
<td>21.8</td>
<td>31</td>
<td>21.4%</td>
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<tr>
<td>7</td>
<td>274</td>
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<td>11</td>
<td>4.0%</td>
<td>3.4</td>
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<tr>
<td>8</td>
<td>82</td>
<td>16.5</td>
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<td>8.5%</td>
<td>27.2</td>
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<tr>
<td>9</td>
<td>12</td>
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<td>0</td>
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<tr>
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<td>Total</td>
<td>2180</td>
<td>12.3</td>
<td>315</td>
<td>14.5%</td>
<td>19.1</td>
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Access Category Analysis

Segments Outside Access Density Criteria:

- Salt Lake County, UT:
  - Redwood Rd.
  - State St.
  - 700E/900E
  - New Bingham Hwy/7800 S.
## Access Category Analysis

**New AC Based on Field Data:**

- If exceed maximum access density, moved to AC 9
- Urban Code and Access Density

### Urban Code, Access Density, Speed Limit

<table>
<thead>
<tr>
<th>AC</th>
<th>Total AC</th>
<th>New Access Category</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
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<tbody>
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<td>0</td>
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<tr>
<td>2</td>
<td>331</td>
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<td>321</td>
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<td>193</td>
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</tr>
</tbody>
</table>

**New Access Category:**
- Green: Current AC Matches Field Data
- Light Red Cells: <10% Total AC Segments
- Dark Red Cells: >10% Total AC Segment
Conclusions

- Used LiDAR data to evaluate driveway spacing and access using existing rules outlined in R930-6:
  - Analysis based on field observations
  - Simply means assigned AC does not meet current roadway characteristics
  - Roadways may need to grow into criteria or make changes to access categories
Questions?

For more information, contact:

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