Prioritizing Barrier Replacement

AASHTO GIS-T
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Presentation Outline

- The importance of barrier and guardrail assets in Utah
- Identifying problematic barrier designs and understanding the funding picture for their replacement
- Using GIS to identify, score, and prioritize barrier by risk and exposure
Why does this matter?

- UDOT’s Three Strategic Goals
  - Zero Crashes, Injuries, and Fatalities
  - Preserve Infrastructure
  - Optimize Mobility
UDOT B&G Assets in Action...

- $438-450 million in assets
- 1,400–1,500 miles of barrier
- From 2006-2016, UDOT’s barrier assets
  - Were hit by nearly 40,000 vehicles
  - Estimated to have prevented 177 fatal and 829 serious injury crashes
  - Estimated $3.63 billion reduction in crash costs
- UDOT’s barrier system has an estimated annual benefit that is about 75% of its replacement cost
How do we inventory our B&G assets?

- 2017 Mandli LiDAR collection
- 10,927 barrier and guardrail assets on state routes
- Spatial location, plus attributes such as route, milepost, type, high end treatment, low end treatment, post type, height, and offset.
Known Issues – Texas Turndowns

- Pre-Test Assets: predate 1960
  - Texas Turndowns
  - Rollovers
  - Too low
- Removal and Funding
  - 1994: FHWA mandates removal plan
  - 1996: $0.3M per year allocated to address issue
  - 2017: Last Texas Turndown removed from NHS
  - $10M worth of Texas Turndowns remain on non-NHS highways
Known Issues – Cable Loop

- NCHRP-230: installed 1960s to mid-1990s
  - Guardrail is too low for modern vehicles (taller and heavier)
  - Pre-cast cable loop barrier may have deteriorated
  - All 12.5’ Jersey barrier is affected, some 20’ Jersey barrier is affected
  - Steel plate mitigation has not been crash tested
Known Issues vs Funding Gap

• With $440 million in barrier assets and a 30-40 year lifespan, we need to replace $11-14 million per year
• Current funding is $1.5-4 million per year short
How can GIS help?

- Where are the problematic barriers?
- What is the risk and exposure of these barriers?
- How to score and weight based on multiple criteria?
- More accurate understanding of Jersey barrier situation
- Visual presentation for Department senior leadership
What's the statewide barrier picture?

Aging and Obsolete Distribution by Region

- Region 1
- Region 2
- Region 3
- Region 4

- NCHRP-230
- Precast Cable-Loop
- Pretest

Segment Data

$L0,000,000$ to $50,000,000$
Jersey Barrier Inspection

- Mandli data does not distinguish between Jersey barrier that is newer, has been plated, or is the older design
- Web map constructed to allow Traffic and Safety staff to visually inspect Jersey barrier statewide without leaving their desk
- Use the Roadview Explorer imagery that was also collected with the Mandli LiDAR runs
- Saves 100s of hours of field visits, and eliminates the risks of field work
Jersey Barrier Inspection Web Map

- UPlan Web Map
Risk and Exposure – Desktop Analysis

• How do we go about prioritizing barrier for replacement?
• ArcGIS Desktop analysis to assign AADT and speed limit to each barrier
• “Overlay Route Events” tool using LRS Route and Milepost

Wood posts, W-Beam, Texas Turndown
65 mph speed limit
1,300 AADT
## Scoring and Prioritization

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<th>BARRIER TYPE</th>
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<td>No AADT Factor</td>
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Scoring and Prioritization

- Rural highway in Southern Utah
- Scoring = Barrier Risk * Speed Risk * AADT Risk
- Example below = 9 * 9 * 2 = 162

- Wood posts, W-Beam, Texas Turndown
- 65 mph speed limit
- 1,300 AADT
• Urban interstate along the Wasatch Front
• Scoring = Barrier Risk * Speed Risk * AADT Risk
• Example below = 9 * 10 * 9 = 810
Understanding the Statewide Picture

- Provide feedback to Regions for them to allocate flexible money appropriately - rather than increasing Traffic and Safety’s B&G fund
- Show Regions B&G needs and track progress towards elimination of aging/obsolete B&G assets.
- Prioritize Barrier replacement to address largest needs first
- GIS output can be combined with planned projects for efficiency
- Look for clusters of high priority barrier to address in one effort
Message to Leadership – Story Map

**B&G Assets Story Map**

UDOT’s Asset Management group values UDOT’s B&G assets at $438-450 million. Assuming a lifespan of 30 years, we should be spending about $15 million per year to keep our barrier in acceptable conditions.

Barrier and guardrail reduce severity of crashes by redirecting vehicles away from hazards (cliffs, bhunt ends, opposing traffic). In 10 years, UDOT’s 1400-1500 miles of barrier was hit by nearly 40,000 vehicles. This equates to:

- 26 barrier hits per mile, or one hit for every 220 feet of barrier
- Estimated $3.83 billion reduction in crash costs 2006-2016
- 177 fatal and 829 serious injury crashes prevented
- A net increase of about 5,000 non injury crashes
How was GIS used?

- Mandli Collection
  - Asset attributes
  - Spatial location
  - Roadview Explorer imagery
- Desktop Analysis – LRS “Overlay Route Events”
  - Speed limit risk
  - AADT risk
- Jersey Barrier Visual Inspection web map
  - Avoid field work and refine data
- Presentation Story Map
Utah Statewide Barrier Prioritization

- The importance of barrier and guardrail assets in Utah
- Identifying problematic barrier designs and understanding the funding picture for their replacement
- Using GIS to identify, score, and prioritize barrier by risk and exposure
Thank You!  Questions?

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