Nationwide Mobile Mapping: TomTom Data for HPMS and Safety

Mitch Caya
MANDLI COMMUNICATIONS

Becky Hjelm
UDOT
Who is Mandli?

- Based in Wisconsin since 1983
- Worked with over 30 state DOT’s
- Provides full highway pavement and asset inventory
- Utilizes
  - HD ROW imagery
  - Velodyne HDL-32 LiDAR sensor
  - Applanix GPS
Nationwide Mobile Mapping: TomTom Data for HPMS and Safety
Mandli LiDAR Movie
Who is Utah DOT?

- Mandli collects nearly 12,000 lane miles of data every year, LiDAR every other year
- Assets delivered:
OUR BUSINESS TODAY

4,700 employees in 35 countries
TOMTOM MAPS EMPOWER USERS TO MAKE SMARTER MOBILITY DECISIONS

- Mobile Usage
- Navigation
- Ride Planning
- Drive Range Calculation
- Autonomous Driving

Internet of Things
TOMTOM HD MAP DELIVERS HIGH ACCURACY & FULL ATTRIBUTION

Highly Detailed
(objects which can be seen)
3D lane geometry:
Lane markings
Drivable surface borders
Road boundaries

Highly Accurate
Sub meter absolute
Decimeter level relative

Richly Attributed
(including inferred attributes)
Lane level attributes:
Speed restrictions
Lane centerlines
Lane widths
Tom Tom North America Coverage
Tom Tom LiDAR Movie
Tom Tom Background
Tom Tom Coverage – Utah
Tom Tom Coverage – Salt Lake City
Mandli/UDOT Project Background

- Project to collect pavement, photolog, LiDAR and assets since 2012
  - 2012
  - 2014
  - 2015/16

- New Contract 2017 - 2023
  - Pavement every year
  - LiDAR Assets every other year
  - RFP required collection and delivery on two Salt Lake City area routes in March 2017
Test Section 1

- Route 186P
  - Urban surface street
  - Wide facility
  - Many lane, shoulder and median changes
  - Mile 4.5 - 7.5
  - Tom Tom collected 2 lanes in each direction in May 2016
LiDAR Collection Dates For 186P

1. Mandli Past Production
   - 6/18/2012
   - 3/10/2014
   - 11/25/2015
   - 9/6/2017

2. Mandli Pilot
   - 3/2/2017

3. Tom Tom Collection
   - 5/11/2016
   - 2018
Test Section 2

- Route 215P and 215N
  - Urban Interstate
  - Several interchanges
  - Median changes
  - Mile 1.5 - 4.0
  - Tom Tom Collected 3 lanes in each direction in June 2017
LiDAR Collection Dates For 215P and 215N

1. Mandli Production
   - 6/17/2012
   - 3/10/2014
   - 11/24/2015
   - 8/21/2017

2. Mandli Pilot
   - 3/2/2017

3. Tom Tom Collection
   - 6/9/2017
   - 6/13/2017
   - 6/23/2017
LiDAR Data in Extraction Environment

Mandli Pilot

TomTom
LiDAR Data in Extraction Environment

Mandli Pilot

TomTom
Differences in 3 Months

- Between March and June 2017
  - 215P
    - 6 Sign Faces Removed
    - 13 Sign Faces Added
  - 215 N
    - 5 Sign Faces Removed
    - 3 Sign Faces Added
Sign Changes from March through June 2017
Large Overhead Sign Removed

Removed Sign 3/2017
Large Overhead Sign Removed

Removed Sign 6/2017
New Sign 3/2017
New Sign

New Sign 6/2017
Interchange in Mandli Data
Interchange in Mandli Data

Mandli Pilot Line Work (March 2017)
Interchange in Mandli Data

Mandli Pilot Surface Area Polygons (March 2017)
Same Intersection in TomTom Data
Interchange in TomTom Data

TomTom Line Work (June 2017)
Interchange in TomTom Data

TomTom Surface Area Polygons (June 2017)
Consistency of Median Width (Route 186)

HPMS Median Width (Item 36)
Consistency of Shoulder Width (Route 186)

HPMS Shoulder Width (Items 38 and 39)
Consistency of Shoulder Widths (Route 215)

HPMS Shoulder Width (Items 38 and 39)
Consistency of Shoulder Widths (Route 215)

HPMS Shoulder Width (Items 38 and 39)
Consistency of Shoulder Widths (Route 215)

TomTom Data

Mandli Pilot Data
Consistency of Shoulder Widths (Route 215)

TomTom Data

Mandli Pilot Data
Consistency of Shoulder Widths (Route 215)

TomTom Data

Mandli Pilot Data
Consistency of Lane Width (Route 186)
Consistency of Lane Width (Route 215)

HPMS Lane Width (Item 34)
Pavement Surface Area (Route 186)
Pavement Surface Area (Route 215)
Guardrail – Mandli Pilot in LiDAR
Guardrail – TomTom in LiDAR
Guardrail – Map
Pavement Message – Mandli Pilot in LiDAR
Pavement Message – TomTom in LiDAR
Pavement Message – Map
<table>
<thead>
<tr>
<th>HPMS Group Items</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>1. Lanes</td>
<td>8. Sign Assemblies (Stop, Yield, Speed, Route Marker)</td>
</tr>
<tr>
<td>2. Medians</td>
<td>9. Sign Faces (Stop, Yield, Speed, Route Marker)</td>
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<tr>
<td>3. Paint Striping</td>
<td>10. Speed Limit</td>
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<tr>
<td>4. Shoulders</td>
<td>11. Curve</td>
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<tr>
<td>5. Curbs</td>
<td>12. Grade</td>
</tr>
<tr>
<td>6. Intersections – Control Type</td>
<td>13. *Photolog</td>
</tr>
<tr>
<td></td>
<td>*Non-HPMS</td>
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</tbody>
</table>
Standard Inventory Offering (All HPMS Plus...)

1. Sign Assemblies
2. Sign Faces
3. Guardrails/Barriers
4. Guardrail Terminals
5. Rumble Strips
6. Drainage
7. Monuments
8. Manholes
9. Pavement Messages
10. Raised Pavement Markers
11. Delineators
12. Bridge Deck Surfaces
13. Paint Striping Quantity

- Broad usage across divisions
- Popular items (signs)
- Safety items
- Design items
Extended Offering (All Assets)

1. Sidewalks
2. ADA Ramps
3. Fire Hydrants
4. Ditches
5. Streetlights
6. Utility Poles
7. Utility Towers
8. Intersections
9. Signal Power Pedestals
10. Signal Cabinets
11. Driveways
12. Retaining Walls
13. Billboards
14. Driveway Culverts

• More cross-division appeal
UDOT Uses of Data

- UPLAN – ArcGIS mapping portal
- Open Data – Online data download
- Traffic & Safety studies
- Maintenance Inspections and Inventory

To learn more, stay for Kaitlin’s presentation at 4:30!
Summary

- TomTom data yields a viable solution to collect assets
- There will always be some differences in the data from collection cycle to cycle, as raters will be the final say in delineation.
- Very important for States to work with their vendors
- Public agencies wanting an asset inventory may find this service extremely useful.
UDOT Data QC

**UDOT Swipe Application**

- UDOT used swipe web application to compare some of the datasets collected by TomTom and collected from Mandli.
- The data was comparable to a degree with a few exceptions.
- Many of these discrepancies may be attributed to changes in UDOT’s data dictionary from the time of the RFP to the time of TomTom’s collection.
Questions?

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