

Indiana DOT's MRU Experience

New England ATSSA

November 2015



- **INDOT has experience with both Mobile Retroreflector Units (MRU) models**
 - Laserlux
 - LTL M
- **We learned a lot of things (Opportunities for Improvement!) that other agencies can learn and benefit from**



Why did we need an MRU?

- **Restriping (waterborne paint) is 100% done by in-house crews**
 - Centerlines – annually
 - Edgelines – depends on retained retro
 - Previously done with handheld units
 - >130, skip a year
- **Performance Based Marking Spec**
 - Initial readings taken by certified contractor
 - Retained readings (for durables) done the following spring by in-house forces



How did we get an MRU?

- **Traffic Safety section secured grant money**
 - Sign retroreflectometer for each District
 - Enough \$\$ left for an MRU



How did we get an MRU?

- **Demos provided by both vendors**
- **Specs developed**
 - Combination of Traffic Evaluations (Materials Section)
 - Traffic Administration (Traffic Engineering)
- **Opportunity for Improvement**
 - Decide up front who will “own” and operate your MRU
 - INDOT ultimately decided this was Maintenance
 - Maintenance had not been involved until the bid was advertised



How did we get an MRU?

- **Opportunity for Improvement**
 - Good specs are essential
 - Decide up front what you want
 - Do you need the ability to record video?
 - Do you need DMI?
 - Make sure complete on-site training is included
 - Know who will need to be trained
 - Decide allowable correlation to handheld units



How did we get an MRU?

■ Winning Bid

- Laserlux (with Ford Transit Connect)
 - Scanning Laser
 - Internal mirrors
- \$165,000
 - LTL M (with Ford Explorer) was \$187,000
- PO October 2013



Our Laserlux Experience

- **Delivery was on the coldest morning on record**
 - State government closed (first time in 20 years)
 - ~8" snow overnight
- **Opportunity for Improvement**
 - Could not field test unit for several months
 - Did a lot of static work inside the shop



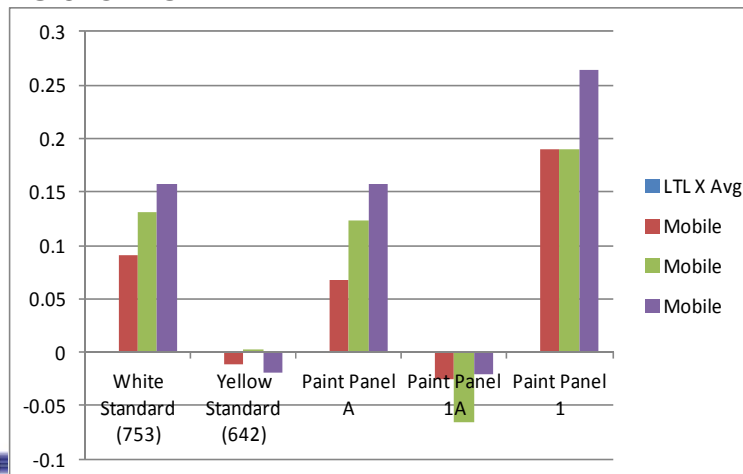
Our Laserlux Experience

- For Acceptance, correlation to handheld is essential
 - Spec called for 5% of LTL X
- Laserlux was delivered with 2 calibration plates (white/yellow markings on a plate)
- We constructed several more of our own (paint, calibrated with handheld)



Our Laserlux Experience

- This is where we started to have problems...



Our Laserlux Experience

■ Gamma Scientific to the Rescue

- The vendor sent out a technical rep, with new panels
- Realigned all the mirrors, went in the field with us
- We initially got very good correlation
- Until he left...



Our Laserlux Experience

■ Laserlux Returned

- There was too much variation between both shop and field measurements to have confidence in our network retro evaluations
- INDOT did not have dedicated staff to become experts on frequent Laserlux maintenance
- The Laserlux was not going to meet our operational needs



Our LTL M Experience

- **Revised specs and re-bid**
 - Removed requirement for video
- **LTL M bid \$191,000 (Ford Explorer)**
 - Remember, initial bid with video was \$187,000
 - Technology uses digital camera/flash unit
 - No internal moving parts
 - Less complicated maintenance
- **PO June 2014**



INDOT LTL-M OPERATIONS



Developing a Plan

■ Requirements

- Read every edgeline (non-Interstate)
- Complete after winter (plow damage), but prior to striping season

■ Start Date

- Use Historical weather data to estimate start date
 - Avg temp >40, Dry
 - Requires one rain to remove salt residue
- Determined could start Mid-February in SW Indiana



Developing a Plan

■ Determining required time

- 2 directions per road
- ~20,000 edgeline miles
- ~Estimated 400 miles/day
 - Attainable, but was more often 300-350 miles
- Plan down days due to weather

■ Target Completion = May 13 (NW Indiana)



Developing a Plan

■ Teams and Shifts

- Teams of Two
 - 1 MQS Operator (Primary)
 - Had more training on MRU
 - 1 District Driver (Assistant)
 - Relied more on primaries knowledge
- 2 x 3 day shifts (Mon – Sat)



Developing a Plan

- Plan for employee's other required work and/or rain days
- Plan base of operations & transport if needed

Mobile Retro Plan 1							
Team	District	Date From	Date To	Total Day	Days for Reflectiv	Days for LOS/QA	CY 14 First day for EL
K/L	Vincennes	2/16/2015	2/28/2015	12	9	3	6/19/2014
K/L	Seymour	3/2/2015	3/14/2015	12	9	3	4/24/2014
K/M	Crawfordsville	3/16/2015	3/28/2015	12	9	3	4/23/2014
L/T	Greenfield	3/30/2015	4/8/2015	9	7	2	5/8/2014
T/M	Fort Wayne	4/9/2015	4/25/2015	13	9	4	5/7/2014
T/M	LaPorte	4/27/2015	5/13/2015	14	9	5	5/30/2014



Begin Date

- Unfortunately, SW Indiana (Evansville) got 8" of snow in early March...
- Actual begin date = March 9
- Opportunity for Improvement
 - May not be necessary to read entire network
 - District Traffic personnel knew where their "bad roads" were
 - Ultimately, we were able to skip a lot
- Completion date = May 8



Managing Data

- With the LTL M, each run of readings must be logged as a separate "series"
 - This includes pulling off the road for a gas/restroom break
 - GPS errors occur if a series is restarted



Managing Data

- When the data is downloaded, each series is a discrete txt & kmz file

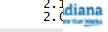
```

Series name      SR 109 5B
Direction       Dec
Side            Edge
Length (M)      0.00
Driven Length (M) 1.12
Reference       9
Comment

User name       Todd Shields
Comment User   comment

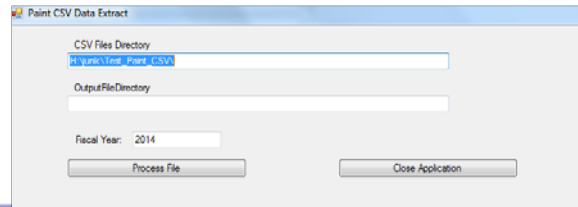
RL Choice       r1
Maximum 288    57
Minimum 85    57
Standard Dev.  47.59    0.00
Average 225.87 56.83

Driven distance (M)  Timestamp      Logmark  RL Left  RL Center  Left  width Left (inch)  Day
0 01/23/2015 09:46:11.919 AM 248 253 3.95714331450129 1.960217796
0.02007576 01/23/2015 09:46:14.983 AM 263 266 3.97262703325959 2.0
0.04015152 01/23/2015 09:46:10.539 AM 263 262 4.00297361192149 2.0
0.06022727 01/23/2015 09:46:07.798 AM 279 286 3.99247175768077 2.1
0.08030303 01/23/2015 09:46:05.901 AM 279 283 3.97766232231483 2.0
0.10037879 01/23/2015 09:46:00.151 AM 283 287 3.94447643246705 2.0
0.12045455 01/23/2015 09:46:02.595 AM Thermoplastic 260 264 3.91542191494037
0.1405303 01/23/2015 09:46:05.048 AM Asphalt; Thermoplastic 247 249 3.75820839
0.16060606 01/23/2015 09:46:02.526 AM Asphalt; Thermoplastic 218 220 3.73959048
0.18068182 01/23/2015 09:46:04.000 AM 218 220 3.32948514299629 1.4
0.20075758 01/23/2015 09:46:05.477 AM 237 243 3.95921144103536 1.4
0.22083333 01/23/2015 09:46:07.821 AM 233 238 3.97293970388723 1.4
0.24090909 01/23/2015 09:46:09.258 AM 232 236 3.9721624500221 1.97691258
0.26098485 01/23/2015 09:46:14.825 AM 243 246 4.08830450738734 2.2
0.28106061 01/23/2015 09:46:12.153 AM 226 230 4.03015489765745 2.1
0.30113636 01/23/2015 09:46:18.749 AM 234 237 4.00895195082246 2.0
    
```



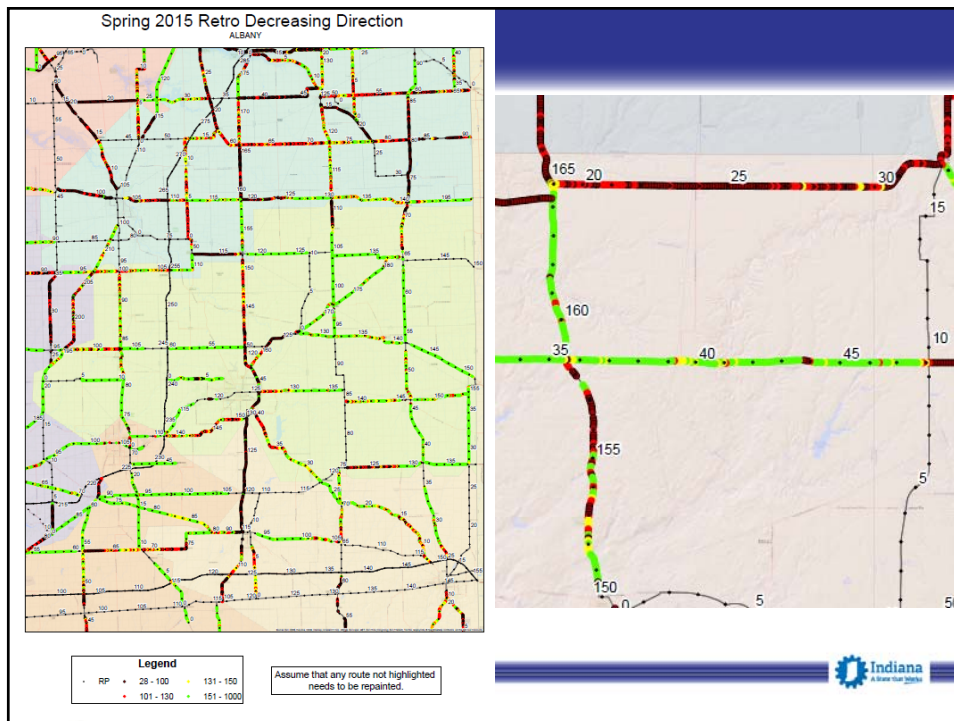
Managing Data

- At a network level, this will result in a LOT of files!
 - Develop standard series naming conventions
- Fortunately, our IT section developed a "quickie" compiler
 - Combines all text files in a folder into one file



Presenting Data

- **INDOT decided the easiest way to present the MRU results was through GIS maps**
- **Need 2 maps/location – 1 for each direction**
- **Summarizing Data**
 - Avg retro reading every 0.1 miles
 - Green – confident retro passes (>150)
 - Yellow – retro passed, but not by much (131-150)
 - Red – retro above 100, but did not pass (101-130)
 - Dark Red – < 100



Parts

- Sensor
- Mounting Bracket
- Calibration Block
- Alignment Bar



Parts

- Processor
- Battery
- Tablet (Android)



Parts

- GPS
- DMI



➤ Opportunity for Improvement

- DMI on LTL-M is not permanently attached to vehicle
 - Uses suction cup that occasionally fell off
- Determined GPS worked well enough



Maintenance

- Clean windows – Daily
- Replace Windows – As Needed
 - We needed to replace halfway through
- Replace Flash Bulb – Not needed yet
 - ~500 hour of operation



Maintenance

- **Run Alignment ~ Monthly**
- **Adjust Support Bracket Height**
 - Needed maybe twice



Issues

- **System sometimes would freeze and need to shut down and restart**
 - Normally during setup
 - Occasionally happened on the road
 - At one point found battery cable loose
- **Alignment must be done inside (no sunlight), and must be completed if started**
- **Cannot stop and restart measurements on same series**



Issues Continued

- **Delivered Package did not seem fully finished**

- Needed Tools (wrenches, screw drivers, tape, level, etc)
- Built our own platform to hold/secure sensor when not in use



Issues Continued

- **Low Clearance**

- Very easy to scrape the bottom
- Measurement Unit needs protection
 - Cage did not hold up very well
 - We did have 1 Curb vs. MRU

- **DMI**

- Not really needed as GPS gets location
- Not permanently mounted
 - Has fallen off on road



Issues Continued

- **Data exports/deletes can be a little cumbersome**
 - Only one or all series at a time
- **Cable failure**
 - Precision Scan very responsive of assisting with issue
 - Was covered with our warranty that was written in the specs
 - Without warranty would have been \$470



Final Thoughts

- **Know exactly what you want up front**
 - Good specs essential
- **Know what you want to do with the MRU**
 - Identify owner/operator and make them part of the process

