Verification of Retroreflectivity

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2015 Transportation Short Course
What Is Retroreflectivity?

- Retroreflectivity is the efficiency of a material to return light in the general direction from which it came.
- Coefficient of Retroreflected Luminance ($R_L$) is the most commonly used measurement of retroreflectance for pavement markings.
- Units: mcd/m$^2$/lux
Data Collection Equipment: Retroreflectometers
TxDOT Areas of Interest

- Item 666 - Retroreflectorized Pavement Markings
  - 4.4 – Retroreflectivity Requirements
  - 4.5 – Retroreflectivity Measurements
    - 4.5.1 – Mobile Retroreflectometer Measurements
    - 4.5.2 – Portable Retroreflectometer Measurements
- January 28, 2015 – Memorandum requiring all non-profile longitudinal pavement markings to meet retroreflectivity requirements
- TxDOT Special Specification – Mobile Retroreflectivity Data Collection for Pavement Markings
TxDOT Special Specification: Mobile Retroreflectivity Data Collection for Pavement Markings

• Specification requires contractor certification at TTI
• Specification describes the following requirements
  • Data files
  • Data mapping
  • Video
  • Field spot checks
• Retroreflectivity verification requirements
  • Specification is currently being modified to incorporate retroreflectivity verification
Certification Program Background

- Certification program began in Spring 2007
- Program was developed after TxDOT questioned the validity of mobile retroreflectivity data that was submitted as part of a contract
- The data was highly variable and didn’t always make sense
- TxDOT questioned the ability of the contractor to operate the equipment and wanted contractors to be tested to make sure they have the ability to collect accurate data
Certification Program Overview

• Prior to conducting work for TxDOT, contractors must come to TTI and pass the certification test
• Certification testing is required for all new operators
• Closed course and open road testing
• All line types and colors measured
• Field verification checks (retroreflectivity verification) are now required to maintain certification
• Loss of certification due to poor retroreflectivity verification results requires full recertification testing
• Certification program guide details information about the program
Certification Test Area

- Paint, tape, thermoplastic, and epoxy markings
- White and yellow, all marking patterns, RRPMs
Certification Testing

- Yellow lines measured from left side of vehicle
- White lines measured from right side of vehicle
- Mobile retroreflectivity data must be within ±15% of the handheld retroreflectivity value collected on the same pavement marking segments
- Data is evaluated for each individual run and for the test as a whole
Currently certified: 11 TX contractors, 3 from out of state
3 different mobile measurement devices have been certified
Several other measurement devices in development
Retroreflectivity Verification Testing

- Federal regulations require DOTs to verify contractor test results for performance based product acceptance
- Guideline is to perform verification on a minimum of 10% of projects
- TTI is working with TxDOT to meet these requirements
  - Verification or spot monitoring can also be conducted by districts contracting the work to ensure accurate data is consistently collected
Retroreflectivity Verification Testing

- TTI is using a SiteManager materials report to monitor and select projects.
- Project selection is based on a stratified random sample.
- Initially selecting 20% of projects with a goal of evaluating 15% to ensure the 10% requirement is met.
Retroreflectivity Verification Testing

• Contractors mobile data will be compared to mobile data collected by TTI (supplemented with handheld readings for accuracy verification)

• TTI verification data to be collected within 7 days of contractor data

• Contractors and/or TxDOT will be required to keep TTI informed of scheduled mobile retroreflectivity data collection activities

• The contractors will not know which projects TTI has selected for verification testing
Data Analysis

• TTI will be checking two things
  1. Does the contractor data fall within ±15% of the TTI data (The acceptable difference between the two data sets may be modified as the verification testing proceeds)
  2. Does the contractor and/or TTI data meet the retroreflectivity requirements

• An adequate sample size will be evaluated to account for variability of the measurements
Notification of Results

- TTI will provide the results to the TxDOT engineer in charge of the project as well as the contractor

- Possible results:
  - Data verifies and is above requirements (*good*)
  - Data verifies but is below requirements (*restripe*)
  - Data verifies but is above/below requirements (*referee test?*)
  - Data does not verify but is above requirements (*corrective actions*)
  - Data does not verify and is below requirements (*restripe, corrective actions*)
  - Data does not verify and is above/below requirements (*referee test?, corrective actions*)
Corrective Actions

• Corrective actions need to take place or certification status can be lost after multiple failed verification tests

• Recommended corrective actions will be provided to the contractor with the results

• Possible corrective actions
  • Have equipment serviced
  • Improve calibration procedure and frequency
  • Adjust software settings
  • Monitor data collection conditions
Referee Testing

- The Engineer can choose to use either the contractor or the TTI data to determine if the marking meets the retroreflectivity requirements.
- The Engineer can request referee testing if they are unsure of the data.
- If the contractor has issue with the TTI results referee testing can be requested:
  - Most likely to occur when the data does not validate and the TTI data indicates the retroreflectivity requirements are not met whereas the contractor data indicates the requirements are met.
- CST will perform the referee testing using handheld retroreflectometers.
Next Steps

• Get final approval on revised special specification
• Notify districts and contractors of the revised special specification
• Distribute revised certification program guide to contractors
• Implement full scale retroreflectivity verification program
• Assist districts and/or conduct retroreflectivity training if there are questions about the retroreflectivity requirements
• Add new material to certification/verification website
Questions?

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