

# IRI and CALIBRATION METHODS

LTRC PAVEMENT PERFORMANCE  
SEMINAR

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# International Roughness Index

- Why IRI?
- Inertial Profiler Certification
- Test Procedure Changes
- Contractor Verification Program
- User Observations

# Why IRI?

- More relevant method of measure
- Safer
- Quicker
- Measures both wheelpaths
- National Standard
- FHWA

# 85th TRB Annual Meeting

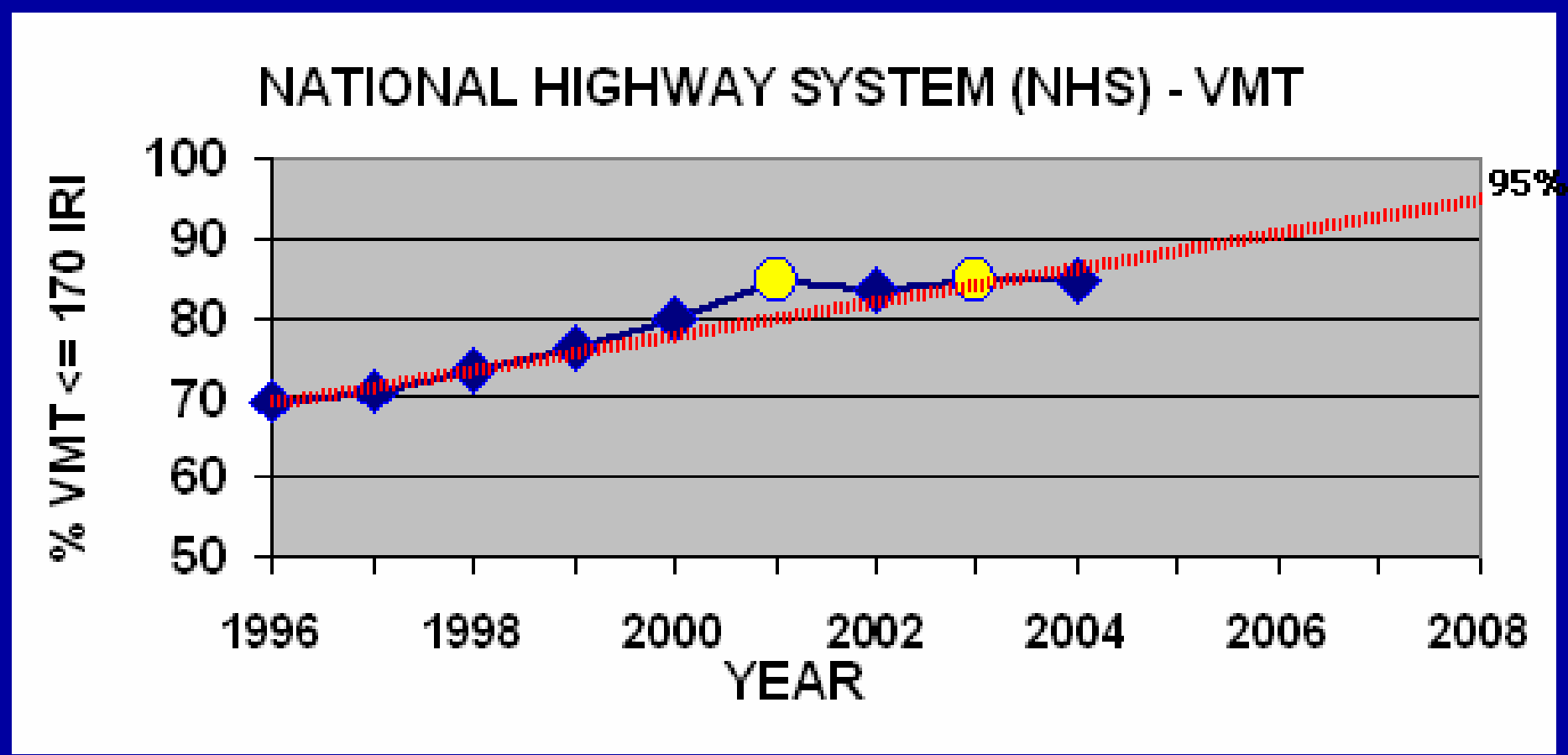
- Applicability of International Roughness Index as Predictor of Asphalt Pavement Condition (04-4421)  \*\*
- **“they confirm the acceptability of IRI as a predictor variable of Pavement Condition Index.**
- Kyungwon Park, University of Rhode Island  
Kang-Won Wayne Lee, University of Rhode Island  
Natacha Elisabeth Thomas, University of Rhode Island



# Why IRI?

- **MONEY – “Poor U.S. Road Conditions Cost Drivers an Extra \$52 Billion in Annual Vehicle Repairs”**
- **LIVES – “and may play a role in nearly 30 percent of traffic fatalities”**
- according to “Market Analysis,” the quarterly automotive market research newsletter published by the Motor & Equipment Manufacturers Association (MEMA). MEMA is headquartered in Research Triangle Park, NC.
- *posted Monday February 28, 2005*

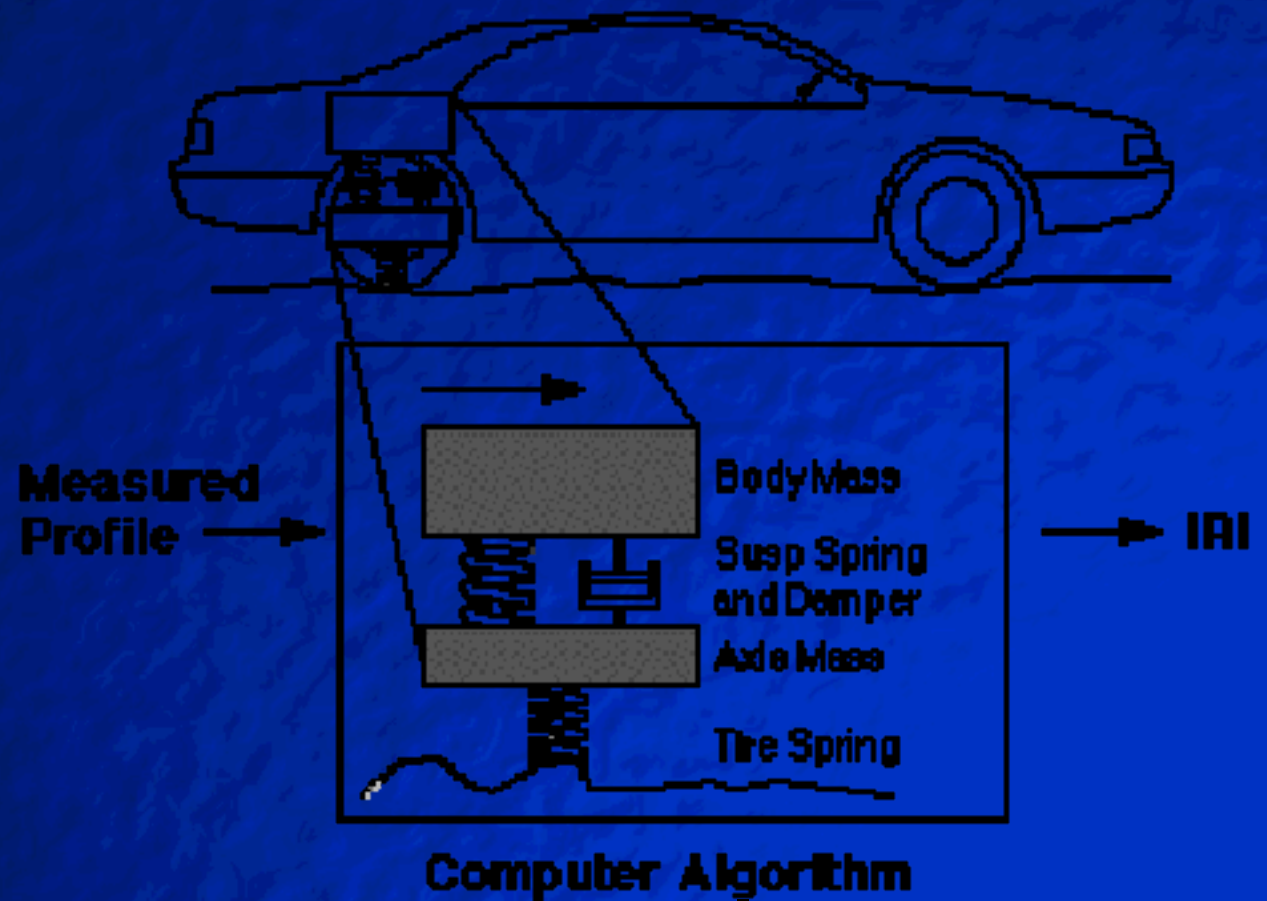
# FHWA Goals



2004 84.9% below 170  
IRI

# Why IRI?

Equipment based on Quarter Car Model which simulates the vehicle response.



# INERTIAL PROFILER CERTIFICATION

- Rodeo in May - yearly – 19 units in 2005
- ICC – 3 units
- Dynatest – 4 units
- Ames – 12 units





# INERTIAL PROFILER CERTIFICATION

- 10 runs, not 5
- Standard Deviation  $\pm 3$  IRI of mean
- Mean IRI  $\pm 6$  IRI of reference

# TEST PROCEDURE

- **TR 644 - 04, “Determining the Longitudinal Profile Roughness of Traveled Surfaces Using Automated Profilers”**



- Automatic Triggering Device – to enable a more precise starting and stopping point when a reflective tape or cone is passed.





# Certification Decal

- Filter Settings
- Expiration date
- Added “operated speed”  
(Lisa is 8 – 12 mph)
- PI and/or IRI

NO. \_\_\_\_\_

LOUISIANA  
DEPARTMENT OF  
TRANSPORTATION AND DEVELOPMENT

LOW PASS FILTER: \_\_\_\_\_

HIGH PASS FILTER: \_\_\_\_\_

COLLECTION FILTER: \_\_\_\_\_

IRI CERTIFICATION: \_\_\_\_\_

PI CERTIFICATION: \_\_\_\_\_

CALIBRATION DATE: \_\_\_\_\_

TECHNICIAN: \_\_\_\_\_



# We need well-Trained Inspectors and Technicians!



# Training Opportunities

- District Demos by Materials Lab
- NHI Course on Pavement Smoothness
- ProVAL Workshop
- Asphalt Newsletter
- Little Book of Profiling by Sayers and Karamihas 1998  
University of Michigan



## District Demos Pre-op Tests

- Take tire pressure - COLD
- Warm the tires 15 – 20 minutes
- Check settings
- Vertical Calibration
- Bounce Test
- Horizontal Calibration
- Odometer Check
- Manufacturer's Manual



Take the tire pressure  
- cold

Run the unit 15 minutes  
to warm the tires.





# Vertical Calibration



**Ave Diff = 0.01 or less**

**Height Sensor**

Block To Measure (in.)

Record	Base	0.25	0.50	1.00
1	0.290	0.550	0.790	1.295
2	0.285	0.550	0.785	1.285
3	0.285	0.545	0.785	1.290
4	0.285	0.545	0.790	1.295
5	0.285	0.540	0.790	1.290
6	0.290	0.550	0.785	1.285
7	0.285	0.545	0.790	1.290
8	0.285	0.550	0.785	1.295
9	0.290	0.545	0.785	1.290
10	0.290	0.550	0.790	1.290
Ave. Diff.		<b>0.010</b>	<b>0.002</b>	<b>0.004</b>



- Bounce Test - accelerometer and vertical sensor.

- Ames - stand in middle
- High speed units - stand on bumper



# Certification Snags

- Accelerometer and Height Sensors, (except for Dynatest units), can only be calibrated by the manufacturer! (Good idea to send them in before the rodeo, during the slow season.)
- According to Texas rep. – accurate DMI is crucial.



# Distance Measuring



# Horizontal Calibration Distance Measuring Instrument DMI

- Get in and run the profiler over a measured 528 foot distance.

Ames Engineering  
LISA

Time: 09:05:05

Date: 04-27-2004

<-- HORIZONTAL CALIBRATION  
RESULTS -->

Calibration Distance = 528.0 ft.

Pulses counted = 5328

Horizontal calibration factor = 80.727

Calibration Successful.



# ODOMETER CHECK

- Measures the distance traveled by the profiler and verifies the horizontal calibration.
- Distance is usually measured by a pulsar attached to the front wheels.



# Certification

- Allow Texas' TTI Certification on profilers
- The high pass filter must set at 300 feet
- Lead-in distance of 300 feet
  - But read manufacturer's recommendations



# New Test Tracks

- Ben Hur – “rough”
- LA 991 – “smooth”

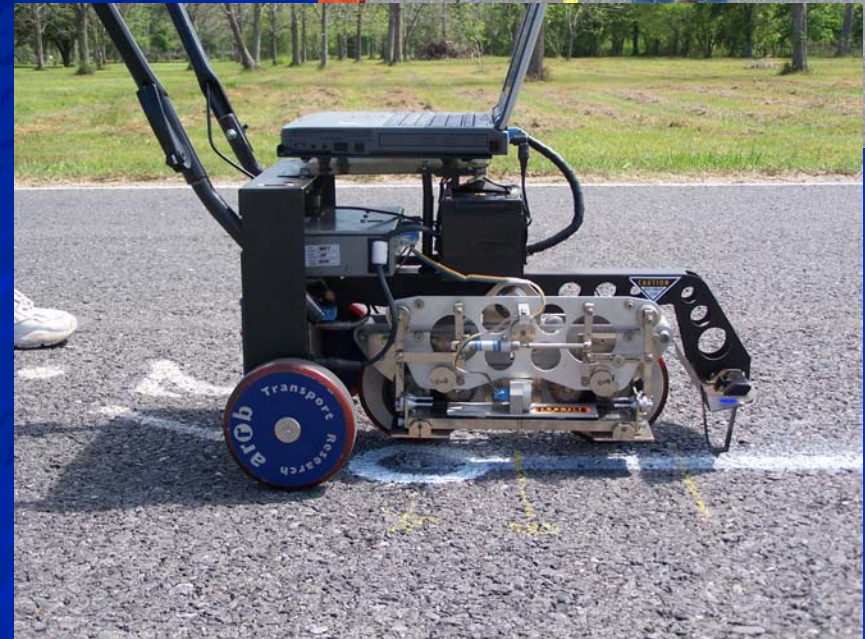




# Test Track

- New survey every 4.75 inches
- New run with the Australian Road Research Board (ARRB) Walking Profiler

69"  
Wheelpath





## ProVAL (Profile Viewing and Analysis)

- Data must be compatible with ProVAL
- Developed by The Transtec Group
- Software to view and analyze pavement profiles in many different ways.
- Sponsored by the US DOT, FHWA, the LTPP.

[www.roadprofile.com](http://www.roadprofile.com)

# ProVAL

- Pooled fund study – 21 states
- George Chang, Bob Orthemeyer, Mark Swanlund
- More uniform method of handling the data
- The new version, 2.7, will export to Microsoft Excel
- New features to identify hot spots (localized roughness)

# ProVAL

- By exporting to excel you can add “reroll” data to your data set after performing corrections.
- By using a sliding base length of 25’ and IRI threshold of 90 IRI, you can identify localized areas of roughness.

Note: recent TRB paper said 125 in/mi in a 25 foot section indicate a bump.

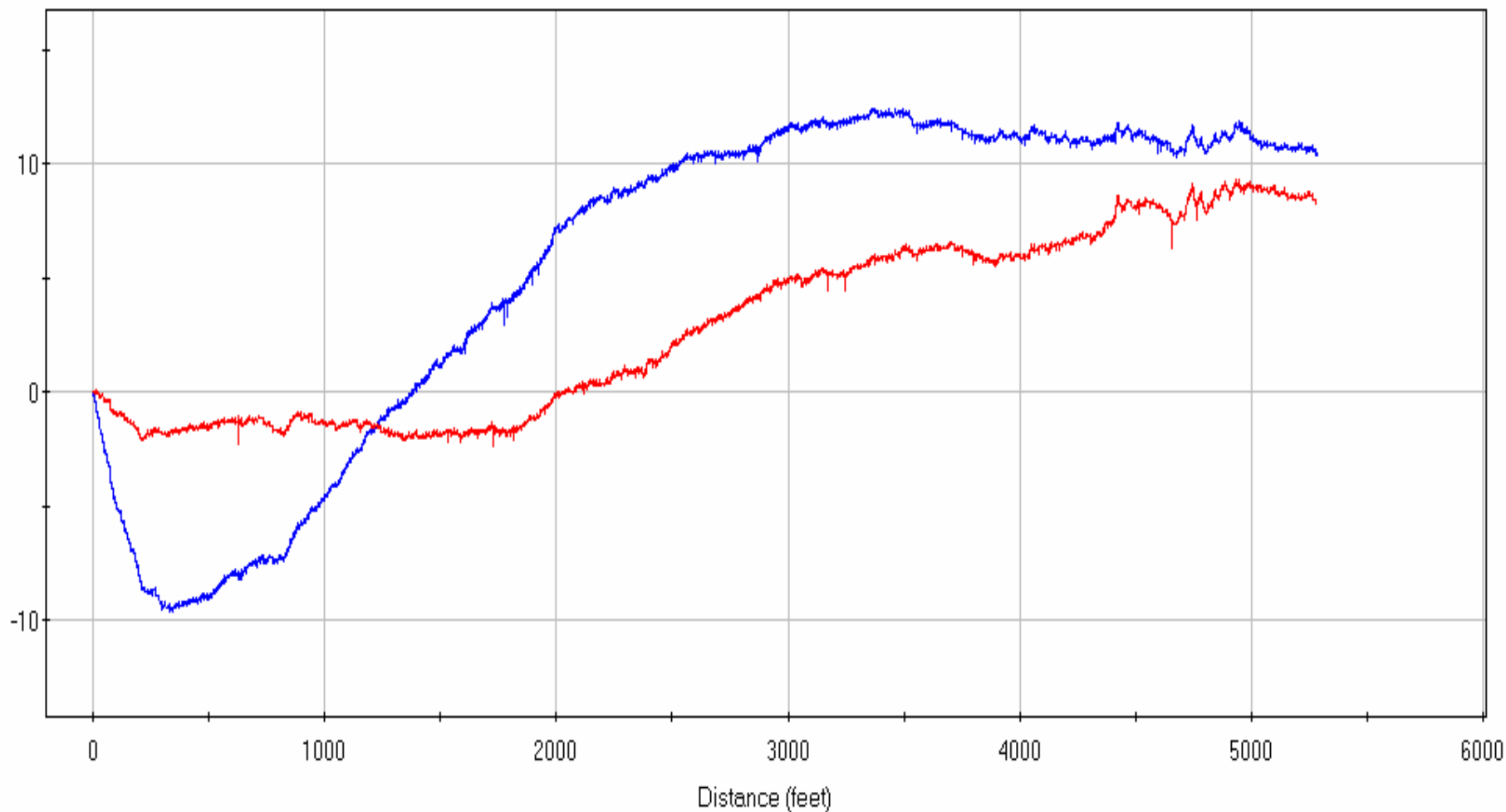


## Best feature.....

- DOWNLOAD FOR FREE!
- [WWW.ROADPROFILE.COM](http://WWW.ROADPROFILE.COM)

# ProVAL

Elevation (inches)



Track Run E1: LElev.    Track Run E1: RElev.

# ProVAL Analysis

- IRI Left 196.5
- IRI Right 174.6
- Mean IRI (MRI) 185.5
- Choose your input data



# ProVAL Report

- **Input Value Unit**
- Vehicle Velocity 49.7mph – standard for IRI
- Apply 250mm Filter Yes
- Use Linear Adjustments No
- Use Redefined End Points No
- Pre-Processor Filter IRI

# ProVAL

- More changes are expected as we ---
  - Use ProVAL to analyze data
  - Gain experience with Cross-correlation
  - Gain experience with Precision and Bias

# Contractor Verification Program

- To date – 5 roads verified
- All of our measurements within 3 IRI of theirs!



# Contractor Verification Goals

- Projects over 50 lane miles.
- Minimum of 1 project per district
- Minimum of 1 project per profiler

# USER OBSERVATIONS

- Contractors say 50% improvement per lift.
- Recommend running IRI before and after.
- Milled surface does not always reflect the true level of smoothness due to the ridges.
- Outside wheelpath of IRI is typically worse than inside wheelpath.
- Soil cement IRI of 200 in/mile or less may help to achieve smoothness.

# USER OBSERVATIONS

- Grinding areas of 180 IRI may help to achieve subsequent smoothness on single lift overlays. (140 for double lift)



# USER OBSERVATIONS – difficulties meeting our specs

- Outside wheelpath of 11' paving strips
- Plans with incorrect runoff distance or geometrics
- Single lift overlay projects without a surface prep item
- Single lift overlay projects with inadequate quantities of leveling.
- Superelevated curves, horizontal curves, and vertical curves

# EXCEPTION AREAS

- “(exceptions) ...will not be used to simply isolate sections of the road that are in poor condition when the project is let.
- No automatic exception areas – PE should first determine if the contractor did all he could to get a good job, then evaluate if a section should be excepted.

# EXCEPTION AREAS

- Exception areas void the incentive for the subplot smoothness pay, but also void the penalty.
  - It voids the incentive because the public feels the roughness
  - It voids the penalty because the problem was beyond the control of the contractor



# What's coming...

- More accurate certification
- ProVAL analysis
- Better predictions of corrections
- More knowledge of profilers
- More frequent contractor verification

