NDT Thickness Measurements for Concrete Pavements - It really works!

Jim Grove, Kevin Jones, Dan Ye, and Jagan Gudimettla

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MAGNETIC PULSE INDUCTION TECHNOLOGY

- MIT SCAN T2 (SCAN T2) is a commercially available device that uses Magnetic Pulse Induction technology to determine thickness of concrete pavement in a nondestructive manner. It provides the same level of accuracy and can save time and money for state agencies when compared to coring the pavement for thickness determination.

PAVEMENT THICKNESS

- Life of pavement is significantly influenced by Pavement Thickness.
- Pavement Thickness measurement is an important QA activity for agencies.

CURRENT METHODS TO MEASURE PAVEMENT THICKNESS

- Probing (Quality Control).
- Coring (Most Prevalent) (Acceptance).
  - AASHTO T148 / ASTM C 174
  - Typical Frequency - One Core per 2000 sq.yds of pavement.

9 point - Core Length Measurement

Cores over Dense Graded versus Open Graded Bases

- Other non destructive methods
  - Impact Echo.
  - Ground Penetrating Radar (GPR).

CORING - LIMITATIONS

- Destructive.
- Expensive.
- Time Consuming (Activities Include: Coring, inspecting, handling, measuring core lengths, patching core holes).

OPERATION OF THE SCAN T2

Target Placement

Target Nailed to the Base

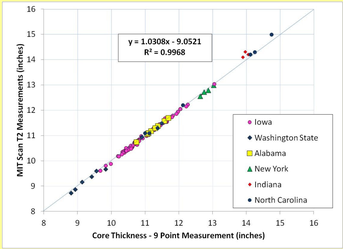
Scanning Operation

Target Locating

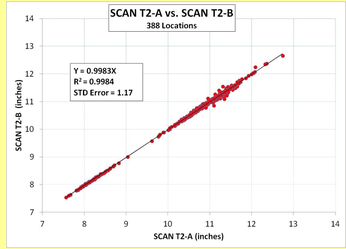
Thickness Measurement

FIELD PERFORMANCE

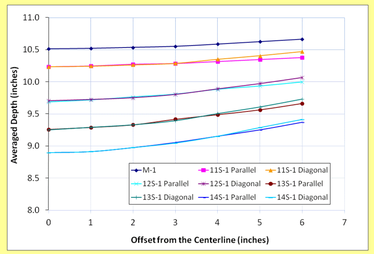
ACCURACY



REPEATABILITY



TARGET STUDY



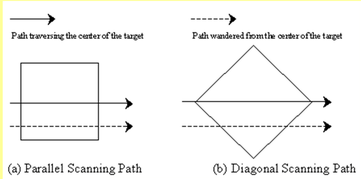
SCAN T2 VS. CORES

State	Project	Number of Locations	Average Core Thickness Measurements, inches	Average T2 Measurements, inches	Average Difference between Cores and T2 Readings, inches	Standard Deviation, Core Measurements, inches	Standard Deviation, T2 Measurements, inches
IA	US 34	8	10.7	10.8	0.0	0.3	0.3
IA	US 63	10	10.8	10.8	0.0	0.5	0.5
IA	I29	8	11.1	11.1	0.0	0.5	0.5
IA	US 20 Knierim	8	10.9	10.9	0.0	0.6	0.6
IA	I35 Clarke	10	11.5	11.4	0.0	0.5	0.5
IA	US 20 Calhoun	10	10.6	10.6	0.0	0.6	0.6
IA	I 35	10	11.9	11.9	0.0	0.5	0.5
IA	US 30 Marshall	10	10.5	10.5	0.0	0.2	0.2
WA	I 5	6	9.3	9.2	0.0	0.4	0.4
AL	I 59	10	11.2	11.2	0.0	0.3	0.3
NY	I 90	4	12.8	12.8	0.1	0.2	0.2
IN	I 465	3	14.0	14.2	-0.2	0.1	0.1
NC	I 540	9	12.4	12.4	-0.1	1.6	1.6
	Total Count	106					

TWO SCAN T2 DEVICES AT SAME LOCATIONS

Project	Data Points	Average SCAN T2 - A Measurements (inches)	Average SCAN T2 - B Measurements (inches)	Difference between SCAN T2-A and SCAN T2-B Measurements (inches)	Standard Deviation, SCAN T2 - A (inches)	Standard Deviation, SCAN T2 - B (inches)
US 63	20	10.8	10.8	0.02	0.53	0.53
Dallas Co.	79	8.2	8.2	0.03	0.27	0.27
I29	83	11.2	11.2	0.04	0.39	0.38
I 29 south	206	10.9	10.9	0.01	0.50	0.51

ORIENTATION OF SQUARE TARGETS



IMPLEMENTATION ACTIVITIES

- Scan T2 Domestic Target Studies:
  - Concrete Pavement Technology Program (CPTP).
  - Iowa DOT.
- Targets made of locally available sheet metals are able to produce consistent measurements.
- ASTM A653, CS Type B, G90 galvanized sheet metal.
- Iowa DOT NDT Thickness Specification. (http://www.iowadot.gov/specifications/dev_specs/DS-09063.pdf)

ADVANTAGES of Scan T2 VS. OTHER METHODS

- Accuracy within 0.08".
- Easy to use.
- Rapid Measurement.
- Cost savings of three to five times compared to coring.
- Non-Destructive.
- Independent of the base material.
- Independent of the Maturity of the concrete.
- Ability to measure pavement thickness a second time after grinding is performed.

LIMITATIONS

- Scan T2 targets cannot be placed within 2 ft of other metal.
- Scan T2 cannot be used on CRC or JRC Pavements.

CONCLUSIONS

- Magnetic Pulse Induction offers a faster, cheaper, accurate and non-destructive way to measure pavement thickness.
- It offers many advantages compared to other non-destructive technologies to measure pavement thickness.
- Iowa DOT has successfully implemented this technology in their specifications for measuring pavement thickness.

ONGOING EFFORTS

- Identify US Source of Targets.
- Other states evaluating the technology to potentially include it in their specifications.
- Development of AASHTO Standard Test Method.
- Demonstration via FHWA's Mobile Concrete Laboratory (MCL).
- Equipment Loan via FHWA's Advanced Concrete Pavement Technology (ACPT) Program.