

NDDOT RD&T Program

*Research,
Development,
& Technology Transfer*

Innovation Through Research



NDDOT Office of Project Development Conference

November 1-2, 2017

NDDOT RD&T Program

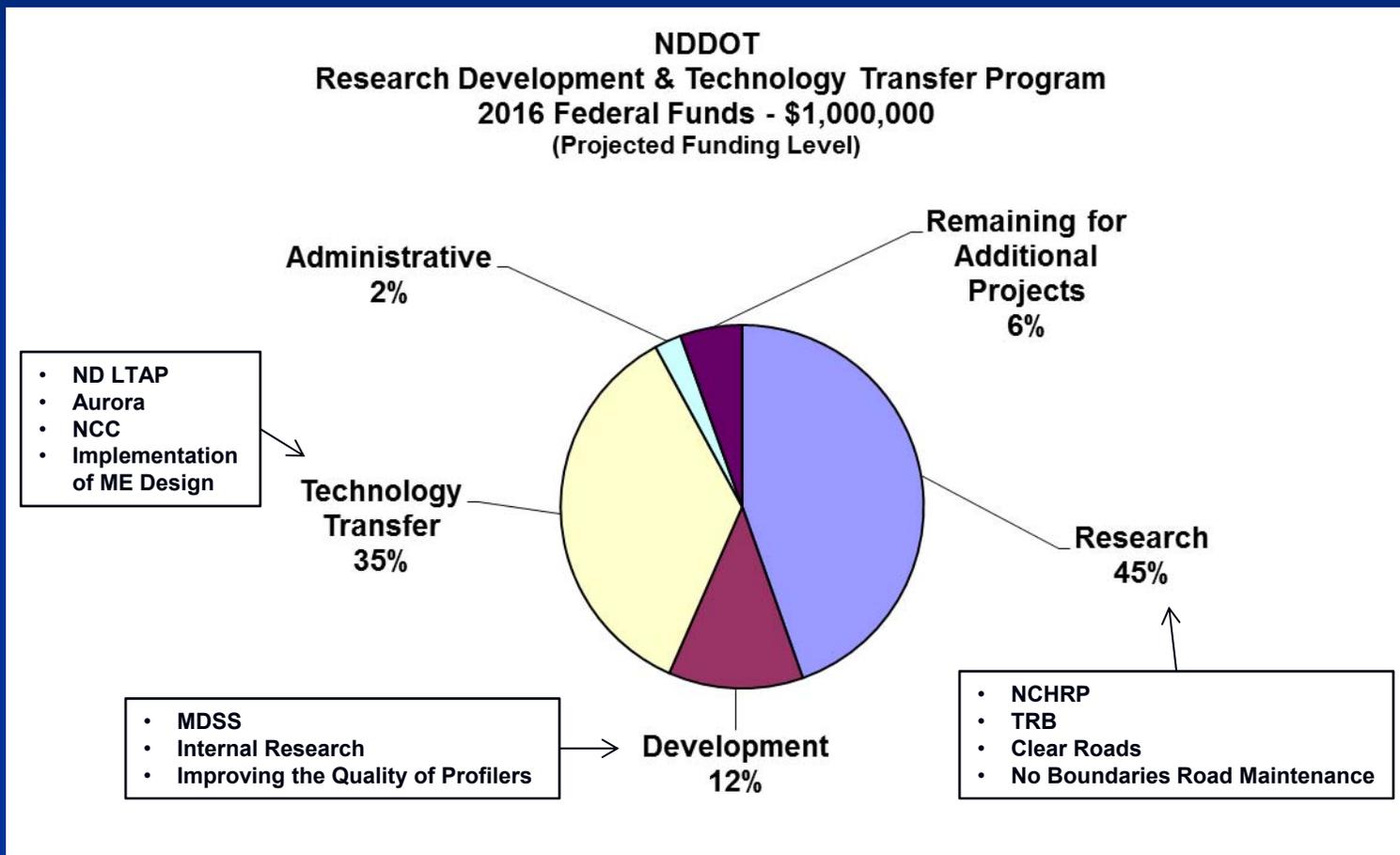
- **RD&T Program Used to Support the Mission and Vision of the NDDOT by:**
 - **Conducting Literature, Field, and Laboratory Research to Evaluate New and Innovative Materials & Methods Used in the Construction, Rehabilitation, and Maintenance of NDDOT Infrastructure.**
 - **Developing Research Activities to address NDDOT needs in all phases of federal, state, and local transportation infrastructure.**

NDDOT RD&T Program

Research Projects are lead by one of three entities:

- **NDDOT**
- **Universities**
- **Pooled Fund Lead Agency**

2017 NDDOT RD&T Program Categories



NDDOT RD&T Program

Research Project Selection

- **Research Advisory Committee (RAC):**
 - **Representatives from each Division and District**
 - **Meet as a group on an annual basis**
 - **Generate topics for discussion at the RAC Meeting**
 - **Select and prioritize research topics**

New Ideas and Innovations

Research Advisory Committee (RAC)

Divisions

Bridge - Jason Thorenson
Construction – Jeff Jirava
Design – Derek Pfeifer
ETS – Justin Ramsey
IT – Carey Schreiner
Local Government – Paul Benning
Maintenance – Brad Darr
Materials & Research – Matt Linneman
P & AM – Scott Zainhofsky
Programming – Logan Beise

Districts

Bismarck – Kirk Hoff
Valley City – Jay Praska
Devils Lake – Wyatt Hanson
Minot – Greg Olson
Dickinson – Belinda Urlacher
Grand Forks – Curt Dunn
Williston – Beth Skabo
Fargo – Duane Carlstrom

Research Complementing Innovations

- TRIP Projects
 - Fiber Reinforced Hot Mix Asphalt
 - MIT-Scan-T3 Non-destructive Testing Gauge for Pavement Thickness

Fiber Reinforced Hot Mix Asphalt (HMA)

Marketed Benefit of Fibers

- Reduce Rutting
- Reduce Thermal Cracking
- Reduced asphalt thickness required
- ASTM Publication – “Evaluation of Fiber HMA”
 - Study evaluating Fiber HMA material properties using advanced material characterization test

What is fiber reinforced HMA?

- Regular asphalt mixture with aramid fibers
- Aramid \approx Kevlar
- Heat Resistant
- High Tensile Strength
- Mix in batch or drum



Aramid Fibers

- Fiber Length = 3/4"
- 1 lb fibers per ton of mix
 - Fiber Cost \approx \$10/lb
- Add fiber w/ equipment that can accurately add and measure fiber

Overview

- Projects - TRIP
 - TRP-NH-5-200(030)102
 - NHU-SS-TRP-2-020(016)001
- Construction Division – provided funding for implementation
- Completed 2017 Construction Season

Design

- TRP-NH-5-200(030)102
 - Mill 2" & 2" HMA – Control
 - Mill 2" & 1.5" Fiber HMA
 - Mill 2" & 2" Fiber HMA

- NHU-SS-TRP-2-020(016)001
 - Mill 2" & 2" HMA – Control
 - Mill 2" & 2" Fiber HMA

Construction

- Fibers added to plant drum.
 - Small alterations to drum for port
- Fiber Rate – determined by the HMA output of plant



Construction

- Fibers did not affect the workability
- Fibers are difficult to see in HMA
- Occasional mass of fibers



How is it being Evaluated?

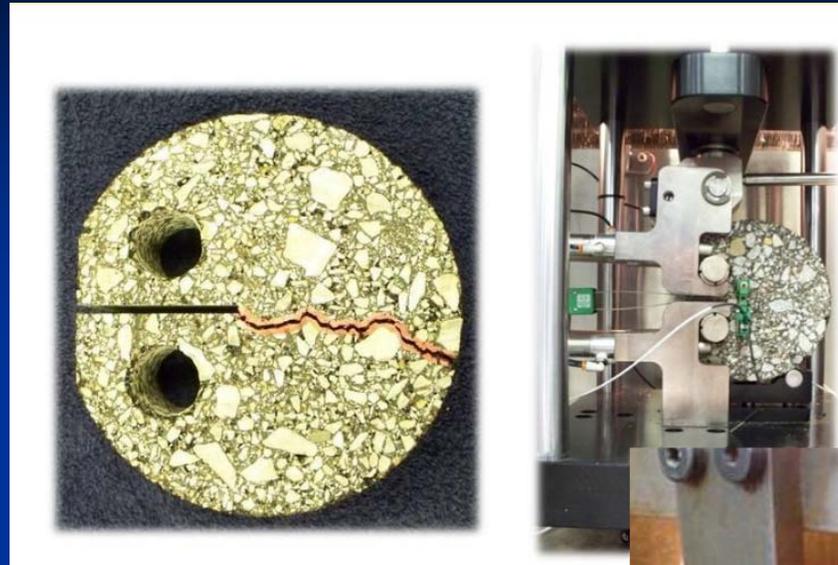
- Laboratory Performance Testing:
 - Asphalt Pavement Analyzer (APA) – rutting performance
 - Disk Shaped Compact Tension Test (DCT) – thermal cracking performance
- Field Evaluations - Annual
 - Cracking distresses
 - Rutting

Asphalt Pavement Analyzer

- Applying repetitive linear load to specimen designed to represent rutting susceptibility



Disk Shaped Compact Tension Test



- Test measures the fracture energy resistance for asphalt concrete.
- MnDOT Research has concluded that the DCT test can accurately forecast asphalt cracking performance.



Moving Forward

- Evaluation results and recommendation will be reported after the completion of performance testing and field evaluation
- Decide if product should be implemented into NDDOT specification

MIT-SCAN-T3

Non-destructive Testing Gauge for Pavement Thickness



Reduce or Eliminate Coring, Expedite Measurement

NDDOT procured two MIT-SCAN-T3

Over 350 units in use Nationwide

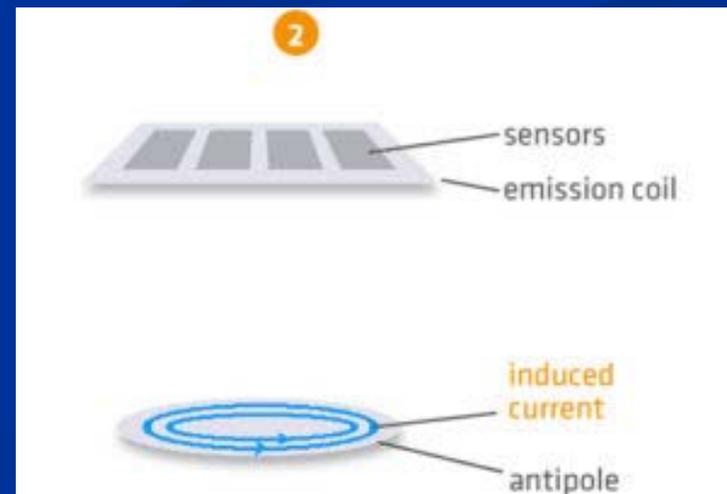
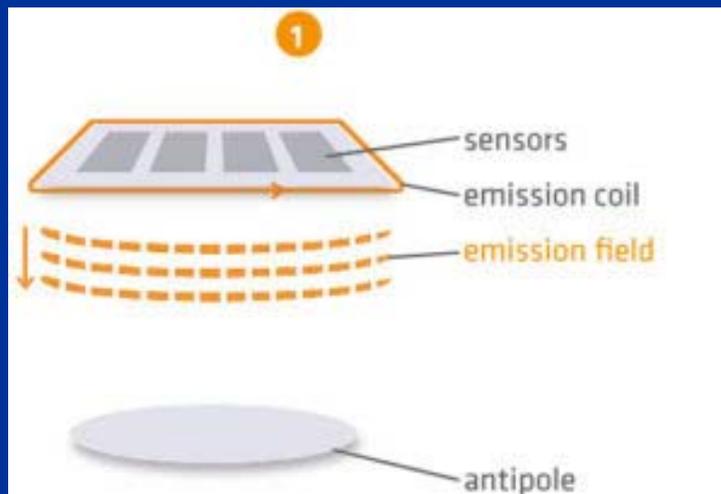
AASHTO Designation: T 359-16 (2016)

Capabilities

- Can measure to depths of 20"
- Accuracy: $\pm 0.5\%$ of measured thickness
- Battery Life: 8 hours or approx. 1,000 measurement
- Recharge Time: 1.5 hours
- Instrument Weight: 8.8 pounds



MIT (Magnetic Imaging Tomography)

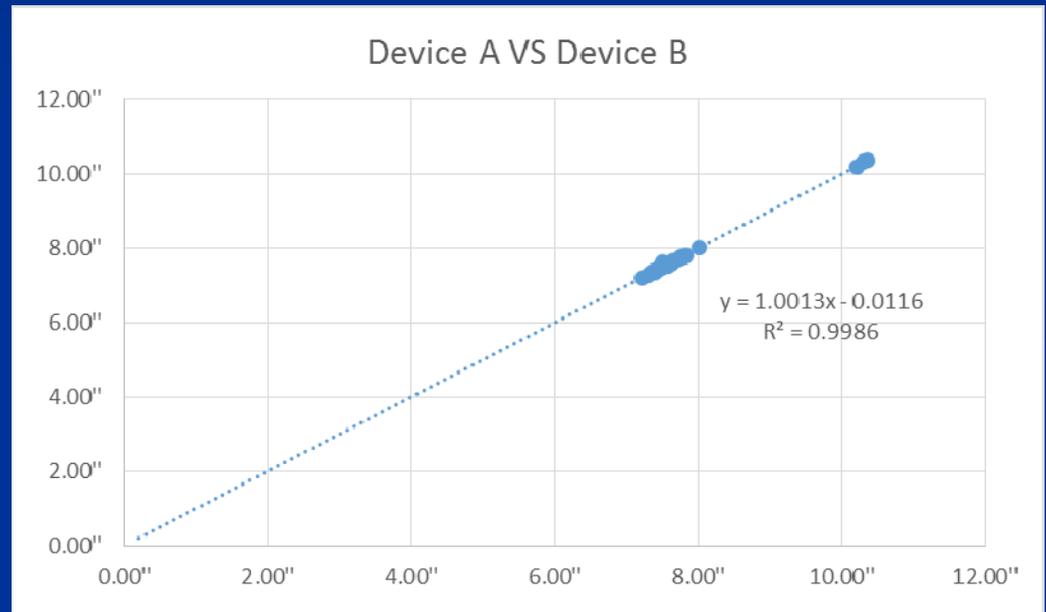




Evaluation

Criteria

- Repeatability
- Ease of Use
- Accuracy
- Limitations



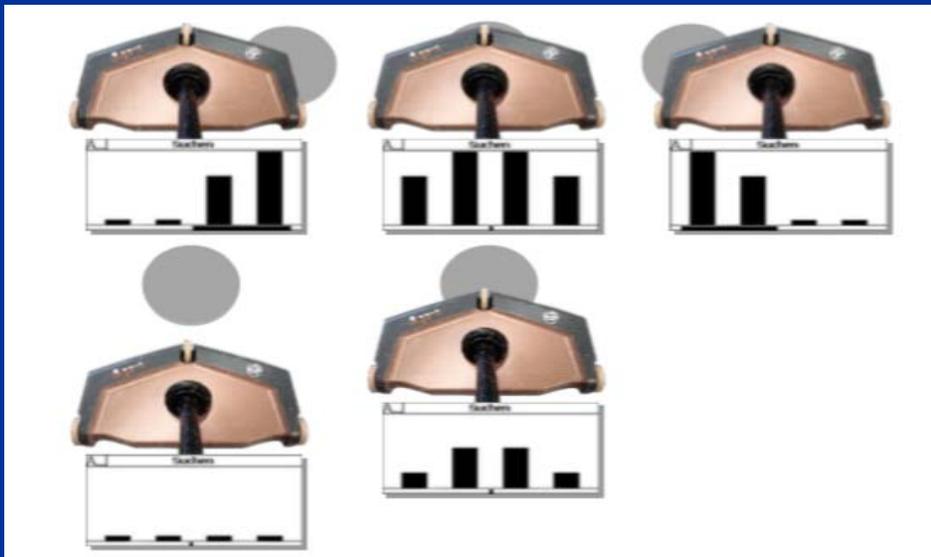
User Friendly

Locate Reflector

Roll over reflector
at a slow and
steady pace

Repeat three
times

Record results



Evaluation Field Trials

I-94 RP 11
WB, 2016
Construction
Season

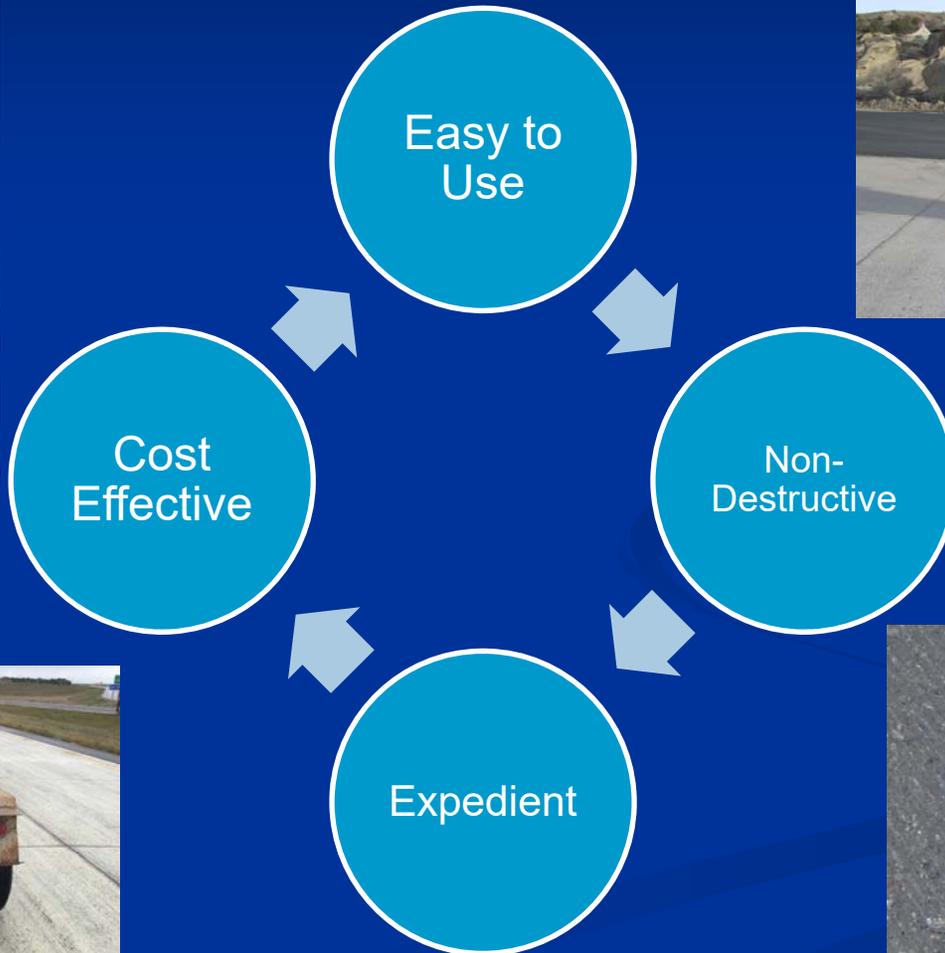
- 12 Reflectors installed on mainline.
- 99.35% Accuracy compare to measured cores

I-94 RP 295 WB,
2017
Construction
Season

- 55 Reflectors installed over 2 miles of mainline.
- Every 300' coincided with contractors depth checks.
- Depth Checks correlated to MIT-SCAN-T3 98.9%
- 4 Cored locations showed a 99.2% correlation.

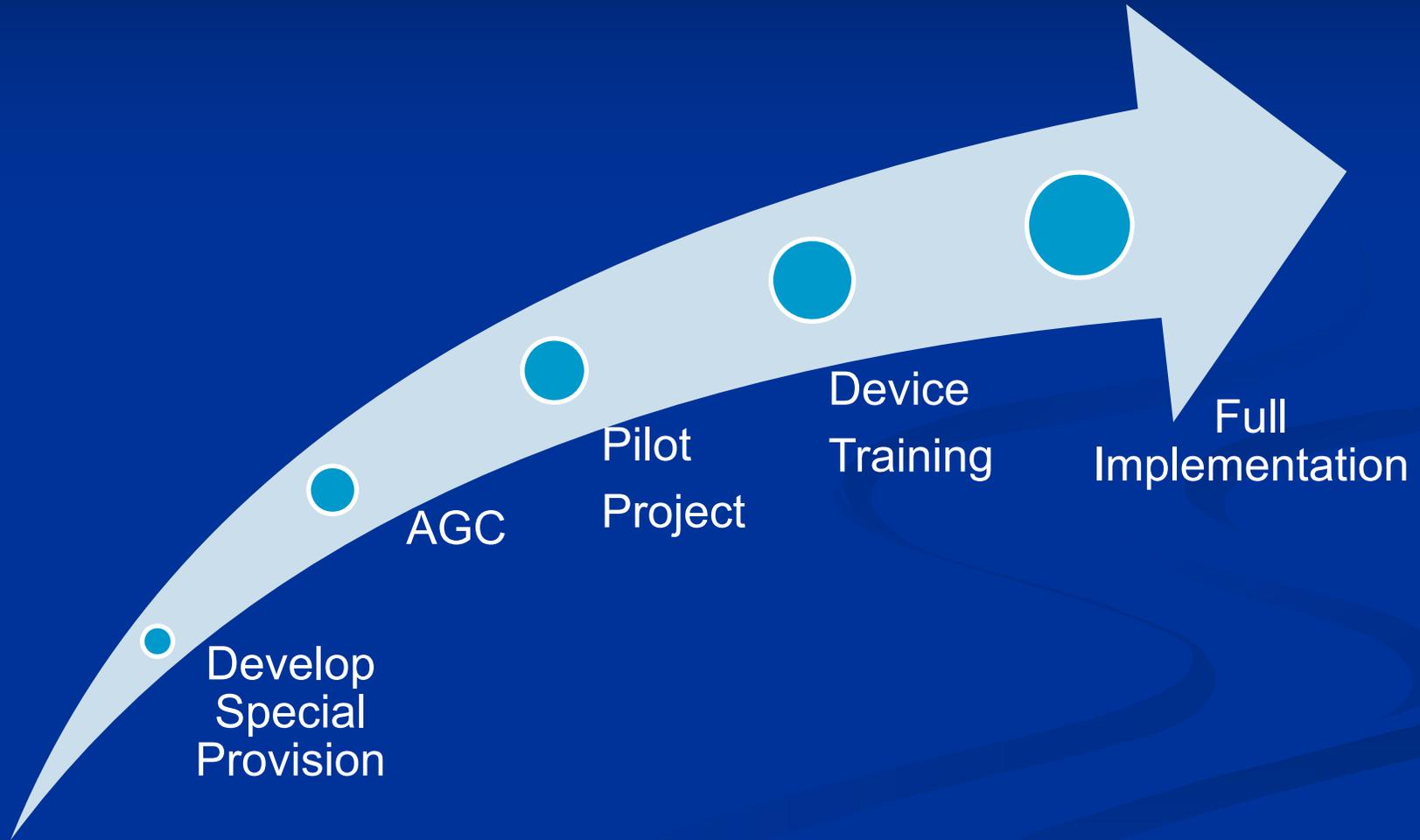


Summary





Implementation



New Ideas and Innovations

Research Advisory Committee (RAC)

Divisions

Bridge - Jason Thorenson
Construction – Jeff Jirava
Design – Derek Pfeifer
ETS – Justin Ramsey
IT – Carey Schreiner
Local Government – Paul Benning
Maintenance – Brad Darr
Materials & Research – Matt Linneman
P & AM – Scott Zainhofsky
Programming – Logan Beise

Districts

Bismarck – Kirk Hoff
Valley City – Jay Praska
Devils Lake – Wyatt Hanson
Minot – Greg Olson
Dickinson – Belinda Urlacher
Grand Forks – Curt Dunn
Williston – Beth Skabo
Fargo – Duane Carlstrom

Link to Research Reports

NDDOT and University Research Project Reports

- <http://www.dot.nd.gov/dotnet2/view/research.aspx>

ND Local Technical Assistance Program (LTAP)

- <http://www.ndltap.org/>

Transportation Research Board (TRB)

- <http://www.trb.org/Main/Home.aspx>