

**Performance Evaluation of Asphalt Surfaced Low Volume Road Foundations**

ALYSSA CLEMEN  
GRADUATE ASSISTANT  
SDLTAP  
SDSU

### Background

- Changing demands on transportation infrastructure:
  - agricultural industry
  - commercial growth
  - energy industry
- Variety of highway performance characteristics in response to changing demand:
  - Some performing well
  - Others experiencing failure
- **Why do some roads perform while others do not?**




### Objective

- Evaluate the penetration resistance of base course and subgrade material with the DCP.
- Correlate road performance with:
  - Layer thicknesses
  - Material quality
  - ADT
  - Maintenance
  - DCP penetration resistance





### Data Requirements


- ADT
- ADTT
- Age
- Maintenance
- Surface type
- Surface performance
- Surface & base thickness
- Base quality (gradation, PI)
- Base & subgrade DCP penetration resistance





## Test Methods

- 1) Field Tests
  - Dynamic Cone Penetrometer (DCP)
  - Bore hole – base & subgrade samples
  - Layer thicknesses
  - Surface evaluation
- 2) Lab Tests
  - Moisture content
  - Gradation
  - Liquid Limit (LL)
  - Plasticity Index (PI)





## DCP: Dynamic Cone Penetrometer

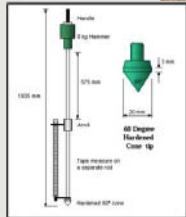

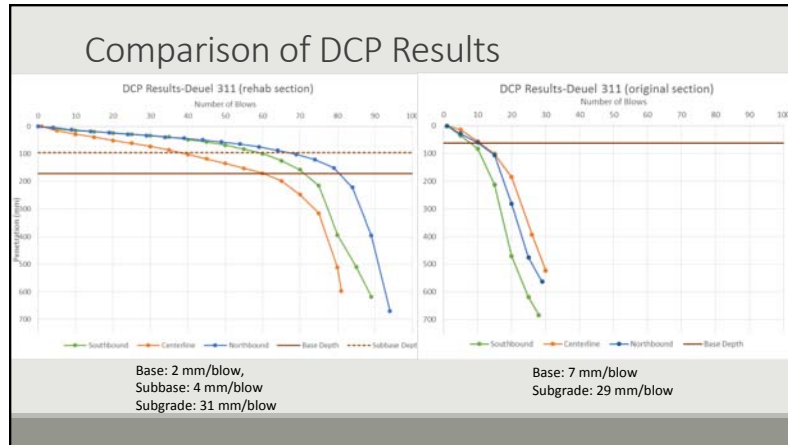
Measures penetration resistance of material –base course and subgrade  
 Indication of material strength  
 Compare to nuclear density gauge which only measures density

Penetration Index

- Depth of penetration per blow
- mm/blow

Mn/DOT limiting values:

- Silty/clay: 25 mm/blow
- Select granular: 7 mm/blow
- Mn/ROAD class 3 special gradation: 5 mm/blow

### Test Sites

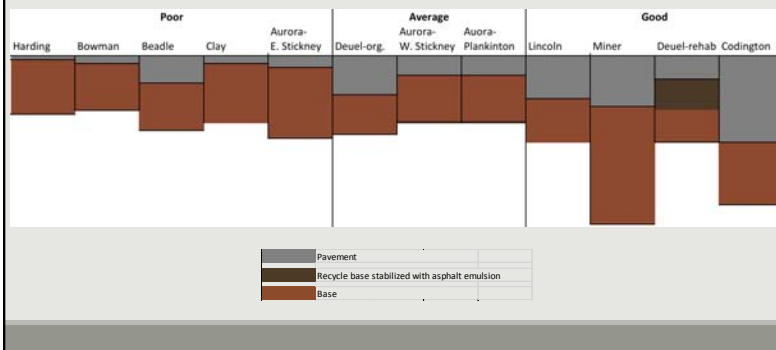
- 1) Harding County: Route 867
- 2) Bowman County, ND: 154<sup>th</sup> Avenue
- 3) Miner County: South Rail Road Street, Canova
- 4) Beadle County: Broadland Road
- 5) Deuel County: Route 311
- 6) Aurora County: 262<sup>nd</sup> Street, Stickney
- 7) Aurora County: 386<sup>th</sup> Avenue, Plankinton
- 8) Codington County: Old Highway 81
- 9) Clay County: Saginaw Avenue
- 10) Lincoln County: Route 135
- 11) Pennington County



### Results

Condition	County	Road	Age	Surface	ADT	Surface Thickness	Base Thickness	Meets Base Spec	Base DCP (mm/blow)	Regular Maintenance
Poor	Harding	867	2013	Blotter	34	0.75	7	N	5, 7	N/A
	Bowman	154th Ave	2013	Blotter		1	6.25	N	7,6	N/A
	Beadle	Broadland Rd.		Mat	97	3.5	6	Y	N/A	N
	Clay	Saginaw Ave.	2004	Blotter	601	1	7.6	Y	4	Y
Average	Aurora	262nd - E.Stickney		Blotter	171	1.25	9	Y	5	N
	Deuel	311-original	1963	Mat	35	5	5.25	Y	7	Y
	Aurora	262nd - W.Stickney		Blotter	212	2.75	6.25	Y	4	
Good	Aurora	386 <sup>th</sup> Ave.		Blotter	113	2.25	6.25	Y	6	
	Lincoln	135	1961	Mat	506	5.6	5.4	Y	5	Y
	Miner	Rail Road St.	1998	Mat		6.5	15	N	4	Y
	Deuel	311- Rehab	1989	Mat	370	3.25	8	Y*	2, 4*	Y

### Comparison of cross-sections



### Conclusions

Cannot rely on subgrade to provide support

What works:

- Thin pavement on adequately thick, good quality base
- Thick pavement on thick base



What does NOT work:

- Thin pavement on poor quality base
- Adequate pavement and base thicknesses with poor maintenance
- Using an inadequate pavement type for the ADT

### Future Plans for Research

- Continue to test roads
- Analyze the data at a greater depth
- Determining the correlations that exist

