SDDOT/SDLTAP Gravel Road Experimental Project

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Reason for Project

- More than 75% of local roads in SD are unpaved – managing them is a challenge!
- Biggest complaints from public are: rough condition (generally from corrugation or “washboard” in surface) and too much loose aggregate on the surface makes it hard to control a vehicle.
- **How critical is gravel quality to this and how does it affect total cost of maintenance?**

Project Background

- **SDLTAP requested a research project on this matter to try to quantify effect of gravel quality on overall maintenance costs and road condition.**
- **SDDOT Research Review Board approved the project in 2009.**
- **SDLTAP was tasked with recruiting counties to build test sections and to advise.**
- **This presentation covers only SDLTAPs observation and documentation.**

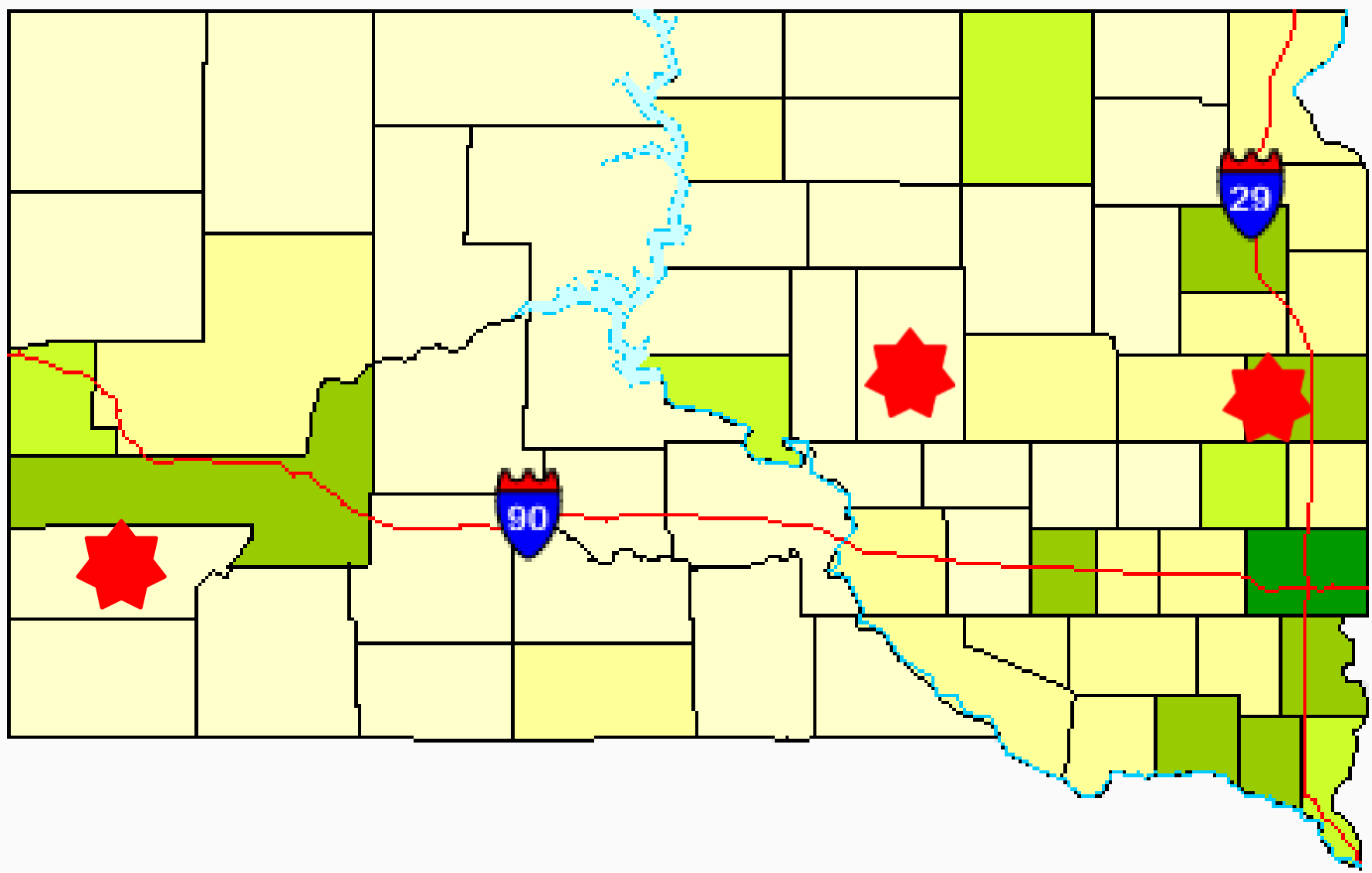
SDDOT Gravel Road Test Project

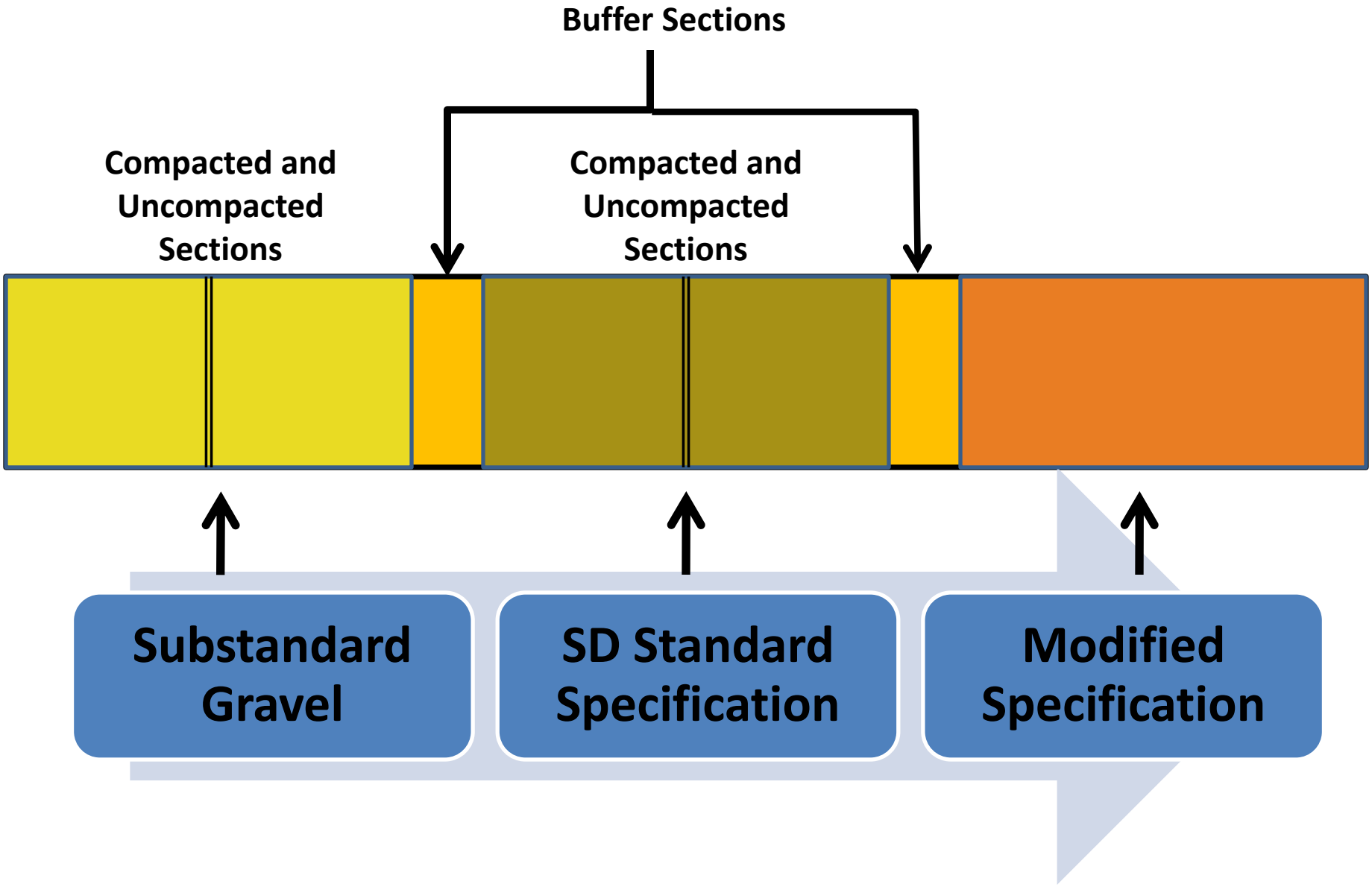
- **Primary focus is on effect of gravel quality on life-cycle cost of gravel road maintenance**
- **Three types of gravel used in study:**
  1. **Substandard but commonly used – meets no spec except top size control – one inch minus.**
  2. **Barely meets SDDOT Gravel Surfacing Spec – percent passing #200 sieve is low and/or plasticity index (PI) at bottom of range at 4**
  3. **Modified SDDOT Spec – higher minimums of 10% passing #200 sieve and PI at 7.**

SDDOT Gravel Road Test Project

- Three test sections were constructed in:
  - Hand County – northeast of Miller
  - Custer County – northwest of Custer
  - Brookings County – south of Volga

Location of Sections:




Buffer Sections
Compacted and Uncompacted Sections
Compacted and Uncompacted Sections
Substandard Gravel
SD Standard Specification
Modified Specification

Each section was built with three to four inches of new gravel after existing surface was prepared and shaped. Compaction/non compaction comparison as well.

One of the biggest challenges was finding gravel that meets the modified SDDOT Specification: "Shall have minimum plasticity index (PI) of seven". (Even higher minimum was considered in project planning)

One way to meet modified spec – blend different material from separate sources

This was done on one section in Brookings Co and one section in Custer Co

More blending or “manufacturing” in the future?

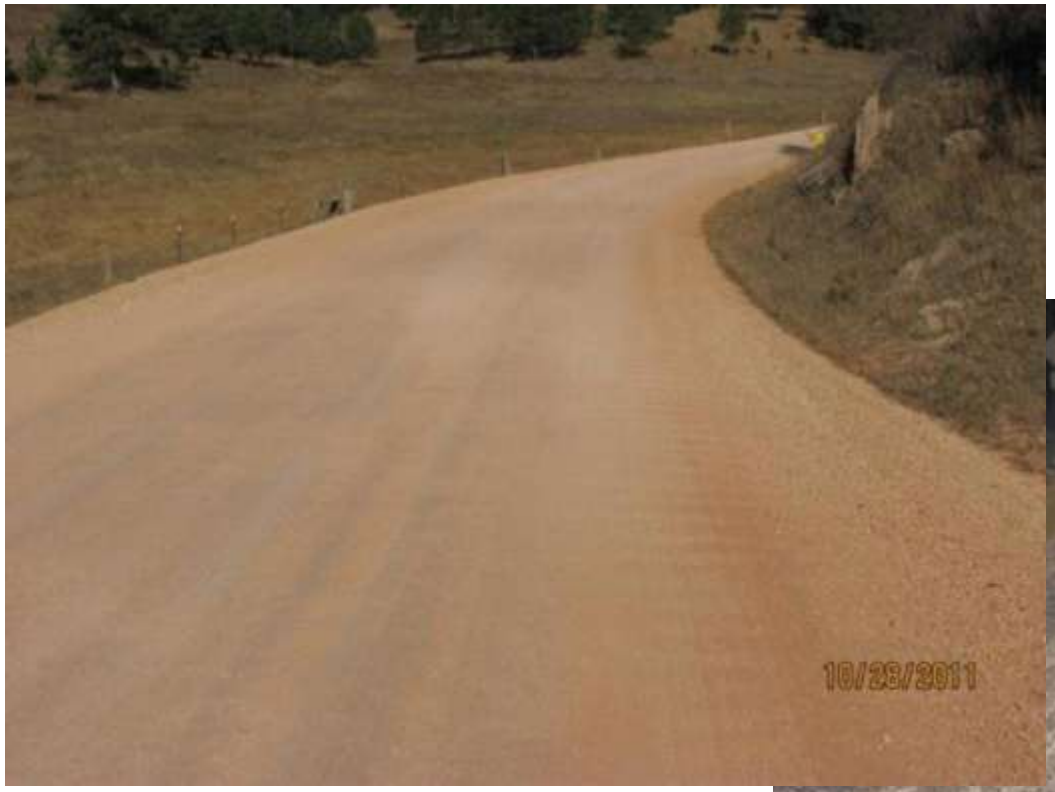
Processing material from a natural clay source

Road mixing to get a high quality surface gravel


CAT


140H

Some sections showed contrast in performance quickly due to gravel quality



Custer County Test Sections

Brookings County Test Sections

Only <u>one month</u> after construction

Substandard gravel loosens in 31 days. Loose aggregate (or float) is 1 ¼ to 1 ½ inches between the wheel paths.

Modified material has only 1/4 to 3/8 inch of loose aggregate (float) between the wheel paths in the same 31 days.

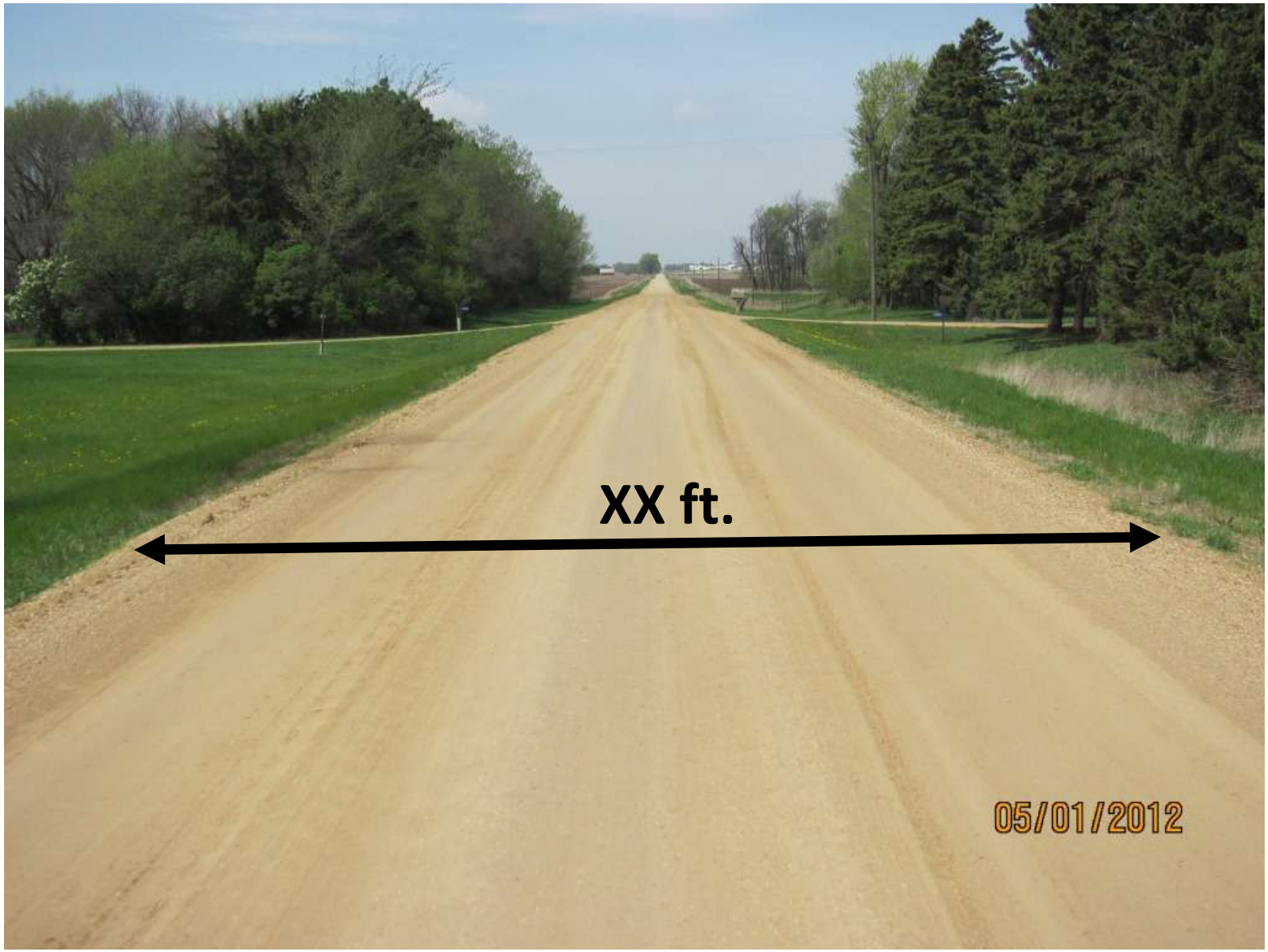
Current Status of Project

- SDLTAP has accumulated photo documentation on all sections over the past two years.
- Measurement and documentation has been done on these distress types in 2012:
  1. Accumulation of loose aggregate (float)
  2. Changes in top width from time of construction
  3. Presence of corrugation (washboard) on surface
  4. Change in roadway crown

The float test

Simply remove loose aggregate from a 10 inch cross section, weigh it and convert that to a one-mile section

Change is top-width is measured on traveled way – grass line to grass line



Corrugation (washboard):

Hard to quantify in extent, fairly easy to measure severity

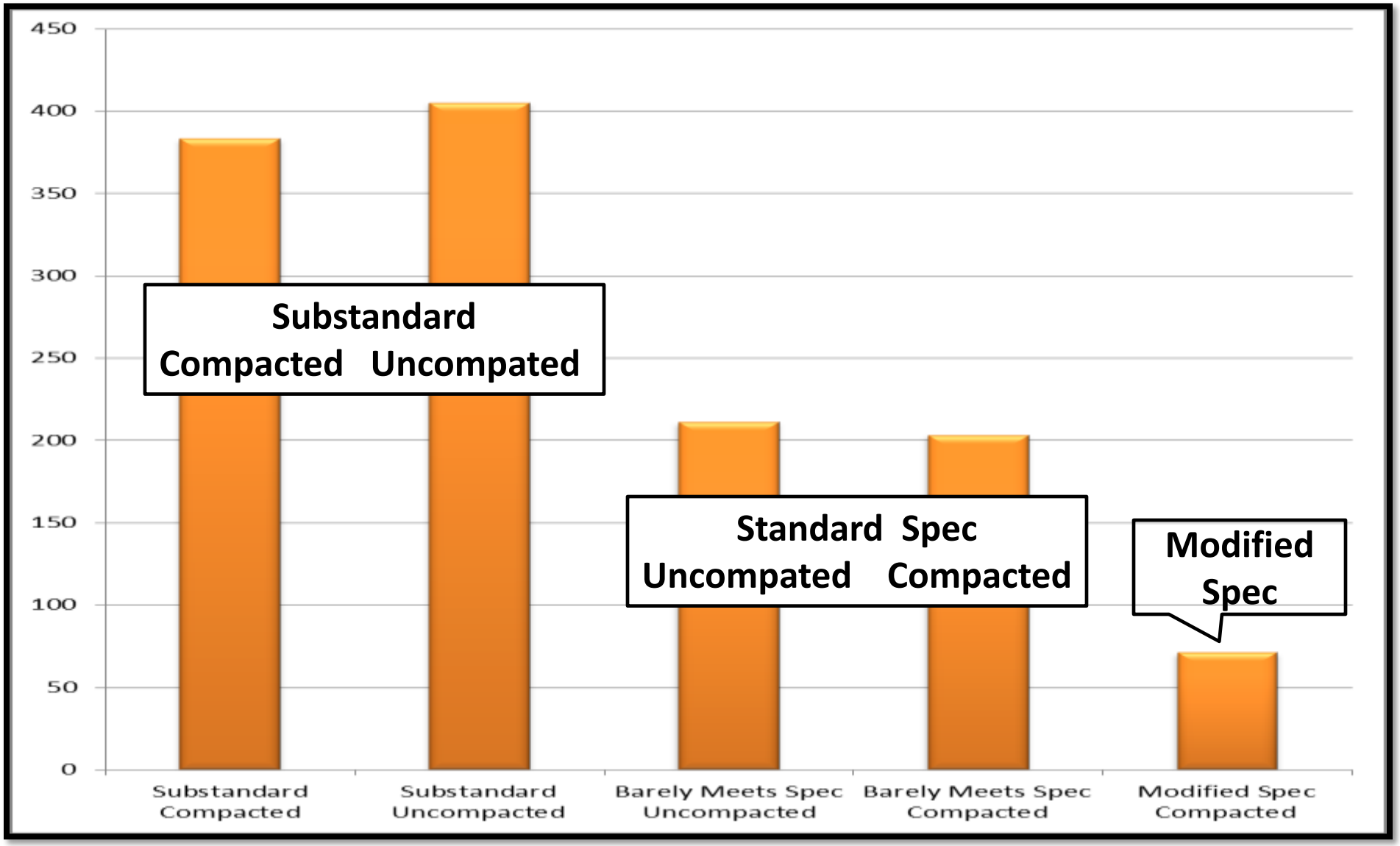
Crown:

measured with a laser level

Summary of Loose Aggregate

- **Brookings Section – measured 10-10-12:**
  - Substandard Compacted: 383 tons per mile
  - Substandard Uncompacted: 405 tons per mile
  - Standard Spec Uncompacted: 211 tons per mile
  - Standard Spec Compacted: 203 tons per mile
  - Modified Spec Compacted: 71 tons pre mile

Brookings Section – Loose Aggregate

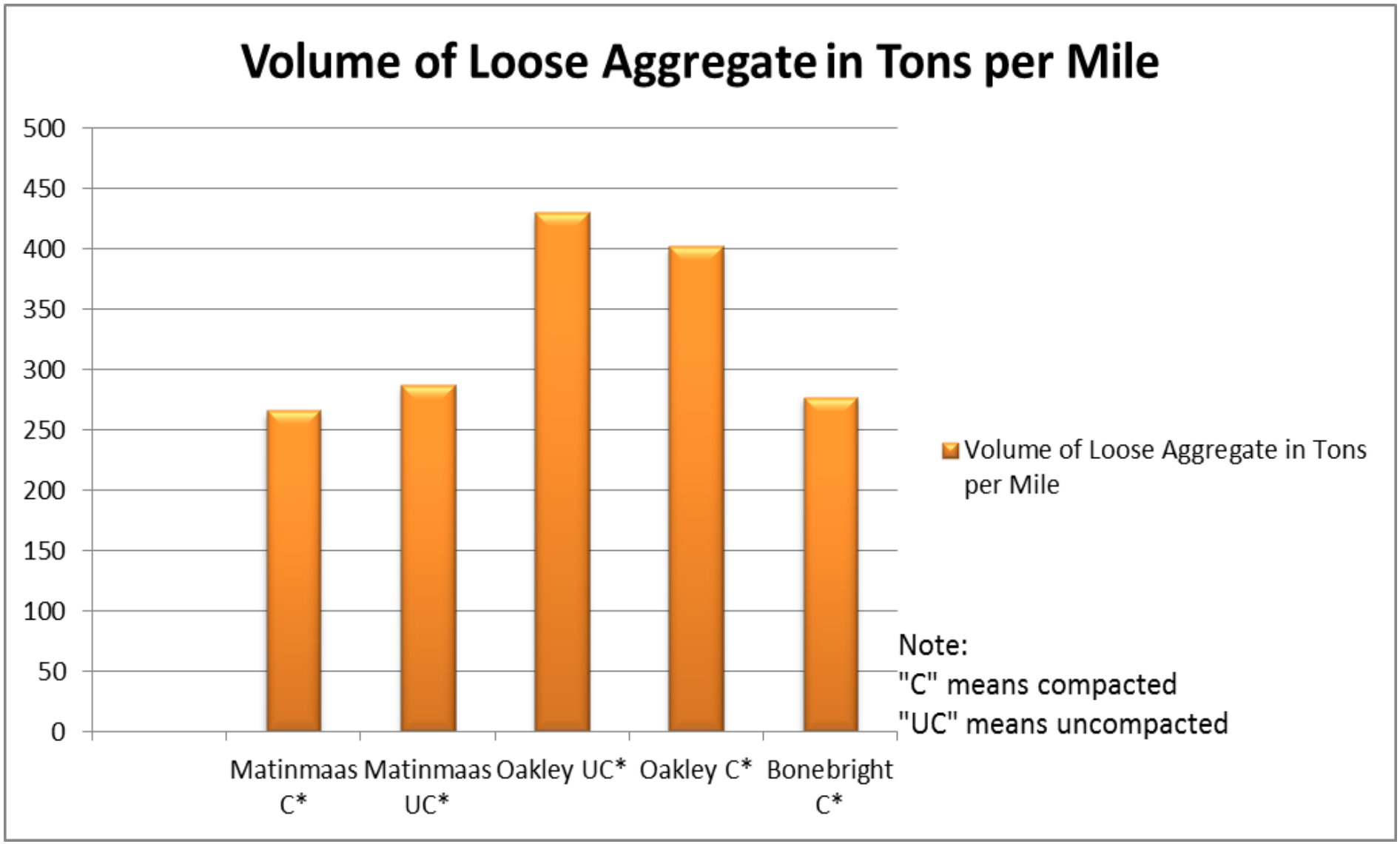


Summary of Loose Aggregate (Con't)

- **Hand Co Section – measured 9-11-12**
  - Substandard Compacted: 430 tons per mile
  - Substandard Uncompacted: 402 tons per mile
  - Standard Compacted: 266 tons per mile
  - Standared Uncompacted: 287 tons per mile
  - **Modified Spec Compacted: 277 tons per mile

** Testing showed gradation and plasticity varied little from Standard

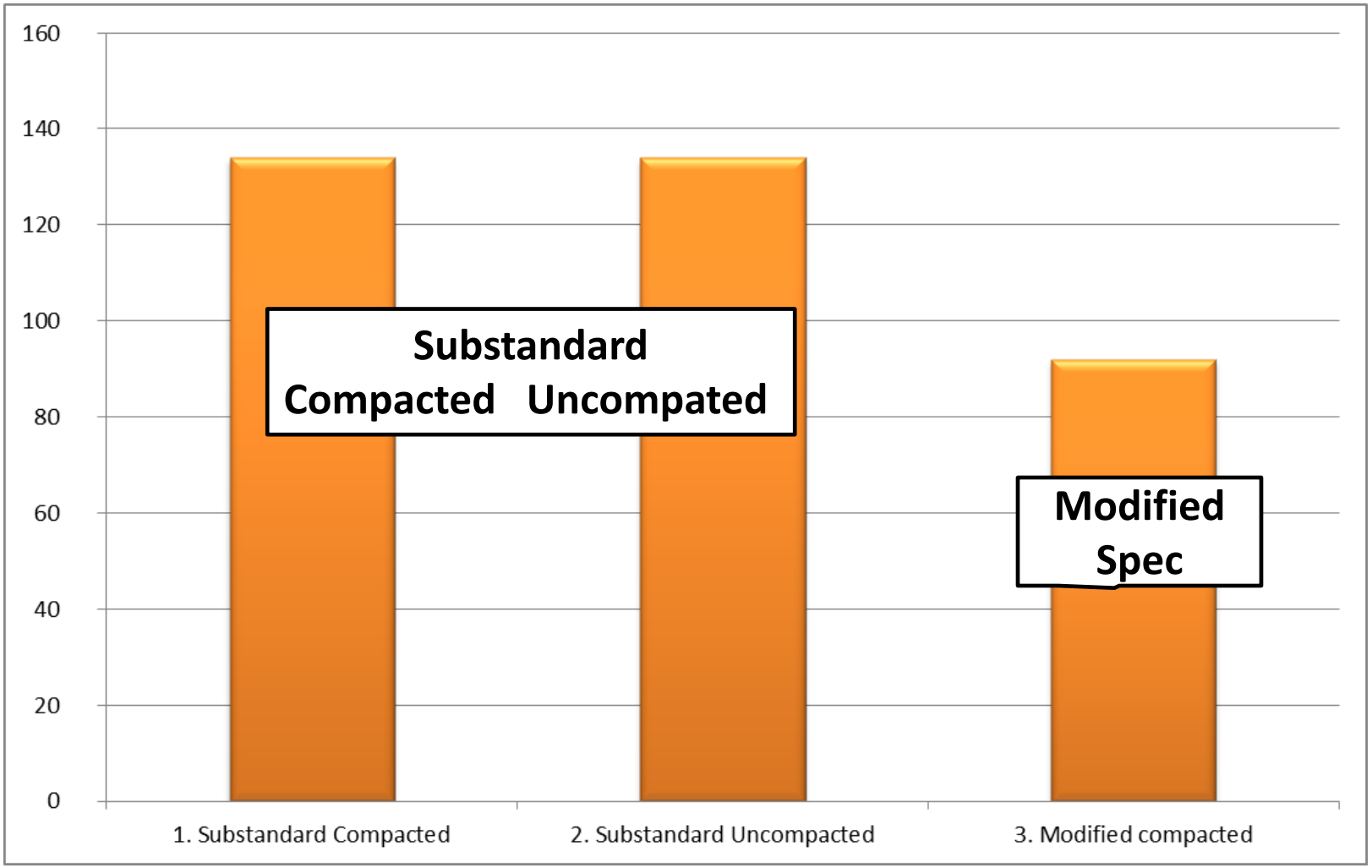
Hand Section – Loose Aggregate



Summary of Loose Aggregate (Con't)

- **Custer Co Section – measured 10-16-12**
  - Substandard Compacted: 134 tons per mile
  - Substandard Uncompacted: 134 tons per mile
  - Modified Compacted: 92 tons per mile

Custer Section – Loose Aggregate



Change in Roadway Width

- **Brookings Section:**
  - Width ranges from 21 ft, 6 inches on the modified section to 24 ft, 7 inches on the substandard section
- **Hand Section:**
  - Width ranges from 24 ft, 6 inches on the modified spec section to 26 ft, 10 inches on the substandard section.
- **Custer Section:** No measurement due to uneven cross section

Corrugation (Washboard)

- No corrugation observed on any sections meeting at least minimum standard specification.
- However, Brookings substandard section had corrugation on 100% of center wheel path at last observation.
- Custer substandard did not have corrugation.

Concluding Points

- Meeting basic SDDOT standard surface gravel specification reduces loose aggregate by 1/3 to 1/2.
- Widest differential was in Brookings County near end of corn harvest with 405 tons of loose aggregate on substandard section to only 71 tons on modified section.
- Most interesting fact thus far: **Brookings has done blade maintenance up to four times on substandard section to only once on modified!**

THANK YOU!

Rainfall Data

- Data from July 1 to Oct 1, 2012
  - Brookings Section: 4.17 inches
  - Hand Co Section: 3.07 inches
  - Custer Co Section: 2.57 inches