Needs Study of County and Township Roads and Bridges

Economic Impact Committee

July 31, 2013

Upper Great Plains Transportation Institute
North Dakota State University

NDSU UPPER GREAT PLAINS TRANSPORTATION INSTITUTE

Study Objectives

- Purpose:
  - Forecast investment needs for county and township roads and bridges over the next 20 years
- Objective:
  - Quantify the investments necessary for efficient year-round freight transportation while providing travelers with acceptable roadway service

Study Results

- Infrastructure needs – roads & bridges
  - Statewide
  - County level (by surface type and jurisdiction)
  - Needs estimates reported by biennium and study period

Study Process

- Data collection
- Traffic modeling
- Road analysis
- Bridge analysis

Data Collection

- Assumptions:
  - Oil production
    - Oil exploration forecasts (ND Oil & Gas)
    - County-level IP (initial production) rates (ND Oil & Gas)
    - Input volumes (freshwater, sand, etc.)
    - Transportation modes (ND Oil & Gas & Pipeline Authority)
  - Agricultural production
    - Township level production estimates (Nat'l Ag. Statistics Service - NASS)
    - Forecasts of crop yields (NDSU EXT. & producer groups)
    - Grain movement data (NDPSC)

Data Collection

- Oil locations:
  - Spacing units/fields (ND Oil & Gas)
  - Freshwater locations (ND State Water Commission)
  - Sand Locations (NDDOT & industry)
  - Transload facilities (NDDOT & industry)
  - Supplies (ND Oil & Gas, NDDOT, & industry)

Data Collection

- Agriculture locations:
  - Elevators (UGPTI and NDPSC licensed elevators)
  - Townships (US Census)
  - Crop data layer (Nat'l Ag. Statistics Service - NASS)
- Manufacturing (ND Department of Commerce)

Data Collection

- Survey of counties and townships
  - 2011-13 study: 51 county & 230 township responses
  - Current study: All counties and townships are being surveyed
  - Assistance being provided by Association of Counties & Township Officers Association

Data Collection

- Aggregate (gravel) costs
- Gravel production techniques
- Placement costs
- Transportation costs from pit to roads
- Dust suppressant usage/costs
- Stabilization usage/costs
- Intermediate practices
  - Stabilization armor coat
  - Double chip seal/armor coat
  - Others

Data Collection

- Enhanced Data Collection
  - Segment specific jurisdiction/ownership
  - Quantitative roadway condition assessment
  - Expansion of traffic count collection
  - Additional roadway structural data

Data Collection

- Jurisdiction/Ownership (where possible – depending on county responses)
  - County major collector (CMC/Federal Aid)
  - County – non-CMC
  - Township
  - Township owned, but maintained by the county
  - Private

Data Collection

- Jurisdiction/Ownership (where possible – depending on county responses)
  - Indian Reservation Roads (IRR)
  - Non-IRR routes maintained by the tribes
  - Municipal
  - Forest Service
  - Air Force
  - Other federal roads
  - Scenic routes
  - Wildlife/conservation routes

Pavement Data Collection

Objective – collect pavement distress, ride , strength and geometric information on paved county roads to determine remaining life and projected construction costs

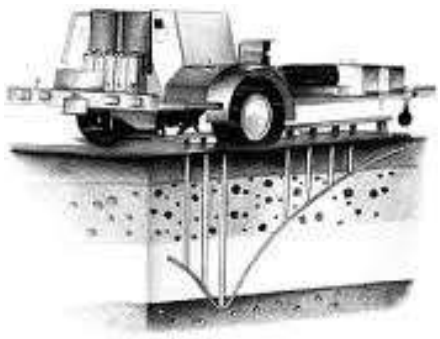
- Condition Data Collection
  - Collect data with NDDOT pathway van
  - 5,600 miles of paved county roads
  - Will not collect short segments
  - Van will provide consistent pavement distress and ride information
  - Will begin collection in July and August, 2013

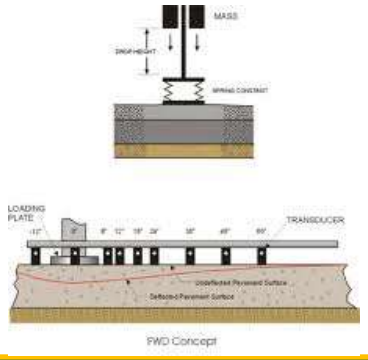
Pavement Data Collection

- Scoring and Reporting of Data
  - New van has automatic scoring which will need calibration
  - NDSU students will do some manual scoring for validation
  - Data will be referenced to roadways to provide on-line mapping
- Other Geometric Data
  - Pavement and shoulder width data will also be collected

Pavement Data Collection

- Non-Destructive Testing - verify prior estimates on subgrade strength
  - Falling Weight Deflectometer (FWD) and Ground Penetrating Radar (GPR)
  - Western ND – all pavements not recently improved
  - Eastern ND – selected based on agricultural production facilities and other major traffic generators
  - FWD will be done first and GPR will be done on the sites thumped with FWD





FWD Concept

Pavement Data Collection

- Non-Destructive Testing – Timeline
  - July 29 - kick-off meeting
  - August 5 - begin data collection
  - September 21 - data collection complete
  - November 21 - data analysis complete

Traffic Data Collection

Objective – collect traffic volume and classification data on county and township roads for the calibration of travel demand models and ESAL (equivalent single axle load)calculations

- Data collection
  - Joint collection with NDDOT staff and NDSU students
  - Number of counts to be taken - 1000+
  - Number of classification counts – 670

Traffic Data Collection

- Traffic data processing
  - Use automatic traffic recorders from around state to factor data
  - Use classification data to factor volume counts
  - Input all traffic data into travel demand model
- Traffic data reporting
  - Specific count location data will be made available with an interactive map on the Web

County Traffic Counts

- Volume Only
- Truck Classification

Traffic Model

- Objective – update and enhance the county and local roads traffic model developed for the 2011-13 Legislative study

Traffic Model

- Modeling
  - The entire modeling process will utilize Cube Base, Voyager and Cargo
  - Specific models for agricultural commodities and oil movements
  - Inclusion of direct passenger modeling
  - Coordination with NDDOT - network modeling necessarily includes state highways

Traffic Model

- Oil
- Agriculture
- Passenger
- Manufacturing
- Through traffic

Item	Number of Trucks	Inbound or Outbound
Sand	100	Inbound
Water (fresh)	450	Inbound
Water (waste)	225	Outbound
Fracturing tanks	115	Both
Rig equipment	65	Both
Drilling mud	50	Inbound
Chemical	5	Inbound
Cement	20	Inbound
Pipe	15	Inbound
Scoria/gravel	80	Inbound
Fuel trucks	7	Inbound
Frac/cement pumper trucks	15	Inbound
Workover rigs	3	Both
Total trucks	2,300	

Traffic Model

- Outbound Movements
  - Drilling and hydraulic fracturing equipment
  - Wastewater
  - Outbound oil to transload locations or final destinations

Agricultural Analysis

Known — Crop production

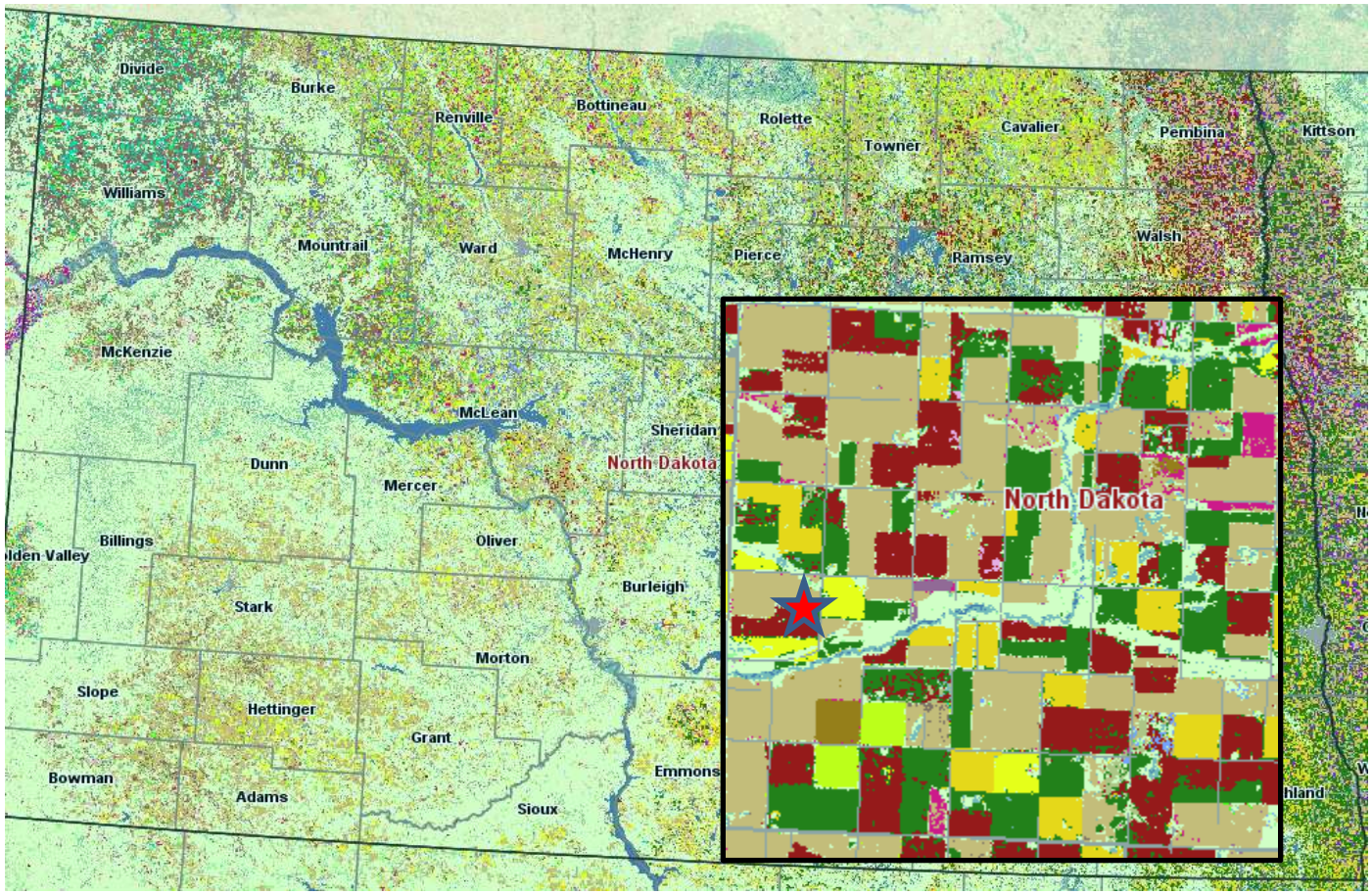
Predict — Truck trips and routes

Known — Elevator & plant demands

Estimate — Segment specific traffic

Data: crop production (NASS), elevator volumes (NDPSC), in-state processors (survey), road network (NDDOT-GIS Hub), local road data (2008 survey)

Crop Production and Location



Pavement Analysis

- Pavement deterioration and recommended improvement process
  - Estimate remaining life given current condition and traffic levels
    - Verify past assumptions on subgrade strength
    - Apply traffic projections and present serviceability rating
  - Determine recommended improvements and costs based on width, starting condition, and future traffic estimates

Gravel Road Analysis

- Life-cycle cost analysis - practices
  - Graveling and blading
    - Normal levels (e.g. regraveling every 5 years, blade once per month)
    - Increased levels (e.g. regraveling every 3-4 years, blade twice per month)
    - High levels (e.g. regraveling every 2-3 years, blade once per week)
    - Usage of dust suppressant on impacted roads

Gravel Road Analysis

- Intermediate improvements
  - Graveling and base stabilization
  - Graveling and base stabilization with armor coat
  - Others as reported at the county level
- Asphalt surface

Gravel Road Analysis

- Traffic model results will be segmented based on traffic levels
- County-specific practices will be used as the base maintenance practices
- Life cycle costs of each maintenance practice will be calculated (i.e. 20 year cost of graveling)
- Maintenance type/improvement selected for each AADT (annual average daily traffic) class based upon minimum life cycle cost

Bridge Analysis

- 2,441bridges on county/local system
  - 45% (1,095) more than 50 years old (theoretical design life)
  - 14% (344) more than 75 years old

Bridge Analysis

- Condition/appraisal data from National Bridge Inventory (NBI)
  - Structurally deficient (SD) – one or more bridge components rated in "poor" condition (≤4 on 0-9 scale)
  - Functionally obsolete (FO) – bridge is not designed to carry modern highway traffic volume, speed, size or weight
  - Bridges with SD or FO status may require posting or closure

Bridge Analysis

- Current Inventory
  - 549 structurally deficient bridges
  - 172 functionally obsolete bridges
  - Estimate replacement unit cost from recent ND bridge projects
  - Survey counties for biennial maintenance cost
  - Forecast replacement of deficient and obsolete bridge

Bridge Analysis

- Future Needs
  - Apply NDSU-developed deterioration models to predict replacement timeframe
  - Replacement prioritization based on detour vehicle-miles and weight restrictions
  - Bridge closings will not be predicted – these are at the discretion of the local road authority

Data Transparency

- Traffic counts will be displayed via a website maintained by UGPTI
- Roadway condition information will be available via the Web to all stakeholders
- County level costs will be published on the UGPTI website

Advisory Committee (Invited)

- ND Department of Agriculture
- ND Department of Commerce
- ND Oil & Gas Division
- ND Pipeline Authority
- ND Association of Counties
- ND Oil and Gas Producing Counties Association
- ND Township Officers Association
- Agricultural producer groups
- ND Associated General Contractors

NDSU-UGPTI Study Team

- Denver Tolliver – UGPTI Director
- Alan Dybing – Associate Research Fellow
  - Traffic modeling/HERS-ST modeling
- Tim Horner – Program Director
  - Pavement/bridge costing & project coordination
- Brad Wentz – Program Director
  - Pavement condition, traffic data, & county scenarios
- Andrew Bratlien – Transportation Research Engineer
  - Pavement non-destructive testing & bridge deterioration
- Darcy Rosendahl – NDLTAP Program Director
  - Jurisdictional ownership and maintenance
- Jon Mielke – Program Administrator

Study Timeline

Task	Start Date	Completion Date
Traffic counts	June 2013	October 2013
Traffic modeling	June 2013	January 2014
Jurisdiction data collection	June 2013	September 2013
Road condition assessment	July 2013	September 2013
Non-destructive testing	July 2013	November 2013
Cost & practices survey	August 2013	October 2013
Assumptions data collection	August 2013	August 2013
Roadway analysis	Fall 2013	May 2014
Bridge analysis	Fall 2013	May 2014
Final report		June 2014

Study Outputs

- Final report – electronic and hard copy
  - Methods
  - Assumptions
  - Procedures
  - Summary of data
  - Results – needs (by biennium)
    - Roads
      - Statewide
      - By county
      - By surface type
    - Bridges
      - Statewide
      - By county

Study Outputs

- Final report – collected data available via the web
  - Condition assessment
  - Traffic counts
  - Enhanced roadway data
  - Costs and practices

Questions?

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