Needs Study of County and Township Roads and Bridges
Economic Impact Committee

July 31, 2013

Upper Great Plains Transportation Institute
North Dakota State University
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
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
<table>
<thead>
<tr>
<th>Item</th>
<th>Number of Trucks</th>
<th>Inbound or Outbound</th>
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<tbody>
<tr>
<td>Sand</td>
<td>100</td>
<td>Inbound</td>
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<tr>
<td>Water (fresh)</td>
<td>450</td>
<td>Inbound</td>
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<tr>
<td>Water (waste)</td>
<td>225</td>
<td>Outbound</td>
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<tr>
<td>Fracturing tanks</td>
<td>115</td>
<td>Both</td>
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<tr>
<td>Rig equipment</td>
<td>65</td>
<td>Both</td>
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<tr>
<td>Drilling mud</td>
<td>50</td>
<td>Inbound</td>
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<tr>
<td>Chemical</td>
<td>5</td>
<td>Inbound</td>
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<tr>
<td>Cement</td>
<td>20</td>
<td>Inbound</td>
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<tr>
<td>Pipe</td>
<td>15</td>
<td>Inbound</td>
</tr>
<tr>
<td>Scoria/gravel</td>
<td>80</td>
<td>Inbound</td>
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<td>Fuel trucks</td>
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<td>Inbound</td>
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<tr>
<td>Frac/cement pumper trucks</td>
<td>15</td>
<td>Inbound</td>
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<tr>
<td>Workover rigs</td>
<td>3</td>
<td>Both</td>
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<tr>
<td>Total trucks</td>
<td>2,300</td>
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</table>
Traffic Model

• Outbound Movements
  – Drilling and hydraulic fracturing equipment
  – Wastewater
  – Outbound oil to transload locations or final destinations
Agricultural Analysis

**Known**
- Crop production
- Elevator & plant demands

**Predict**
- Truck trips and routes

**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

- 2,441 bridges 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

<table>
<thead>
<tr>
<th>Task</th>
<th>Start Date</th>
<th>Completion Date</th>
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<tr>
<td>Traffic counts</td>
<td>June 2013</td>
<td>October 2013</td>
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<tr>
<td>Traffic modeling</td>
<td>June 2013</td>
<td>January 2014</td>
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<td>Jurisdiction data collection</td>
<td>June 2013</td>
<td>September 2013</td>
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<tr>
<td>Road condition assessment</td>
<td>July 2013</td>
<td>September 2013</td>
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<td>Non-destructive testing</td>
<td>July 2013</td>
<td>November 2013</td>
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<td>Cost &amp; practices survey</td>
<td>August 2013</td>
<td>October 2013</td>
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<tr>
<td>Assumptions data collection</td>
<td>August 2013</td>
<td>August 2013</td>
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<td>Roadway analysis</td>
<td>Fall 2013</td>
<td>May 2014</td>
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<tr>
<td>Bridge analysis</td>
<td>Fall 2013</td>
<td>May 2014</td>
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<tr>
<td>Final report</td>
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<td>June 2014</td>
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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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