Road Use Agreements to Mitigate Impacts of Energy Developments on Low Volume Roads

Paul W. Wilke, P.E.
Michael Harrell, P.E.
Presentation Outline

- Background – Energy Development Impact on County Roads
- Policy Considerations for Road Owners
- Road Use Maintenance Agreements (RUMAs)
- Best Practices Study Ohio DOT
  - Recommended Best Practices
Introduction

- Energy Development Boom Past Decade
- Oil & Gas (hydro-fracturing)
- Wind
- Biofuels
Trucks Associated with Gas Wells

- Hydraulic Fracturing Process Requires Trucks For:
  - Water
  - Sand & other chemicals
  - Other construction materials
- Typically 1300 Trucks/Well site
Trucks Associated with Wind Farm Construction

- **Huge Blades**
  - 115-165 ft. long; 5-10 tons

- **Huge Tower**
  - 200 to over 300 ft. high
  - 3 -4 pieces @ 50-75 tons each

- **Nacelle**
  - 65-125 tons

- **Tower Foundation**
  - 43 truck loads concrete
Haul Roads for Tower Construction

- 35 Trucks For Main Crane Transport
- 5 Support Cranes - 5 trucks Each
- Access Road Construction
  - 313 gravel trucks/mile of road
  - Other trucks for water & dust control
Effect on Transportation

- Large loads
- Weak roads
How Should Road Owners Respond To This New Road Usage?

- Anticipate Development & Improve Roads In Advance
  - Encourages development (should taxpayers pay?)
- Channel Trucks to Strengthened Roads
- Seek Reimbursement From Industry For Road Damage
- Policies Should be Developed to Address These & Many Related Issues
Current Approaches

- Most Common-Developer Reimburses Road Owner For Damage

- Less Common- Road Owner Anticipates Truck Traffic & Upgrades Roads in Advance (Texas)

- Many Methods Used For Reimbursement Approach
  - Road Use Maintenance Agreement (RUMA) is mechanism
RUMAs Can Cover Multitude of Issues

- Bonding
- Pre-Development Road Upgrades
- Design Standards
- Pavement Damage Projection & Assessment
- Multiple Users of Same Routes
- Restrictions During Spring Thaw
- Maintaining “Safe & Passable” Conditions
- Signage
- Right of Way Acquisition
- Other
Different Approaches to Development of RUMAs

- **New York**
  - Each county developed individually

- **Pennsylvania**
  - Not “home rule” state; DOT jurisdiction over local roads
  - Central Office invested substantial resources to develop robust policies & procedures

- **Ohio**
  - County Engineers Association of Ohio (CEAO) took leadership
  - Assistance from ODOT, ODNR & other transportation officials
  - Developed model RUMA for use by municipalities
Ohio Initiative to Improve RUMAs

- ODOT Planning & Research Office’s ORIL Program (Ohio Research Initiative for Locals) Commissioned Study
- Development of Best Practices for RUMAs
- Report Available Through Website:
  - http://oril.transportation.ohio.gov
ORIL Best Practices Study

- Literature Review of Practices Throughout U.S.
- Survey of Counties & Townships
  - 31 county & 46 township responses
- Interviews With Selected Municipalities
- Sample RUMAs Obtained
  - 12 counties & 3 townships
Highlights From ORIL Best Practices Report

Best Practices of Road User Maintenance Agreements Amongst Local Government Agencies in Ohio

Prepared by Roger Green, Issam Khoury, Paul Wilke, and Praveen Gopallawa

Prepared for:
Ohio's Research Initiative for Locals
The Ohio Department of Transportation,
Office of Statewide Planning & Research

State Job Number 135251
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Final Report

Ohio Research Institute for Transportation and the Environment
Bonding & Escrow

- Bond/Security Provided to Agency
- Ensure RUMA Requirements Followed
- $/Mile Based on Type of Road
- Enough $ to Rebuild Road
  - Examples: $100k/mi (gravel); $200k/mi (chip seal); $400k/mi (AC)

<table>
<thead>
<tr>
<th>Projected Traffic (ESAL-miles)</th>
<th>Pavement Strength Class</th>
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<tbody>
<tr>
<td></td>
<td>A- Heavy Duty</td>
</tr>
<tr>
<td></td>
<td>B- Medium Duty</td>
</tr>
<tr>
<td></td>
<td>C- Light Duty</td>
</tr>
<tr>
<td>up to 5,000</td>
<td>$ 5,000</td>
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<td></td>
<td>$ 10,000</td>
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<td></td>
<td>$ 15,000</td>
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<tr>
<td>5,000 - 10,000</td>
<td>$ 20,000</td>
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<tr>
<td></td>
<td>$ 50,000</td>
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<tr>
<td></td>
<td>$ 75,000</td>
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<tr>
<td>10,000 - 20,000</td>
<td>$ 200,000</td>
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<td>$ 400,000</td>
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<td>$ 600,000</td>
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- Could Waive if Pre-Development Upgrade Done
Pre-Development Upgrades

- Engineering Study By Qualified Pavement Engineer
  - Forecast truck traffic
  - Existing pavement structural capacity & strengthening required
Pre-Development Upgrades

- Encourage Developer to Upgrade; Avoid Premature Failure

- Common Upgrade Technique- Full Depth Reclamation
Design & Inspection of Upgrades

- Upgrades to Meet Appropriate Standards (eg- DOT)
- Agency Representative Inspect Construction
Damage Assessment Based on Surface Condition ("Patch & Go" Approach)

- Some Agencies Only Require Repair of Visible Surface Defects
- Only Condition Survey Required For Assessment
- Underestimates Full Extent of Damage
- Early Fatigue Cracking Not Considered
Limitations of Visual Evaluation
(Fatigue Cracking Begins at Bottom)
Propagation of Fatigue Cracking
Early Stage of Fatigue Cracking
Intermediate Stage of Fatigue Cracking
Advanced Stage- Fatigue Cracking
Innovative Approaches (Less Commonly Used)

- Fee Based on Pavement Life Consumed
- Determine Remaining Life at Start and End of RUMA Period
- Remaining Life in Terms of ESALs Before Failure
Methods to Determine Remaining Life

- Falling Weight Deflectometer (FWD)
- Determine Strength of Pavement (Structural Number)
Alternative Method to Determine Remaining Life-Visual

- Visual Condition Survey to Estimate SN
- Alligator and L&T Cracking % Estimated
- Reduced Structural Coefficient Related to % Cracking
# Hybrid Approach

## Hybrid Approach-Tompkins County, NY

<table>
<thead>
<tr>
<th>Anticipated Truck Volume (ESALs)</th>
<th>Initial Pavement Condition</th>
<th>A= Visual Assessment Only</th>
<th>B= Pavement Life Consumed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>Medium</td>
<td>A &amp; B</td>
<td>A &amp; B</td>
<td>A</td>
</tr>
<tr>
<td>High</td>
<td>A &amp; B</td>
<td>A &amp; B</td>
<td>A</td>
</tr>
</tbody>
</table>

A= Visual Assessment Only
B= Pavement Life Consumed
Automated Condition Survey
PaVision®
PaVision®

- **PaVision® Provides:**
  - Pavement imagery
  - Roughness
  - Distress Quantity Takeoff

Forward Image

Automated Distress Analysis
Innovative Approaches

- Global Impact Fee
- Estimate Trucks & ESALs Associated With Development Project
- Calculate $ of ESAL Life Consumed
- Charge Impact Fee as Part of Permit Approval

Examples:
- Rio Blanco County, CO
- Kansas Meat Plant study
- PennDOT Study (Wilke)
Other Issues To Consider

- **Assessment & Allocation of Road Damage is Multi-Faceted Challenge**
  - Analogous to “layers of an onion”:…..

- **Consider the Following:**
  - Requirement to keep road safe for motoring public
  - Proactive maintenance/upgrade before winter
  - Signage
  - Multiple Haulers
  - Communication & Collaboration
Maintain “Safe & Passable Condition”

- Simply Repairing Damage at End Not Sufficient

- One Approach- Repair Within 8 Hours or County Repairs & Bills Developer
Proactive Maintenance Before Winter

- PennDOT Lesson 1st Winter
  - Failed roads repaired with gravel
  - Hot mix asphalt not available late fall/winter
Signage

- Encourage Developers to Sign Roads Within RUMA Limits
- Guide Drivers-Avoid Hauling Outside Limits
- Avoids Unnecessary Damage Repair
- Less Effort by County to Detect Damage Outside RUMA
Multiple Users of RUMA Roads

- Allocate Repair Costs Based on ESALs
- Potential Refinement for Relative Seasonal Damage
- Equivalent ESALs = ESAL X Seasonal Adjustment Factor
Communication & Collaboration

- Forum For Communication Between Industry & Government Useful
- Collaboration and Pooling Resources Between Multiple Agencies
  - Example- one county coordinates RUMAs for all townships
  - Funded jointly
  - Uniformity in RUMAs and administration

- Manuals & Training Useful
  - PA local LTAP offered classes to municipalities
How Do You Get Developers into a RUMA?

- **Ohio Laws**
  - Permits for horizontal oil & gas wells & wind farms > 5MW require RUMA
  - ORIL report recommended extension to all “heavy haulers”

- **PennDOT Posted & Bonded Roads Law**
  - Updated to suit Marcellus gas development
  - Engineering study determines need for load posting
  - RUMA required to haul over load limit
Summary

- RUMA Useful Mechanism to Exert Control/Protect Assets
- Local Law to Require RUMA
- Bonding to Ensure Repairs Completed by Developer
- Common Damage Assessment - Visual Distress Survey
- Visual Survey Doesn’t Fully Account for Loss of Pavement Life
- FWD Testing or Unit Cost/ESAL Can Account for Loss of Life
Summary (cont’d)

- Road Impacts From Energy Development a Multi-Faceting Challenge
  - Design standards
  - Avoid pavement failures during winter
  - Safe & passable conditions to be maintained
  - Signage useful
  - Allocating costs between multiple RUMA holder
Questions???

- Contact Info:
  - Paul Wilke, P.E.
  - pwilke@ara.com
  - Ph: 717-975-3550
  - Michael Harrell, P.E.
  - mharrell@ara.com
  - Ph: 217-356-4500
Extra Slides (if needed during Q&A)
Pre- & Post- Development Pavement Life Determination

- Mechanistic-Empirical Approach:
  - FWD testing & pavement cores
  - Back-calculation of elastic modulus
  - Determine effective SN & remaining life
Pre- & Post- Development Pavement Life Determination

- **Empirical Approach:**
  - Pavement cores & surface condition survey
  - Empirical correlations relate surface condition to equivalent structural layer coefficients ($a_i^*$)
  - SN effective = $(a_1^*) + (a_2^*) + (a_3^*)$
  - Remaining life determined from SN effective (AASHTO design equation)
## AASHTO Layer Coefficients

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>SURFACE CONDITION</th>
<th>COEFFICIENT</th>
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<tbody>
<tr>
<td>AC Surface</td>
<td>Little or no alligator cracking and/or only low-severity transverse cracking</td>
<td>0.35 to 0.40</td>
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<tr>
<td></td>
<td>&lt; 10 percent low-severity alligator cracking and/or</td>
<td>0.25 to 0.35</td>
</tr>
<tr>
<td></td>
<td>&lt; 5 percent medium- and high-severity transverse cracking</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt; 10 percent low-severity alligator cracking and/or</td>
<td>0.20 to 0.30</td>
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<tr>
<td></td>
<td>&lt; 10 percent medium-severity alligator cracking and/or</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt; 5–10 percent medium- and high-severity transverse cracking</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt; 10 percent medium-severity alligator cracking and/or</td>
<td>0.14 to 0.20</td>
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<tr>
<td></td>
<td>&lt; 10 percent high-severity alligator cracking and/or</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt; 10 percent medium- and high-severity transverse cracking</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt; 10 percent high-severity alligator cracking and/or</td>
<td>0.08 to 0.15</td>
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<td></td>
<td>&gt; 10 percent high-severity transverse cracking</td>
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Pavement Damage Assessment (Based on Pavement Life Consumed)

- SN effective used to quantify damage
- Cost may be expresses as:
  - (% Pavement life lost) X ($ to rebuild pavement);
  - (% SN lost) X ($ to rebuild pavement)
  - $ for structural overlay to restore original SN
- Same result, just different ways to express