Consideration of Shale Oil and Gas Development in Long-Range Transportation Planning

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Presentation Overview

• Introduction to long-range metropolitan and statewide transportation planning
• Implications of O&G development to regional transportation planning
• Study Methodology
• Current practices in statewide and regional transportation plans
• Overview of other studies outside of formal transportation planning process with potential methodologies/best practices
• Conclusions
Transportation Planning Overview

- Process required to receive federal funding of transportation projects and for air quality conformity in nonattainment areas.
- Different requirements for urbanized areas with >50,000 population which have Metropolitan Planning Organizations (MPOs) compared to rural areas which are addressed by the State DOTs long-range transportation plan.
- Long-range plans address at least 20 year outlook, MTPs updated at least every 5 years.
- MAP 21 increases emphasis on performance measures supporting national goals in seven areas: Safety; Infrastructure Condition; Congestion Reduction; System Reliability; Freight Movement and Economic Vitality; Environmental Sustainability; and Reduced Project Delivery Delays.
Transportation Planning Overview

• Major steps include:
  o Monitoring existing conditions;
  o Forecasting future population and employment growth
  o Identifying current and projected future transportation problems and needs
  o Developing long-range plans and short-range programs of alternative capital improvement and operational strategies for moving people and goods;
  o Estimating the impact of recommended future improvements to the transportation system on environmental features, including air quality; and
  o Developing a financial plan for securing sufficient revenues to cover the costs of implementing strategies.
Transportation Planning Process

1. Regional Vision and Goals
   - Alternate Improvement Strategies
     - Operations
     - Capital
   - Evaluation & Prioritization of Strategies
   - Development of Transportation Plan (LRP)
   - Development of Transportation Improvement Programs (S/TIP)
   - Project Development
   - Systems Operations (Implementation)
   - Monitor System Performance (Data)

CRITICAL FACTORS AND INPUTS

FEEDBACK

Data
Public Involvement
Fiscal Constraint
External Issues
Economic Development
Non-Discrimination
Air Quality
Safety

FEEDBACK
U.S. Shale Oil and Gas Production

Consideration of Shale Oil and Gas Development in Long-Range Transportation Planning

One-Way Truck Trips for One Horizontal Well

<table>
<thead>
<tr>
<th>Well Pad Activity</th>
<th>Early Well Pad Development (all water transported by truck)</th>
<th>Peak Well Pad Development (pipelines may be used for some water transport)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Heavy Truck</td>
<td>Light Truck</td>
</tr>
<tr>
<td>Drill pad construction</td>
<td>45</td>
<td>90</td>
</tr>
<tr>
<td>Rig mobilization(^2)</td>
<td>95</td>
<td>140</td>
</tr>
<tr>
<td>Drilling fluids</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>Non-rig drilling equipment</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>Drilling (rig crew, etc.)</td>
<td>50</td>
<td>140</td>
</tr>
<tr>
<td>Completion chemicals</td>
<td>20</td>
<td>326</td>
</tr>
<tr>
<td>Completion equipment</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Hydraulic fracturing equipment (trucks and tanks)</td>
<td>175</td>
<td></td>
</tr>
<tr>
<td>Hydraulic fracturing water hauling(^3)</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>Hydraulic fracturing sand</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>Produced water disposal</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Final pad prep</td>
<td>45</td>
<td>50</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>-</td>
<td>85</td>
</tr>
<tr>
<td><strong>Total One-Way, Loaded Trips Per Well</strong></td>
<td><strong>1,148</strong></td>
<td><strong>831</strong></td>
</tr>
</tbody>
</table>

Assumes 5 million gallons of water
Implications for Performance of the Transportation System

• Shale O&G development has and will continue to result in 1) increased heavy truck traffic and freight rail movement to supply equipment, water, sand and chemicals; and 2) increased employment and population, that in turn generates additional travel demand.

• Implications for issues considered in long-range transportation may include:
  - Economic vitality—transportation system support for shale gas related economic benefits.
  - Safety—impacts from additional heavy truck traffic, hazardous material transport.
  - Congestion—highway and freight rail (not an issue in most rural areas, but potential for impact on facilities serving regional travel needs).
Implications (Continued)

- Implications for issues considered in long-range transportation may include:
  - System preservation and financial resources to meet future needs—addressing accelerated roadway deterioration from heavy loads.
  - Linking transportation and land use—interaction between shale gas-related development and transportation system.
  - Air quality/transportation conformity—heavy diesel truck traffic and diesel locomotives are a major source of particulate matter emissions. Transportation conformity regulations require use of “latest planning assumptions” about future development of the area.
  - Environmental justice—consider potential for disproportionate transportation system impact on minority and/or low income populations.
Study Objectives

• Review the state of the practice for considering unconventional oil and gas impacts in long-range transportation planning.

• Provide a baseline for measuring progress in addressing oil and gas development impacts in planning over time.

• Identify the best practices currently available and directions for future development of guidance and tools to assist with planning for shale gas development impacts.
Methodology

Reviewed MPO, RPO and statewide long-range transportation plans meeting the following criteria:

- Plans covering areas located in Marcellus and/or Utica Shale (primarily Pennsylvania, West Virginia and Ohio (New York excluded due to uncertainty on whether or when HVHF will be approved) or Barnett Shale in Texas (longer history of production).

- Plans published in 2009 or later (earlier plans may not have been aware of issue due to rapid shale gas drilling and production growth since 2007).

• Content analysis and keyword searches to identify relevant sections within planning documents meeting the criteria.
Statewide Long-Range Transportation Plans

O&G development impacts not explicitly addressed in current long-range plans of Texas, Virginia or North Dakota.

O&G development impacts were discussed in Access Ohio 2040.

- Addressed in statewide freight study, including identification of rail infrastructure improvements needed.
- Qualitatively addressed O&G-related transportation impact on road condition and describes state law encouraging Road Use Maintenance Agreements with local governments.
Four noteworthy practices were identified in the review of MPO/RPO Plans.

**#1- Explaining the trend and implications** - Southwestern Pennsylvania Commission, 2040 Transportation and Development Plan for Southwestern Pennsylvania

- Two page discussion of shale gas in section on regional conditions and trends includes quantitative information permits issued and acknowledges influence on local economy and transportation system
#2- Revising population and employment projections to take into account shale gas-related growth- Belmont-Ohio-Marshall Transportation Study, Transportation Plan for 2035

• Assumptions on future growth adjusted and concurred with through interagency consultation process for transportation conformity. Incorporated into transportation and air quality modeling.
#3- Incorporation of shale-related goals and objectives. Williamsport Area Transportation Study 2033 LRTP (2013) and Lackawanna-Luzerne Regional Plan (2011).

- WATs LRTP includes goal of monitoring and posting/bonding to address impact on roads and provides 17 page analysis of Marcellus shale impacts and trends across modes.

“The sudden emergence of Marcellus Shale natural gas exploration has had profound impacts on population, employment, public safety, land use availability and utilization and all modes of transportation within Lycoming County.”
#4- Quantitative analysis of truck traffic impact. 
Northern Tier Regional Planning & Development Commission, Marcellus Shale Freight Transportation Study (2011).

- Quantitative analysis of existing impact and projection of future truck trip generation.
- Qualitative discussion of routes potentially most impacted based on existing and expected future well development patterns.
Marcellus Shale Freight Transportation Study

- Peak year of 2022- 4,100 daily truck trips (double existing). Likely impacted roadways identified, but trips not assigned to specific roadways to assess VMT, pavement damage and other indicators.
Other Non-Transportation Plan Resources

• Douglas County (Colorado) Oil and Gas Production Transportation Impact Study. 2012
  o High, medium, low development scenarios to quantify range of impact.
  o Random selection of pad sites based on existing lease data.
  o Travel demand modeling of impact on specific roads.
  o Roadway repair cost assessment and tax revenue assessment.
Other Non-Transportation Plan Resources

• North Dakota- Upper Great Plains Transportation Institute-
  Numerous projects, including ongoing “Needs Study of North Dakota Roads and Bridges” for North Dakota Legislature (Tolliver)

• TxDOT energy research projects– Energy Developments and the Transportation Infrastructure in Texas: Impacts and Strategies, among others (Quiroga et. al.)

• RAND- Estimating The Consumptive Use Costs of Shale Natural Gas Extraction on Pennsylvania Roadways (Abramzon et al.)
Conclusions

• Shale O&G impacts on transportation system are beginning to be considered qualitatively in long-range planning. Primary emphasis is on freight movement and road damage.

• There is a considerable gap between the sophistication of analyses of O&G impacts outside of formal transportation planning process and the analyses conducted for long-range transportation plans. Need to integrate some of the lower-cost best practices from research work in North Dakota and Texas.

• Approaches used to forecast land use change for future planning may be adaptable to shale gas well development—build-out analyses, scenario planning, expert panels/Delphi method etc. Address uncertainty with a range of possible outcomes and monitoring. Examples are available for MPOs/RPOs to adapt to their situation.
Conclusions (continued)

Best practices for addressing shale O&G development in planning include:

• Obtain good baseline data on existing well development activity (permitted wells, drilled wells, production, waste disposal volumes, water usage, and waste disposal locations) to characterize trends.

• Determine whether shale gas development is a large enough contributors to overall growth that it warrants special consideration in developing population and employment totals for transportation modeling.

• Consider the full spectrum of shale gas-related impacts on transportation, including socioeconomics, safety, congestion, system maintenance and air quality.