Exhibit 7

Working Paper Series

A Comprehensive Economic Impact Analysis of Natural Gas Extraction in the Marcellus Shale

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Hammer Down:
A Guide to Protecting
Local Roads Impacted by Shale Gas Drilling

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photo/David Keeler, *Rocket-Courier*, Wyalusing, PA

Summary: What is the issue?

There are engineering, logistical and legal obstacles to insuring good management of local roads in the face of the high-intensity truck travel associated with Marcellus Shale gas drilling. This policy brief lays out the effects of shale gas drilling on local roads and draws on best practices from states already affected by shale gas drilling to develop recommendations for local officials.

Keywords

Marcellus Shale, Local Roads, Economic Development

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Introduction

Dust, noise, and road damage from industry truck travel are tops on the list of citizen complaints in areas where shale gas is extracted via shale gas drilling. A typical Marcellus well requires 5.6 million gallons of water during the drilling process, in almost all cases delivered by truck. Liquid additives are shipped to the well site in federal DOT-approved plastic containers on flatbed trucks; hydrochloric acid and water are delivered – and flowback is hauled away – in tanker trucks. Millions of gallons of liquid used in the short (weeks-long) initial drilling period account for half of the estimated 890 to 1340 truckloads required per well site.[1] Because of its weight, the impact of water hauled to one site (364 trips) is the equivalent of nearly 3.5 million car trips.[2,3] Few roads at the town level in New York State have been built to withstand this volume of heavy of truck traffic. Local road quality management effectively functions as one barometer of municipal capacity to manage the pace and scale of natural gas extraction.

[1] Impacts of Community Character of Horizontal Drilling and High Volume Hydraulic Fracturing in Marcellus Shale and Other Low-Permeability Gas Reservoirs, prepared for New York State Energy Research and Development Authority by NTC Consultants, September 16, 2009
[2] Denton County Oil and Gas Task Force Summary Report, June 1, 2005.
[3] Equivalent Single Axle Load formula

From broadcasts on CNN[4] to full spreads in *National Geographic*,[5] the public face of natural gas drilling is the enormous volume of truck traffic and the resultant impact on municipalities and their citizens. Officials in Pennsylvania, trying to play catch-up with truck routing, have spent "tens of thousands of dollars just on signs," according to Rick Mason of PennDOT District 3-0.[6] Pennsylvania Department of Environmental Protection's Secretary John Hanger told Pittsburgh's National Public Radio, "I wish I was exaggerating when I say that there are roads that are being destroyed and that have been literally turned into mud and made impassable for all motorists including emergency responders."[7] In West Virginia, Department of Transportation officials recently proposed that natural gas companies post road repair bonds ranging from $25,000 per graveled mile to $100,000 per paved mile.[8] Roads resuscitated year after year with a seal coating have neither the width nor depth to handle sustained pummeling by heavy trucks; sinkholes, 6" to 10" of rutting, and complete road failures are not uncommon. Unlike state highways and primary county roads that are designed and engineered to last a specific length of time based on predicted traffic, local roads are generally not built to stringent guidelines.

What does this mean for New York?

Under New York State's Environmental Conservation Law[9] oversight of the actions of the gas industry is relegated to the state. Power over local roads is, however, ceded to local jurisdictions. Steven Messmer, Project Manager at Delta Engineering of Endwell, NY, estimates risk of damage to state roads is approximately 5% (negligible); the risk at the county level is approximately 20% (low); the risk to the roads built by towns and municipalities is approximately 90% (high).[10] For example, the impact of 1000 extra trucks per year on a county road (3" asphalt, 6" base, and 12" sub-base totaling 21" total pavement thickness) represents .13% of that road's lifespan; the resultant impact of those same trucks on a town road (2" asphalt and 12" base totaling 14" total pavement thickness) represent 2% of that road's life.[11]

[4] http://money.cnn.com/galleries/2010/news/1010/gallery.pennslyvania/index.html
[5] http://news.nationalgeographic.com/news/2010/10/photogalleries/101022-energy-shale-gas-drilling-pictures/#/energy-marcellus-shale-environment04-gas-truck_27066_600x450.jpg
[6] West Virginia DOT memorandum, August 20, 2010
[7] http://wduqnews.blogspot.com/2010/09/fracnet-and-trashnet-to-expand.html
[8] http://www.transportation.wv.gov/highways/policies/Documents/InterimOilandGasPolicy.pdf
[9] New York State Environment and Conservation Law §23- 0303(2)
[10] 'Preservation of Local Roads – Road Use Agreements and Local Law,' presentation by Steve Messmer of Delta Engineering, and Todd Mathes, attorney with Whiteman, Osterman, and Hanna, LLP, June 22, 2010, Conklin, NY.
[11] 'Preserving Municipal Roads: What are Your Options?,' presentation by David P. Orr, P.E., Cornell Local Roads Program at the NYS County Highway Superintendents Association Winter Meeting, January 20, 2010, Albany, NY.

Despite the need, there are engineering, logistical and legal obstacles to insuring good management of local roads in the face of abrupt, high-intensity truck travel. Following is a set of best practices tailored to New York municipalities, drawing from the experience of other states and shale plays:

- Conduct a comprehensive traffic impact study with the assistance of a certified traffic engineer (or firm) that takes into consideration the ability of the roads to withstand the volume of traffic anticipated (estimated cost $6000-$9000)
- Document *baseline* road conditions and calculate value of remaining road life
- Sign a *Road Use Agreement* (RUA) with the operator at the time of permitting to require that the operator offset the predicted loss of useful life at current reconstruction costs (estimated cost $900-$1200 for drafting)
- Develop and implement a system for *haul route management*, post roads accordingly (estimated cost $3000-$9000, dependent on route analysis in town and/or county)
- Enforce load zoning, ranging from routine patrol to high-intensity, multi-agency enforcement sweeps

Comprehensive traffic impact study

Local government should hire an engineering company to assess the structural condition of roads, measuring response to loads, predicting remaining life, and calculating required strengthening. A thorough study should include sampling of cores; a sample of gravel is not enough. The assessment may also include a seismic pavement test (different from that of geologic purposes). Consideration should be given to school bus routes, the geometrics of noise, and the sight distances around curves. Cornell Local Roads Director Lynne Irwin cites the following reasons not to test the roads in the worst part of spring thaw: 1.) There may be a frozen layer underneath the surface of the road, and base cores may behave more like water than a solid, leading to an incorrect picture of the performance of the road. 2.) Testing is more expensive during spring thaw because of demand; test early- to mid-May and then again in August or September to collect a full range of data. This data is critical to developing an accurate model of the road's strength. If the budget doesn't allow for testing twice, test between the beginning of June and the end of October. [12]

[12] 'Marcellus Shale: Local Roads Impacts' - presented by Lynne Irwin and David Orr, Cornell Local Roads Program, Cornell University, June 23, 2010.

A complete study will weigh different criteria to produce a structural measure, which determines the total number of Equivalent Single Axle Loads (wheel loads of various magnitudes and repetitions) that a particular road can support. Variations in temperature change the stability of a road; upstate New York's freeze and thaw cycle exacerbates road damage. Frozen roads are very strong and can carry a very large number of heavy loads; the same volume of trucks on a rural road during a dynamic spring thaw can wreak havoc, as illustrated by before and after photos of SR 3020 in Towanda Township, Bradford County, PA:

photo/PennDOT Engineering District 4-0

Document baseline road conditions

Video and photographic documentation of pre-development road conditions helps to bolster the case made by the aforementioned engineering study. Divide roads into manageable segments and keep it simple. Take an inventory of current road conditions by driving slowly while taking video, being careful to indicate rate of speed and where the video documentation begins and ends geographically. Gather measurements of length, width, sight distance, sharp curves, and thickness. Pavement management software is available for a nominal fee ($25) from the Cornell Local Roads Program.[13]

Road Use Agreements (RUAs)

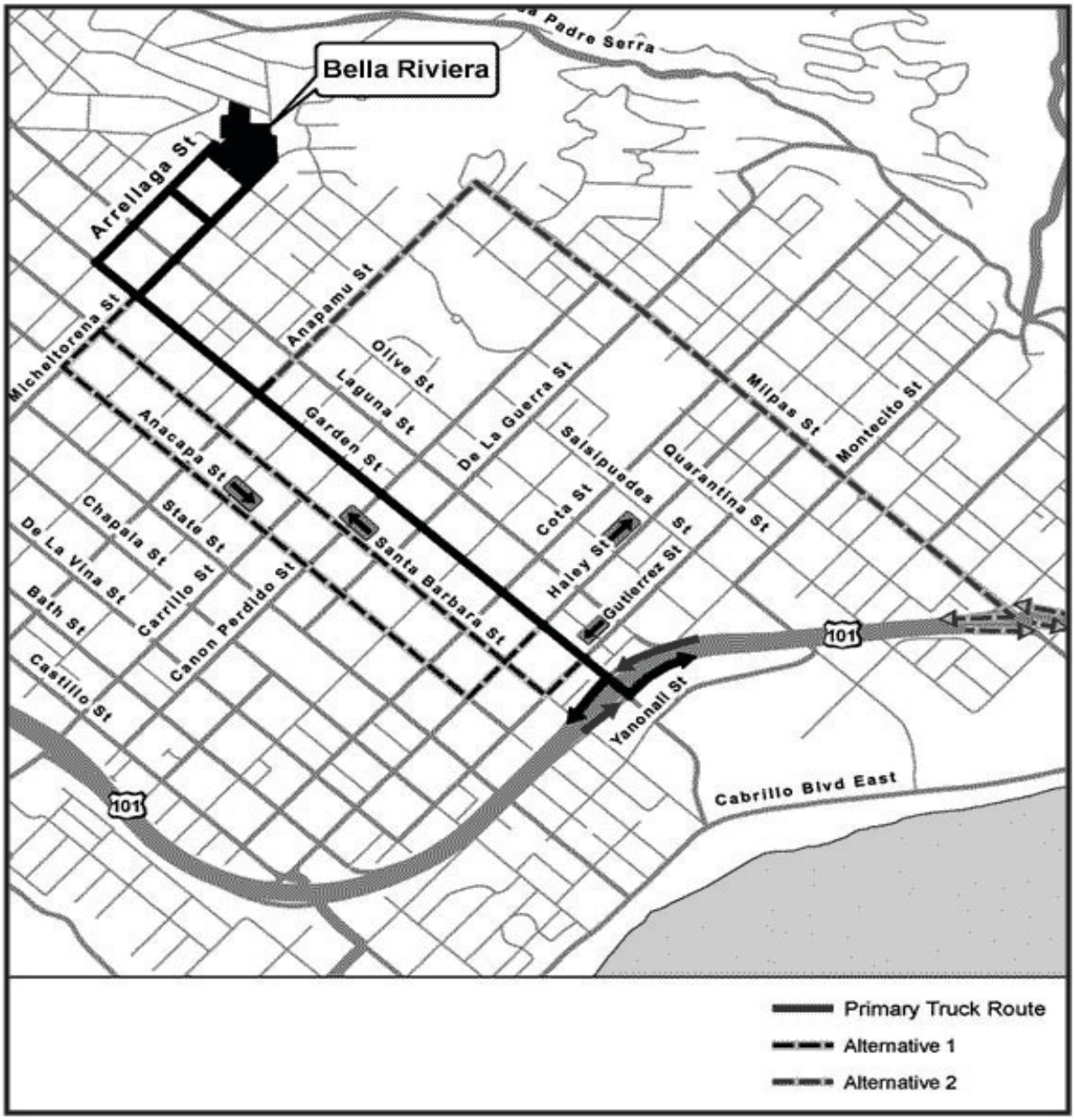
At present, there is a patchwork of Road Use Agreements at the town and county level throughout New York State with no central repository. Some RUAs are complex documents conceived from a road impact study; others are simple, built on the bones of contracts established years or decades ago. Any Road Use Agreement between the municipality and the operator should be placed on file with NYSDEC, as recommended by the draft SGEIS.[14] This is currently the only guidance on RUAs at the state level. It is unclear whether NYSDEC will commit resources to develop a database of RUAs or provide technical assistance to municipalities. A comprehensive RUA includes items such as trigger clauses that require developers to submit haul routes to a town before a permit is issued, effectively connecting a RUA to road use. Road Use Agreements are ineffective unless enforceable; thorough legal vetting is key to developing a RUA an operator will sign and abide by. Operators are not legally obligated to enter into a RUA, but are legally bound by a RUA once signed.

Haul route management

Identify acceptable truck routes that utilize the strong portion of the road system. Use load zoning to keep heavy trucks off most vulnerable roads; legal load limits must be based on a structural evaluation, rather than determined arbitrarily by weight. Each county in New York State has the planning capacity to conduct a GIS (Geographic Information System) analysis to route rigs and trucks on primary county and state roads suited for heavily-laden

[13] http://www.clrp.cornell.edu/Library/Compsoftware.htm
[14] Draft sGEIS 7-109-7-111.

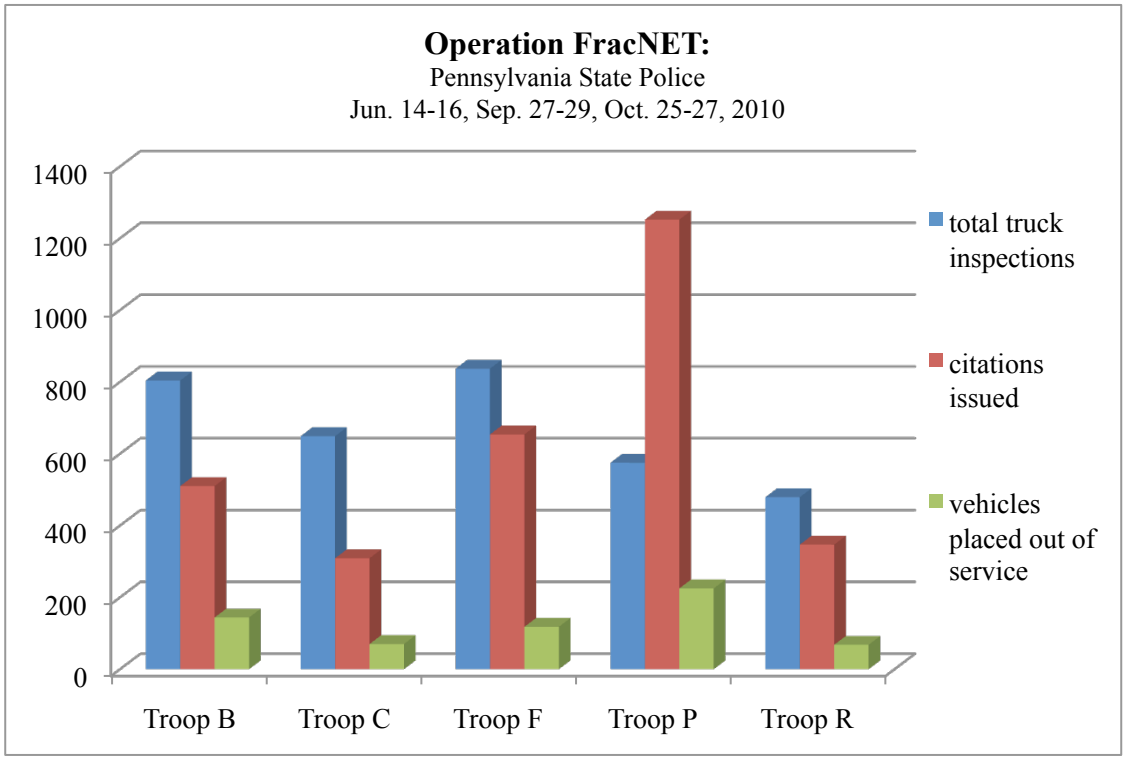
vehicles, using the shortest route on town and village roads for reaching their final destination, as characterized in this example:



Enforcement

At the legal limit, a semi-trailer truck weighs 80,000 pounds. A large body of evidence from Pennsylvania's Northern Tier suggests that natural gas operators are running trucks carrying loads past the legal limit. Similar circumstances have been reported in the

Fayetteville shale play in Arkansas.[15] Pennsylvania State Police Commissioner Frank Pawlowski has attributed much of that state's road damage to overweight trucks serving the gas industry. A February enforcement effort in Susquehanna County found more than half of 194 trucks checked were found to be over the weight limit; fifty percent of the trucks were also cited for safety violations.[16] With frustrations mounting over the condition of rural roads and damage caused by overweight vehicles related to the natural gas industry,[17,18,19,20,21,22] the Pennsylvania State Police, Pennsylvania Department of Environmental Protection, Pennsylvania Public Utility Commission, and the federal Motor Carrier Safety Administration inspected nearly 3500 trucks over three weekends (June 14-16, September 27-29, and October 25-27, 2010) and issued more than 2600 citations:[23,24]



[15] http://thecabin.net/news/local/2010-08-02/county-judges-irked-road-damage-caused-gas-drillers
[16] http://www.oilandenergynews.com/2010/05/increased-gas-drilling-activities.html , May 24, 2010
[17] http://www.stargazette.com/article/20100210/NEWS01/2100367/Truck-bound-for-drilling-site-49-7-tons-overweight-company-fined-31-304
[18] http://gantdaily.com/2010/06/22/dep-fines-grand-water-rush-llc-for-solid-waste-transportation-violations/
[19] http://www.stargazette.com/article/20100128/NEWS01/1280385
[20] http://www.pressconnects.com/article/20100204/NEWS11/2040374/0/NEWS01&theme=GASLEASE
[21] http://74.95.82.237:591/rconline/FMPro?-find=&-format=record_detail.html&-recid=12637109&-db=rconline.fp5
[22] 'Roads Under Siege,' W. David Keeler, Wyalusing Rocket-Courier, March 4, 2010
[23] Pennsylvania State Police press releases, June 23, October 6, and November 9, 2010
[24] Troop B: Allegheny, Fayette, Greene, and Washington counties
Troop C: Clarion, Clearfield, Forest, Elk, Jefferson, and McKean counties
Troop F: Cameron, Clinton, Lycoming, Montour, Northumberland, Potter, Snyder, Union, and Tioga counties
Troop P: Bradford, Sullivan, Wyoming, and Luzerne counties
Troop R: Lackawanna, Pike, Susquehanna, and Wayne counties

Enforcement comes at a price, however; Pennsylvania's DEP has funded these unannounced roadside inspection blitzes for $550,000 from the state's Waste Transportation Safety Account.[25]

A legal primer

Any municipal traffic regulation excluding trucks must be based on necessity, rather than an attempt to confine a particular company (or industry). For a local traffic regulation to pass muster in a court of law it has to be deemed *reasonable*. Is the proposed truck route regulatory or prohibitory? Thorough documentation of structural and functional road conditions (through a traffic impact study and the documentation of present road conditions) helps to lessen liability to the locality. Load zoning and haul route management is permitted, provided that the route provides access to all state routes entering or leaving town.[26] Consider that industry executives may prefer that costs be consistent, and therefore accept fees as a cost of doing business, but may dispute the *legality* of being 'singled out'; restrictions must apply to all trucks, not just those serving natural gas drilling rigs.[27] Municipalities may not pass or enforce ordinances that impose a tax or fee for the use of public roads,[28] but comprehensive road use agreements that link capacity of the road to a permitting for heavy use may be implemented with the expressed intent of preservation of the road and/or public safety. The safety of passenger and commercial vehicle operators on rural roads is of concern even before adding heavy traffic; half of fatal accidents in New York State occur on rural roads[29] although only 7% of New York's population resides in rural areas.[30]

Some guidance on exclusionary traffic regulations can be found in *People v. Grant*[31], a case in which residents in a Long Island town objected to a high volume of through traffic from a particular company. The New York State's highest court ruled that while local municipalities have authority to adopt local laws under the Municipal Home Rule Law[32], they may not do so if the ordinance conflicts with the state constitution. Although it was

[25] http://wduqnews.blogspot.com/2010/09/fracnet-and-trashnet-to-expand.html
[26] N.Y. Veh. & Traf. Law Art. 41 § 1660, paragraphs 10 and 17
[27] Sarah Fullenwider."If We Knew Then What We Know Now….A Decade of Lessons Learned from Urban Drilling in Fort Worth," Webinar presented by Penn State College of Agricultural Studies Cooperative Extension, May 20, 2010.
[28] N.Y. Veh. & Traf. Law Art. 41 § 1604
[29] http://www-nrd.nhtsa.dot.gov/Pubs/810996.PDF NHTSA Rural/Urban Comparison, 2007
[30] Jeryl Mumpower and Warren Frederick Ilchman, *New York State in the year 2000*, p. 138
[31] *People v. Grant*, 306 N.Y. 258 (1954)
[32] Municipal Home Rule Law §10[2]

decided in 1954, that case is still considered good law with respect to restrictive ordinances.[33] Municipal attorneys interested in further clarification of how Municipal Home Rule Law, Vehicle and Traffic Law, and the Environmental Conservation Law[34] statutory language – "local jurisdiction over local roads" – should be interpreted may request an informal opinion from the state Attorney General's office, Division of Appeals and Opinions.[35]

A handful of municipalities have hired engineering firms together as part of a cooperative deal to defray some of the costs of conducting road studies and drafting legislation. Feedback from this process is ongoing, yet decentralized; technical assistance is available from the Cornell Local Roads Program (see 'Further Resources'). Evidence from Pennsylvania, West Virginia, and Arkansas suggests that municipalities lacking traffic ordinances are severely impacted when shale gas drilling commences. The short-term costs of developing a comprehensive plan – based on the likelihood of sudden, high-volume truck traffic as a result of shale gas drilling – more than offset the anticipated cost to municipal road crews, whose budgets are toward regular maintenance, not major repairs and construction.

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[33] "Town board's limited power to exclude certain vehicles from certain highways – general discussion," 1980 N.Y. Op. Atty. Gen. (Inf.) 209 (see appendix)
[34] New York State Environment and Conservation Law §23- 0303(2)
[35] http://www.ag.ny.gov/bureaus/appeals_opinions/guideline_informal.html

Further Resources

American Association of State Highway and Transportation Officials (AASHTO) – http://www.transportation.org/

American Society of Highway Engineers (ASHE) – Central New York Section Officers:
Charles T. Liggett, CDM, Syracuse, NY; (315) 427-7380; Liggettct@cdm.com
Mark D. Premo, P.E., OCDOT, Syracuse, NY; (315) 435-3205; MarkPremo@ongov.net
Donald P. Blasland, PW Labs, E. Syracuse, NY; (315) 437-1420; pwlabsinc@hotmail.com

The Cornell Local Roads Program provides a range of technical assistance to New York State municipalities, including Road Surface Management System software; (607) 255-8033 http://www.clrp.cornell.edu

The Cornell Local Roads Program recently enlisted the legal expertise of former New York State Assistant Attorney General Jim Gelormini to develop model ordinances for municipalities; those ordinances and has made those available to the public at http://www.clrp.cornell.edu/resourcesLinks/model_ordinances.htm

Delta Engineers, Architects & Land Surveyors, P.C. (http://www.deltaengineers.com) of Endwell, NY has contracted with Sullivan County and Schyuler County as well as the towns of Fenton in Broome County and Danby and Dryden in Tompkins County

Google map of Road Destruction in Tioga County, PA

Appendices

Guidelines and Standards for Classifying Roads and Streets, Cornell Local Roads Program, March 2008

"Town board's limited power to exclude certain vehicles from certain highways – general discussion," 1980 N.Y. Op. Atty. Gen. (Inf.) 209