



DATE: April 16, 2015
TO: Transportation Commission
FROM: Debra Perkins-Smith, Director, Division of Transportation Development
SUBJECT: Oil & Gas Transportation Impacts Study Key Findings

Purpose

Update the Transportation Commission on the findings of the Oil & Gas Transportation Impacts Research Study and CDOT Region 4's related analysis of pavement design life and crash history.

Action

Informational. Direction from TC as to whether additional policy discussions such as cost recovery should be pursued.

Background

With the increase in oil and gas activity and change in extraction method in Colorado, the Transportation Commission requested information on oil and gas impacts. The purpose of the research study is to identify and quantify the magnitude of the impacts from oil and gas trucking activities on the state highway system. The Region 4 analysis provides corridor-specific analysis of the industry's impacts on pavement design life and safety.

Industry Context in Colorado

Due to technological advancements, oil and gas development has significantly increased across the country over the past five years, and Colorado is one of several states to experience dramatic increases in industry activity. There are about a dozen different oil and gas basins in Colorado. As of December 2014, Colorado has about 53,000 active wells. Over the past five years, Colorado's active well count has increased by approximately 26 percent. Oil and gas activity is heavily concentrated in Weld County, which has nearly 21,900 active wells or roughly 40 percent of all active wells within the state. There are 46 drilling rigs in Colorado as of early March 2015, which is down from 68 rigs in July 2014. New well development, which causes the acute transportation impacts, is slowing as a result of slumping oil and gas prices; however, oil and gas production from existing active wells is at record levels.

Attachment A maps the producing wells and well permits in Colorado and shows that the activity is heavily concentrated in a few areas of the state, most notably in the Denver-Julesburg Basin. The Key Energy Corridors shown on Attachment A represent those state highways that are most likely to experience the industry's impacts, some to a much greater extent than others.

Truck Trip Generation and Loads

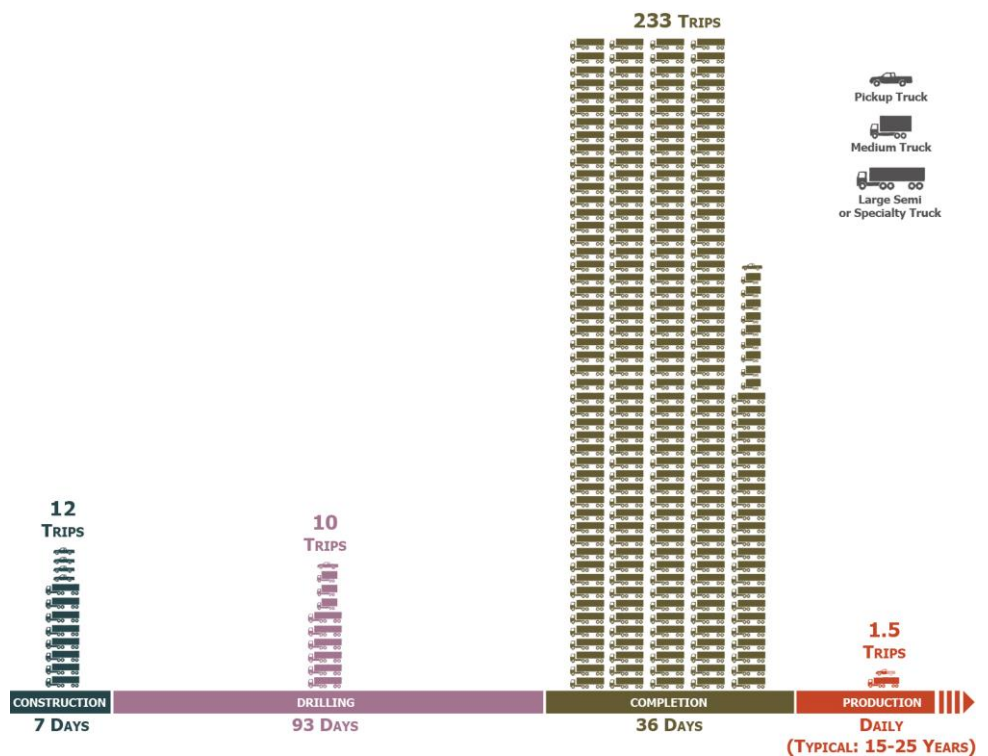
Oil and gas development requires the transport of heavy equipment to the well site to build access roads, construct a well pad, and transport a drilling rig. Heavy trucks are also required to bring fresh water to the well site and often to transport produced water and extracted resources off site. Oil and gas drilling practices have evolved to cluster multiple wells on one pad and employ horizontal drilling and hydraulic fracturing (fracking) techniques. Average trip generation for a horizontal 6-well pad is shown in the following table.



Phase		Truck Trips 1 pad, 6 wells
Construction	Pad and Road Construction	87
Drilling	Drilling Rig	67
	Drilling Fluid and Materials	472
	Drilling Equipment (casing, drill pipe, etc)	389
Completion	Completion Rig	33
	Completion Fluid and Materials	195
	Completion Equipment (pipe, wellhead, etc)	13
	Fracturing Equipment (pump trucks, tanks, etc)	250
	Fracture Water	5,537
	Fracture Sand	503
	Flowback Water Disposal	1,848
Total Development Trips		9,393
Annual Production Trips Per Pad		560

The table shows about 9,400 trips associated with the development of a 6-well pad, which typically occur over a four-month timeframe. Most of the trips are associated with the large amounts of water required in fracking operations. In areas where well density allows, some oil and gas operators are using pipelines to transport water to the well sites for fracking and to transport flowback water to disposal sites. If pipelines are used (as they reportedly are on approximately 60 percent of new pads in Weld County), about 80 percent of trips could be reduced.

Oil and gas development results in more traffic on the system, but even more impactful are the increased loads on state highways. A loaded water truck (the highest frequency trucking activity for the oil and gas industry) can result in 3,500 to 14,000 times the load impact of a passenger car. The diagram to the right shows the average number of truck trips per day and the typical duration of that activity for a 6-well pad.



To provide context to the loads generated by the oil and gas industry, the research team compared the truck loads (Equivalent Single Axle Loads - ESALs) generated by development of a single pad (with six wells) to the truck loads generated during construction of a typical big box retail store. A big box retail store construction generates approximately 1.75 times the load of a single pad development. In 2013, an estimated 300 oil and gas pads were developed; which would be equivalent (in terms of truck loads) to the construction of 170 big box retail stores.

Details

Statewide Impacts

The research study and Region 4’s analysis help to address four questions to provide a better understanding of the magnitude of oil and gas impacts on the state highway system:



1. How much truck activity on the state highway system is related to the industry?
2. What portion of the loads on the state highway system are related to the industry?
3. What are the estimated costs to offset the industry impacts?
4. What are the impacts on specific corridors that are heavily used by the industry?

The research team based the analysis on actual well activity in 2013, as provided by the Colorado Oil and Gas Conservation Commission (COGCC). In 2013, 1,839 wells were drilled in Colorado, and there were 49,878 producing wells.

The oil and gas industry can contribute to a variety of impacts to our roads and bridges, including pavement deterioration, increased safety concerns, capacity problems in areas of intense activity, and bridge deterioration. The methodology used to estimate the statewide impacts focuses solely on pavement deterioration. The research team developed an approach to isolate the road surface damage caused by the industry and to calculate the cost to offset those incremental impacts. An Excel-based tool was developed to provide spot analysis for a particular site based on information entered by the user.

To estimate the statewide impacts, the calculation tool was applied using generalized parameters. The research team made assumptions about trip length, which can be widely variable; two average trip lengths (5 and 15 miles) were used to provide a range of possible impacts. Estimating the magnitude of statewide impacts required other generalizations, including the use of average roadway characteristics to estimate the cost implications, and the conservative assumption that all water is transported by truck.

In 2013, the state highway system carried approximately 2.4 billion truck vehicle miles of travel (VMT). Using the estimated trip lengths of 5 and 15 miles, the research team estimated that the oil and gas industry trips (development and production activities) may have been 60 to 180 million VMT, accounting for 2.5 to 7.5 percent of the system wide truck VMT.

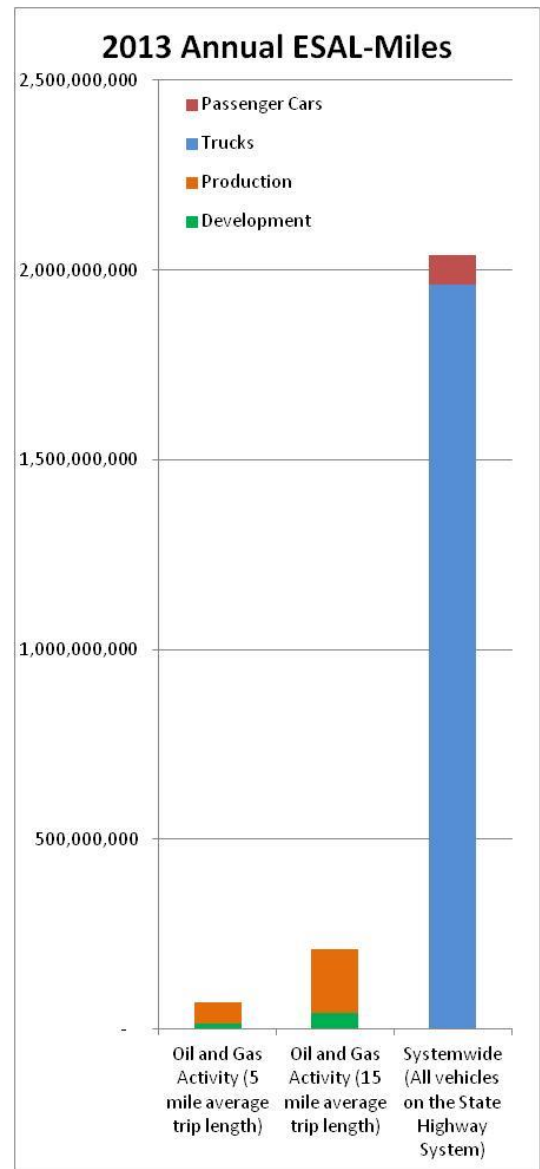
The portion of loads on the state highway system that came from the oil and gas industry in 2013 was also estimated. Similar to the concept of VMT, ESAL-miles were used, which is the load times the trip length. In this case, all vehicles on the state highway system were accounted for, not just trucks. As the chart on the right shows, trucks account for the vast majority of system wide ESAL-miles. Using the estimated trip lengths of 5 and 15 miles, the research team estimated that the oil and gas industry (development and production activity) may have accounted for 3 to 10 percent of the system wide ESAL-miles in 2013.

By calculating the pavement overlay depth required to compensate for the estimated 2013 industry loads, the study team estimated the magnitude cost to offset the impacts to be in the range of \$10 to \$30 million. For comparison, CDOT's FY16 budget for surface treatment is \$236 million. Mitigating oil and gas impacts could take 4 to 13 percent of CDOT's annual surface treatment budget.

Impacts on Select Corridors in Region 4

Concurrent with the research study that addresses the magnitude of statewide industry impacts, Region 4 analyzed the pavement and safety conditions of three state highway segments that have experienced a notable increase in oil and gas activity over the past several years:

- US 85 between Fort Lupton and Platteville
- SH 14 near New Raymer
- SH 392 between Lucerne and Barnesville



The pavement design life analysis found that the increased truck traffic (which is likely predominately attributed to increased oil and gas activity) on both US 85 and SH 392 is expected to result in a loss of approximately 36 percent of the pavement design life. On SH 14, the increased truck activity is expected to reduce the design life by at least 44 percent. The analysis indicates a significant acceleration of pavement deterioration on these highways due to increased truck traffic. Full documentation of the analysis is available at:

<https://drive.google.com/folderview?id=0B4pvpu5Gvwziflh3cTJFVUZSNnRsV3FGMXBReHJBOWdCWTRleG9vSk04ZjZxWGZQX0JQOTA&usp=sharing>

Region 4 also examined traffic volumes and crash histories on US 85 (two segments), SH 14, and SH 392. Staff looked at corridor AADT, crashes, vehicle type, crash type, crash severity, and crash location over three 5-year time periods ranging from July 1999 to June 2014. Below are a few findings from the analysis performed. Full documentation of the analysis is available at:

<https://drive.google.com/folderview?id=0B4pvpu5Gvwziflh3cTJFVUZSNnRsV3FGMXBReHJBOWdCWTRleG9vSk04ZjZxWGZQX0JQOTA&usp=sharing>

- Over the same period, crash totals increased on three of the four corridor segments.
- SH 392 experienced appreciable growth (62 percent) in number of crashes that involved large truck/bus vehicle type between 2000 and 2014.

Cost Recovery Context

Colorado has a low effective tax rate and lacks a direct dedication of oil and gas revenue to transportation; and oil and gas revenue does not accrue to the general fund for discretionary appropriations (which could then be used for transportation). Current practices allocate all oil and gas state-level revenue to DNR and to DOLA for distribution back to local governments.

Key Conclusions (Assuming 2013 Levels of Oil and Gas Activity)

- Oil and gas loads (development and production) are estimated to be 3 to 10 percent of the total loads on the state highway system.
- Costs to offset the impacts of oil and gas pad development could account for 4 to 13 percent of CDOT's annual surface treatment budget.
- Oil and gas activity is geographically focused in several key areas of the state; therefore, transportation impacts are concentrated specifically in those areas. The use of pipelines to transport water to the site and for flowback water greatly affects the number of trips associated with site development.
- Increased trucking activity has been found to reduce the pavement design life on three specific corridors by approximately 40 percent.
- Crash totals have increased on three of the four study corridor segments; SH 392 experienced appreciable growth (62 percent) in the number of crashes that involved large truck/bus vehicles.
- CDOT currently has no dedicated revenue related to mineral extraction.

Key Benefits

The updated Oil & Gas Impacts Calculator can be used by CDOT Region staff as input to design for surface treatment strategies in the oil and gas energy corridors. The findings from these studies provide the TC with a level of magnitude of the impacts from oil and gas trucking activities on the state highway system. This information could be used to support future policy and investment decisions.

Next Steps

- Based on the information presented, are there additional issues or policy discussions such as cost recovery the Commission would like to pursue. If desired, staff can provide information from the research study that looked at Colorado's oil and gas taxation compared to the cost recovery practices of several other states that experience high levels of oil and gas activity.
- Finalize Research Study by FHU and BBC

Attachment

Attachment A: Current Producing Wells and Well Permits and Key Energy Corridors



Attachment A

Key Energy Corridors, Producing Wells and Well Permits (March 2015)

