Multimodal Analysis of Freight Transport Activity and Infrastructure Impacts Related to Manitoba's Energy Sector

Annual Conference of the Transportation Association of Canada, Winnipeg, MB 2013

University of Manitoba Transport Information Group

Mark Reimer B.Sc. (CE), EIT
Jonathan D. Regehr Ph.D., P.Eng.
University of Manitoba
Winnipeg, MB, Canada

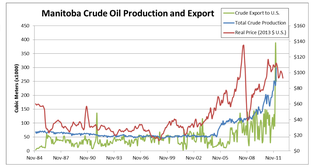
INTRODUCTION

Research Objectives

1. Characterize the nature of the energy industry in southwest Manitoba, including locations of major freight origins and destinations, and prospects for future growth
2. Inventory the freight transportation system that currently meets industry demands, including the infrastructure (highway, rail, and pipeline networks), vehicles (trucks, trains), and relevant regulations
3. Assess the impacts on and needs of regional infrastructure

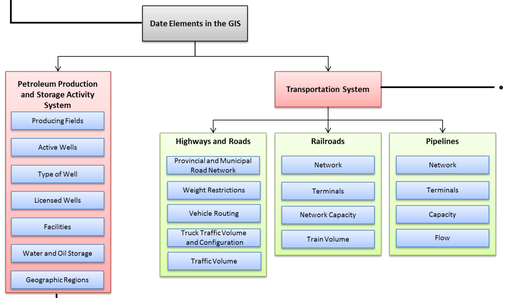
Background

- Manitoba has experienced considerable growth in the energy sector since 2006 due to technological changes in the petroleum extraction process and identification of new oil reserves
  - Rapid increase in active wells and wells drilled per year
  - Expected rapid growth for the foreseeable future
- Jurisdictions across North America are beginning to consider the impacts of the energy sector in long-range transportation plans
- Planning for the transportation needs of the energy sector is challenging due to its multifaceted nature
  - Development along low-volume secondary highways
  - Railroads are upgrading previously low-volume routes and adding transload facilities
  - Limited pipeline capacity has resulted in increased rail traffic for crude oil
  - Well development requires many inputs and both origins and destinations are dynamic



Method to Characterize the Activity and Infrastructure Systems

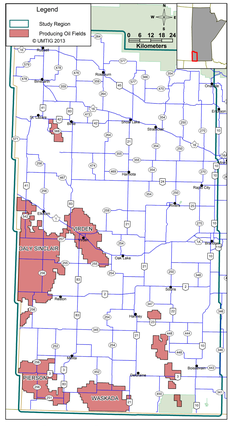
- Development of a geographic information system (GIS) that incorporates data elements of the activity and transportation system



- Multimodal transportation system
  - Highways and roads serve trips to and from wells
  - Railroads import materials and export crude oil
  - Pipelines used for collection and export
- The activity system can be determined by locating regions of oil production, transload facilities, storage facilities, and locations of inputs (materials and supplies)

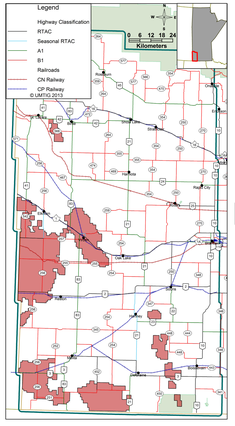
TRANSPORT AND ACTIVITY SYSTEM

Regional Perspective



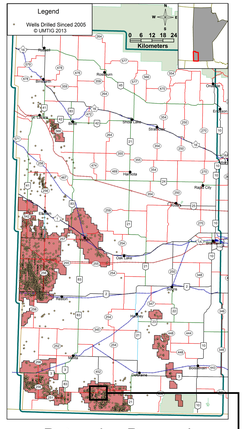
Select Study Region

- Mineral rights
- Crown leases
- Existing fields



Identify Transport System

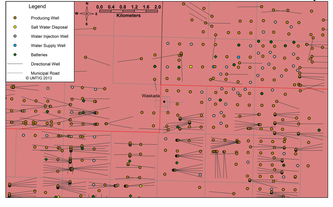
- Road classification
  - Weight limits
- Railroads
- Pipelines



Determine Demand

- Well drilling activity
- Drill rig moves
- Communities

Well-Specific Perspective



Oil Drilling → Produced Water Disposal

Oil Production → Pipe Transloading / Rail Transloading

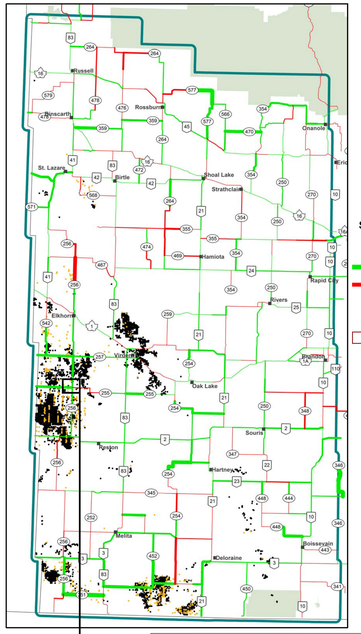
- Well development and production has multiple stages with wells serving as origins and destinations
- Well-specific activity leads to substantial truck traffic during the drilling phase and continued truck traffic throughout its production life
- Major origins are material sourcing sites such as rail transload facilities bringing frac sand and supplies and sources of freshwater
- To develop a single well in North Dakota typically requires over 1000 loaded truck trips
  - Volumes are expected to be lower in Manitoba due to differences in geological formations

North Dakota Truck Trips for One Well

Well Pad Activity	Loaded Trucks	Inbound or Outbound
Sand	80	Inbound
Water (Fresh)	400	Inbound
Water (Waste)	200	Outbound
Frac Tanks	100	Both
Rig Equipment	50	Both
Drilling Mud	50	Inbound
Chemical	4	Inbound
Cement	15	Inbound
Pipe	10	Inbound
Gravel	80	Inbound
Fuel Trucks	7	Inbound
Pumper Trucks	15	Inbound
Workover Rigs	1	Inbound
Total	**1012**	**both**

Source: Additional Road Investments Needed to Support Oil and Gas Production and Distribution in North Dakota. Upper Great Plains Transportation Institute, North Dakota Department of Commerce. December, 2010.

IMPACTS ON MANITOBA INFRASTRUCTURE



- Oil well development has had a significant impact on total traffic volumes in southwest Manitoba
  - Changes in annual average daily traffic (AADT) is captured by coverage count stations and continuous classification stations along primary and secondary highways
  - Linking highway volume changes with increases in oil well development provides insights into the overall impact

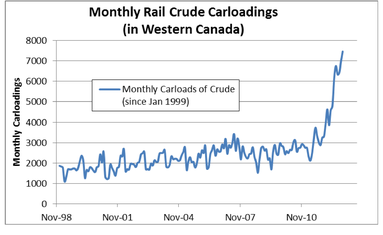
2008 to 2010 Annual Average Daily Traffic (AADT) Change in Southwestern Manitoba

Legend
- AADT Growth
- AADT Decline
- Active Wells in 2008
- Wells added by 2010
- Study Region

0 6 12 18 24 Kilometers

N W E S

- Increased rail carloadings as crude production increases and pipelines reach capacity
- Rail is capable of reaching more markets and refineries across North America
- Current investment in new transload facilities to meet projected increase in demand



CONCLUSIONS

- Improved knowledge of the energy sector can assist in developing effective transportation plans
- Development of a geographic information system (GIS) provides a useful analytical and mapping tool to support engineering and policy decisions
- Oil well development is a year-round activity that can be impeded by spring weight restrictions, particularly along secondary highways and roads
- A multimodal systems approach is necessary for developing transportation plans for the energy sector as each mode plays a significant role in the movement of inputs and outputs
- Accurate, up-to-date datasets are necessary when investigating the impacts of the energy sector as origins and destinations (primarily oil wells) are dynamic and active regions may only remain active for short periods of time

ACKNOWLEDGEMENTS

- Natural Sciences and Engineering Research Council of Canada
- University of Manitoba Research Grants Program
- Manitoba Innovation, Energy, and Mines - Petroleum Branch