

APPENDIX M

TRANSPORTATION REPORT



GOLDBORO
LNG



Traffic Impact Review

**Goldboro LNG Project
Site Access Roadways**

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Background

The Goldboro LNG Project proposed by Pieridae Energy (Canada) Limited is at the same location as the Keltic Project that underwent provincial and federal environmental assessments and obtained EA approvals in 2007 (provincial) and 2008 (federal). The construction phase for the project is expected to begin during 2015 with the operational phase beginning approximately mid-2019.

Traffic volumes on the approximately 77 kilometer site access route that included sections of Trunk 7, Route 276 and Route 316 were evaluated extensively in the *Traffic Impact Study, Keltic Petrochemical Inc. and Maple LNG Liquefied Natural Gas Facilities* (December 2007) report prepared by Atlantic Road & Traffic Management (ARTM). While the traffic volumes used in the 2007 study included data collected by NSTIR up to 2005, more recent data from the NSTIR 2008 and 2011 count programs are now available.

Traffic volume annual growth trends for the access route road sections have been reviewed using the more recent data and compared to the results included in the 2007 report. Impacts of construction phase site generated trips have been reviewed for horizon year 2017 and impacts of operational phase trips have been reviewed for horizon year 2024, five years after the project is expected to become operational.

Projected 2017 and 2024 Road Section AADT Volumes

Historical road section traffic volume data used in the 2007 Study and more recent 2008 and 2011 volume data have been used to estimate 'vehicles per day per year' (vpd / year) annual growth rates, projected 2013 background volumes and 2017 and 2024 horizon year volumes (Table 1) for road sections on the site access route from Antigonish to Goldboro.

Table 1 – Projected 2017 and 2024 Annual Average Daily Traffic (AADT) Volumes				
Location	Annual Growth Rate ² (vpd / year)	Projected AADT ¹ Volumes for Background and Horizon Years		
		2013 ³	2017 ⁴	2024 ⁴
Trunk 7 – 1.0 km South of Highway 104	40	4420	4,580	4860
Trunk 7 – 1.0 km South of Salt Springs	40	2900	3,060	3340
Route 276 – Halfway Trunk 7 and Route 316	6	520	545	585
Route 316 – 1.0 km South of Route 276	10	530	570	640
Route 316 – 1.5 km north of Isaac's Harbour	5	460	480	515

NOTES: 1. AADT is Annual Average Daily Traffic.
2. Annual Growth Rates for road sections were estimated from analysis of historical counts between 1970 and 2011.
3. Projected 2013 volumes were estimated from evaluation of historical volumes.
4. Projected 2017 and 2024 volumes are based on projected 2013 volumes and annual growth rates of vehicles per day per year (vpd / year).

Review of Traffic Volume Growth Trends since the 2007 Study was Completed

Table 2.3 of the 2007 Report included traffic data for access route road sections including estimated values for annual traffic volume growth, percent annual volume growth, and projected 2017 Annual Average Daily Traffic (AADT) volumes. Traffic volume growth rates and projected 2017 volumes for access route road sections from the 2007 Report are compared to updated growth rate trends and 2017 volume projections prepared using 2008 and 2011 count data in Table 2.

While the growth rate and projected 2017 volume for the Route 316 section just south of Route 276 have experienced small increases from the values estimated in the 2007 Report, growth rates and volume projections on other road sections are reduced from the previous estimated values. An annual traffic volume growth rate of 1.5% is considered appropriate for use throughout the 2013 Review.

While Trunk 7 volumes can be considered to be moderate, Routes 276 and 316 volumes are very low for two lane roadways. The following 2011 AADT volumes for several two lane roads are provided to provide an example of the potential for two lane roads to accommodate higher volumes:

- Highway 104 – Pictou / Antigonish County Line – 6800 vehicles per day (vpd);
- Highway 104 – Lower South River to Heatherton – 10,000 vpd;
- Route 213 – Highway 103 to Upper Tantallon (Halifax County) – 15,300 vpd; and
- Route 333 – Goodwood to Brookside (Halifax County) – 10,600 vpd.

Location	Annual Growth Rate (vpd / year)		Annual % Growth ¹		Projected 2017 AADT ² Volumes	
	2007 Study ³	2013 Review ⁴	2007 Study ³	2013 Review ⁴	2007 Study ³	2013 Review ⁴
Trunk 7 – 1.0 km South of Highway 104	55	40	1.2	0.9	5,050	4,580
Trunk 7 – 1.0 km South of Salt Springs	50	40	1.7	1.4	3,400	3,060
Route 276 – Halfway Trunk 7 and Route 316	10	6	1.8	1.1	650	545
Route 316 – 1.0 km South of Route 276	5	10	1.2	1.9	530	570
Route 316 – 1.5 km north of Isaac's Harbour	5	5	1.0	1.0	570	480

NOTES: 1. The Annual % Growth rate for the 2007 Study was based on estimated 2007 AADT volumes and the rate for the 2013 review has been based on projected 2013 AADT volumes at each location.
 2. AADT is Annual Average Daily Traffic
 3. Growth trends and projected 2017 AADT volumes for the 2007 Report have been extracted from Table 2.3 of that Report.
 4. Growth trends and projected 2017 AADT volumes for the 2013 Review have been estimated by including 2008 and 2011 data in the analysis.

Seasonal Variation in Traffic Volumes

Daily volumes fluctuate from one time of year to another, with volumes typically higher in the summer and lower in the winter. NSTIR maintains a number of permanent count and vehicle classification stations throughout the Province. Permanent counters are grouped in accordance with their seasonal variation patterns; Group AA counters have the least seasonal variation and GENIVAR Inc.

Group H counters have the greatest seasonal variation. While most roads in the Project area are considered to be in Group C, seasonal variations for Groups A, B, C, and D permanent counters are presented in Table 3. These factors indicate how the average weekly volumes vary from season to season in comparison to the AADT. For example, a Group C road with an AADT volume of 1000 will have average volumes of 720 during the winter, 980 during spring and fall, and 1230 during the busier summer months. However, since traffic volumes in the study area are generally low, seasonal variation has little impact on level of service.

Season	Average Daily Volume as a Percent of AADT by Counter Group			
	A	B	C	D
Winter (December, January, February, March)	0.82	0.79	0.72	0.65
Spring / Fall (April, May, October, November)	1.01	1.00	0.98	0.96
Summer (June, July, August, September)	1.11	1.15	1.23	1.22

Source: Unpublished data for Average 2013 Counter Group Factors; NSTIR

Projected 2013, 2017 and 2024 Background Design Hourly Volumes

Since it is not practical to design roadways to accommodate the highest hourly volume of the year, it is generally accepted that the 30th highest hour of the year be used as the Design Hourly Volume (DHV) for rural roads. Average AM and PM peak hourly volumes from the 2008 and 2011 machine traffic counts obtained on access route road sections have been increased by 10% to provide estimated Design Hourly Volumes (DHVs) for the count year. DHVs estimated from traffic counts have then been increased by a 1.5% annual volume growth rate to provide estimated 2013, 2017 and 2024 AM and PM DHVs which are included in Table 4.

Location	2013 DHVs ¹		2017 DHVs ²		2024 DHVs ²	
	AM	PM	AM	PM	AM	PM
Trunk 7 – 1.0 km South of Highway 104	370	455	390	480	430	530
Trunk 7 – 1.0 km South of Salt Springs	220	225	235	240	260	265
Route 276 – Halfway Trunk 7 and Route 316	55	60	60	65	65	70
Route 316 – 1.0 km South of Route 276	50	65	55	70	60	75
Route 316 – 1.5 km north of Isaac’s Harbour	40	65	40	70	45	75

NOTES: 1. 2013 Design Hourly Volumes (DHVs) have been estimated by increasing average AM and PM peak hour volumes from 2008 or 2011 machine counts by 10% and a 1.5% annual traffic volume growth factor.
 2. 2017 and 2024 DHVs have been estimated using the 2013 values increased by 1.5% per year.

Collision Experience

Review of the 2000 to 2004 collision history and rates for access route road sections was included in *Traffic Impact Study, Keltic Petrochemical Inc. and Maple LNG Liquefied Natural Gas Facilities* (December 2007). It was concluded that since collision rates on the access route sections are lower than Provincial average, there is no indication of abnormal collision experience on those road sections. Since the NSTIR collision data base does not include records for recent years, it is not feasible to update the evaluation from that included in the 2007 report. However, since there has been no significant change in traffic volumes on the access route road sections since 2007, it is assumed that the conclusion relative to collision experience is still valid.

Construction Phase Trip Generation

Since construction on the site is expected to start during 2015 with the operational phase starting approximately mid-2019, construction phase traffic impacts have been estimated for 2017. Information provided by *CB&I Oil and Gas* indicate that approximately 3500 workers will be employed on the site during peak construction periods. The majority of the workforce will be housed at a construction camp near the site and are expected to be transported to the camp by buses, probably on weekends about every four weeks. While the workers at the camp are not expected to affect traffic volumes on the access route roads, daily commuters from Antigonish and Guysborough county communities, as well as trucks delivering material to the site, will be travelling on various access route road sections during AM and PM peak hours.

The work schedule provided by CB&I includes approximately 90% of the workers in the day shift and 10% in the night shift. Approximately 315 passenger vehicles for the day shift are expected to arrive at the site between 0600 and 0700 hours, with 42 vehicles from the night shift leaving the site between 0700 and 0800 hours. In the afternoon, it is expected that 42 vehicles will arrive for the night shift between 1700 and 1800 hours and 315 vehicles from the day shift will leave the site between 1800 and 1900 hours. The 42 night shift related vehicle trips are expected to travel during the normal AM peak hours between 0700 and 0900 hours the PM peak period between 1600 and 1800 hours. However, since many vehicle trips generated by the day shift will arrive before the AM peak travel period and leave after the PM peak travel period, it is assumed that only 50% (158 vehicle trips) of the 315 vehicle trips generated by that shift will travel during AM and PM peak hours. Commuter workers are expected to generate approximately 200 two-way vehicle trips during both AM and PM peak hours.

Site development in the early months of the project will require removal of cut material to a designated spoil site. While this may include up to 160 trucks loads a day for several months, the spoil site with probably be close to the construction site. Since trucks are not expected to travel far on Route 316, and are not expected to be hauling during AM and PM peak hours, truck traffic from site development is not expected to have any significant impact on level of performance on the site access route roads.

Approximately ten semi-trailers trucks are expected to arrive at the site each morning and will leave the site throughout the day. Since many of the trucks are expected to arrive during early morning hours and will leave early in the afternoon, only five truck trips are expected to be included in the AM and PM peak hours. Combined commuter worker and delivery truck trips will include approximately 205 two-way vehicle trips during both AM and PM peak hours.

Construction Phase Trip Distribution

Delivery trucks are expected to use the Trunk 7 – Route 276 – Route 316 access route between Highway 104 and Goldboro. After a review of the local road network and locations of communities in the Guysborough – Antigonish area, the following trip distribution has been assumed for construction commuter employee trips:

- 30% - south on Route 316 towards Canso and Guysborough areas;
- 10% - Isaac’s Harbour area;
- 10% - Country Harbour Ferry to areas around Sherbrooke;
- 10% - connecting roads at Cross Road Country Harbour;
- 10% - connecting roads in the Goshen area; and
- 30% - Antigonish area.

Construction Phase Trip Impacts

Daily construction vehicle trips of 200 passenger vehicles and five semi-trailer arriving at the site during the AM peak hour and leaving during the PM peak hour, distributed to access route road sections, have been added to projected 2017 background DHVs (Table 3) to provide estimated 2017 DHVs that include site generated construction trips which are shown in Table 5.

Table 5 – Estimated 2017 Two-Way Design Hourly Volumes (DHVs) during Construction Phase						
Location	Background 2017 DHVs¹		Construction Phase Vehicle Trips³		Estimated 2017 DHVs with Construction Trips⁴	
	AM	PM	AM	PM	AM	PM
Trunk 7 – 1.0 km South of Highway 104	390	480	65	65	455	545
Trunk 7 – 1.0 km South of Salt Springs	235	240	65	65	300	305
Route 276 – Halfway Trunk 7 and Route 316	60	65	65	65	125	130
Route 316 – 1.0 km South of Route 276	55	70	85	85	140	155
Route 316 – 1.5 km north of Isaac’s Harbour	40	70	105	105	145	175
Route 316 – Goldboro Area north of the Site	40 ²	70 ²	145	145	185	215
Route 316 – South of the Site	40 ²	70 ²	60	60	100	130

NOTES: 1. Projected background 2017 Design Hourly Volumes (DHVs) are taken from Table 3.
 2. Since recent counts are not available for these road sections, projected 2017 DHVs have been assumed to be the same as those in the section north of Isaac’s Harbour.
 3. Construction trips have been distributed to access route road sections in accordance with the trips distributions included above.
 4. These are the estimated 2017 DHVs that include vehicle trips generated by the construction phase.

Since construction vehicle trips are moderate and projected 2017 DHVs on the access route road sections are low to moderate, it is expected that the access route road sections will provide satisfactory performance while accommodating construction site generated trips.

Operational Phase Trip Generation, Trip Distribution and Traffic Impacts

Since the operational phase is expected to start approximately mid-2019, operational phase traffic impacts have been estimated for 2024, five years after completion of the construction phase.

The operational phase which is expected to begin during mid-2019 will be fully manned 24 hours per day, 365 days per year. The operation will use two 12 hour shifts (0600-1800 hours and 1800-0600 hours) covered by three shift teams working six days on and three days off. On-site workers will include 22 workers for each of the three shifts, so that 22 workers will arrive and depart at the 0600 and 1800 hours shift changes. There will also be 67 daily personnel working 0800-1630 hours, Monday to Friday.

It is assumed that shift workers will each travel to and from the site with only the driver in the vehicle. Therefore, it is expected that 22 vehicles will arrive at the site within the half-hour before each shift change and 22 vehicles will leave the site within the half-hour after each shift change. Since shift change vehicle trips are low, and the 0600 hours shift change is much earlier than the normal AM peak hour traffic flow between 0700 and 0900 hours, and the 1800 hours shift change is towards the end of the normal PM peak period between 1600 and 1800 hours, vehicle trips generated by operation workers at shift changes are not expected to have any significant impact on the level of operation of site access roads.

It is assumed that daily workers have some limited ride-sharing with perhaps 1.25 persons per vehicle, so that the 67 daily workers are expected to generate approximately 55 trips arriving at the site before 0800 hours and leaving after 1630 hours. While permanent employees may have a greater tendency than construction workers to live reasonably close to the site, operational employee trips have been distributed throughout the Guysborough – Antigonish areas in the same manner as was used for the commuter construction employee trips.

Daily personnel work trips of 55 vehicle trips arriving at the site before 0800 hours and leaving after 1630 hours, distributed to access route road sections, have been added to projected 2024 background DHVs (Table 4) to provide estimated 2024 DHVs that include site generated operational trips which are shown in Table 6.

Since operational personnel trips are low and projected 2024 DHVs on the access route road sections are low to moderate, it is expected that the access route road sections will provide satisfactory performance while accommodating operational site generated trips.

Location	Background 2024 DHVs ¹		Operational Phase Vehicle Trips ³		Estimated 2024 DHVs with Operational Trips ⁴	
	AM	PM	AM	PM	AM	PM
Trunk 7 – 1.0 km South of Highway 104	430	530	17	17	447	547
Trunk 7 – 1.0 km South of Salt Springs	260	265	17	17	277	282
Route 276 – Halfway Trunk 7 and Route 316	65	70	17	17	82	87
Route 316 – 1.0 km South of Route 276	60	75	22	22	82	97
Route 316 – 1.5 km north of Isaac's Harbour	45	75	28	28	73	103
Route 316 – Goldboro Area north of the Site	45 ²	75 ²	39	39	84	114
Route 316 – South of the Site	45 ²	75 ²	17	17	62	92

NOTES: 1. Projected background 2024 Design Hourly Volumes (DHVs) are taken from Table 3.
2. Since recent counts are not available for these road sections, projected 2024 DHVs have been assumed to be the same as those in the section north of Isaac's Harbour.
3. Operational trips have been distributed to access route road sections in accordance with the trip distributions included above.
4. These are the estimated 2024 DHVs that include vehicle trips generated by the operational phase.

Summary Traffic Impact Review of Site Access Roadways

1. Existing 2013 background Design Hourly Volumes (DHVs) on Trunk 7 are considered to be low to moderate for a primary trunk highway, and volumes on Routes 276 and 316 are very low for a normal collector road. Review of recent traffic count data indicates that while volumes have generally reduced since the *Traffic Impact Study, Keltic Petrochemical Inc. and Maple LNG Liquefied Natural Gas Facilities* (December 2007) was completed, an annual traffic volume growth rate of 1.5% is still considered to be appropriate to project future background DHVs.

2. Since site construction is expected to take from 2015 to 2019, construction phase traffic impacts have been estimated for 2017 and operational phase impacts have been considered for 2024, five years after the beginning of the operational phase.

3. Information provided by *CB&I Oil and Gas* indicate that approximately 3500 workers will be employed on the site during peak construction periods. While the majority of the workforce will be housed at a construction camp near the site, commuter workers are expected to generate approximately 200 two-way vehicle trips during both AM and PM peak hours. With addition of approximately five semi-trailer trucks, combined commuter worker and delivery truck trips will include approximately 205 two-way vehicle trips during both AM and PM peak hours during the construction phase of the project.

4. Daily operational phase personnel work trips are expected to include 55 vehicle trips arriving at the site before 0800 hours and leaving after 1630 hours during the operational phase in 2024.

Conclusions Traffic Impact Review of Site Access Roadways

1. Since construction vehicle trips are moderate and projected 2017 DHVs on the access route road sections are very low to moderate, it is expected that the access route road sections will provide satisfactory performance while accommodating construction phase site generated trips.
2. Since operational personnel trips are low and projected 2024 DHVs on the access route road sections are very low to moderate, it is expected that the access route road sections will provide satisfactory performance while accommodating operational phase site generated trips.