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MEMORANDUM

To: Maine DOT

From: Moffatt & Nichol

Date: 4/19/2024

Subject: Sears Island Vehicle Analysis

MN Project No: 211914

Introduction and Assumptions

This document summarizes the findings of an analysis of the vehicles travelling to the proposed offshore wind port located on Sears Island in Searsport Maine. Both trucks and cars were included in this feasibility study. Due to the lack of historical floating offshore wind projects at a commercial size, two scenarios for the vehicle analysis were considered, based on concrete floating foundation assembly time. Scenario one considers the assembly of a foundation to take one week, while scenario two considers an assembly time of two weeks. The findings of these scenarios are preliminary, and both are based on the assumptions below.

- Representative vehicles used, with the weights and payloads of trucks based on general, publicly available, information.
- Volumes and weights of materials for the 20 MW rated concrete foundations provided by Diamond Offshore Wind.
- Port working 7 days a week, 8-hour days.
- Truck deliveries during delivery periods happen only 4 days a week.
- A full-scale project was assumed to consist of 50 floating foundations.
- The installation season per year was assumed to be 44 weeks, or about 10 months.
- Truck delivery was limited to the installation seasons.
- During the 8-week period outside installation season per year, workers would still be active at the port 7 days a week.
- Based on historical project knowledge in Maine provided by Maine DOT, fine and coarse aggregate would be supplied from North of the port location and all other materials would be supplied from South of the port.
- The water main connected to Sears Island would be considered adequate to supply the terminal's water needs.
- 500 cars for worker transport and miscellaneous activities per day.
- Gross vehicle weight was limited to 100,000 lbs in accordance with Maine transportation laws.
- Adequate space for truck activities and parking on site was assumed.
- This study accounts for the number of vehicles coming to the port, not number of trips.

Materials for one 20 MW Foundation		Truck Type	Est. Curb Weight (lbs)
Cement (CY)	1616	20 cbm Dry Bulk Tanker Trailer	34,000
Fine Aggregate (CY)	3052	20 cbm Tipper Truck	27,000
Coarse Aggregate (CY)	4702	20 cbm Tipper Truck	27,000

Water (CY)	1513	N/A	N/A
Admixtures (CY)	661	6,000-gallon Water Truck	27,000
Rebar (MT)	1481	53' Flatbed Trailer with Semi Cab	35,000
Post-tensioning (MT)	302	53' Flatbed Trailer with Semi Cab	35,000
Grout (CY)	5	53' Trailer with Semi Cab	35,500
Steel struts (MT)	338	53' Flatbed Trailer with Semi Cab	35,000
Secondary Steel (MT)	75	53' Flatbed Trailer with Semi Cab	35,000

Results

Based on the volumes and weights of the materials for 50 concrete foundations, the total number of trucks needed over an entire project, regardless of foundation assembly time, was 22,602. With prior knowledge from Maine DOT on projects within Maine and specifically Searsport, the fine and coarse aggregate used for making concrete was assumed to come from locations north of Sears Island. All other materials, including cement and rebar, would come from locations south of Sears Island. The percentage of trucks coming from both directions is shown below. These percentages can also be assumed as the average daily percentage of trucks coming from the north and south direction during delivery days in the port.

- Percentage of trucks coming from north of Sears Island: 65.6%
- Percentage of trucks coming from south of Sears Island: 34.4%

For the purpose of this study, the use of alternate delivery methods, such as barges was not considered. Using barges for the delivery of some or all the materials would reduce truck delivery over the duration of the project. Additional information on port efficiency would need to be known to accurately estimate the effect delivery by barge, would have on truck delivery numbers and schedule. Based on the plans of the current proposed offshore wind port, a rail line has not been considered. The addition of a rail line could potentially reduce the number of trucks needed for delivery of materials to the port. A separate analysis on the impacts of a rail line on the terminal logistics and efficiency has not been conducted.

Scenario 1

Floating concrete foundation assembly time considered as one week.

With a foundation assembly time of 1 week and project size of 50 turbines, two separate installation seasons would be required. An initial installation season lasting 44 weeks, and a second lasting 6 weeks after the 8-week no delivery period. Total project duration would therefore be 58 weeks.
For the 58-week project duration, with the assumption of 500 cars per day, 7 days a week; the total number of cars, vehicles, and percentage of trucks is shown below:

- Number of cars over the 58-week project period: 203,000.
- Total number of vehicles over project duration: 225,602.
- Percentage of trucks over project duration: 10%.

Based on the assumption of an install period of 44 weeks per year, the cumulative installation season duration was calculated to be a 50 weeks over the 58-week project. During installation season: truck deliveries happen

4 days a week, with cars coming 7 days a week. Truck deliveries were assumed to only happen during these install periods. The statistics for the cumulative installation season are shown below:

- Number of trucks (same as total amount): 22,602.
- Number of cars: 175,000.
- Total number of vehicles over cumulative installation season: 197,602.
- Percentage of trucks over cumulative installation season: 11.4%

Below are the statistics of an average delivery day during installation season:

- Number of trucks per delivery day: 113.01
- Number of trucks from North: 74.11
- Number of trucks from South: 38.90
- Trucks per hour (8-hour delivery day): 14.13
- Number of cars: 500
- Number of vehicles: 613.01
- Percentage of trucks during a delivery day: 18.4%

For scenario 1, only one, 8-week no delivery period was required, bringing the cumulative no delivery period duration to be 8-weeks. The following statistics are from this period.

- Number of trucks: 0.
- Number of cars: 28,000.
- Total number of vehicles over the no delivery period: 28,000.
- Daily number of cars over the no delivery period: 500.
- Percentage of trucks over the no delivery period: 0%.

Scenario 2

Floating concrete foundation assembly time considered as two weeks.

With a foundation assembly time of 2 weeks and project size of 50 turbines, three separate installation seasons would be required. An initial installation season lasting 44 weeks, a second lasting 44 weeks, and a third lasting 12 weeks, with two, 8-week no delivery periods. Total project duration would therefore be 116 weeks.
For the 116-week project duration, with the assumption of 500 cars per day, 7 days a week; the total number of cars, vehicles, and percentage of trucks is shown below:

- Number of cars over the 116-week project period: 406,000.
- Total number of vehicles over project duration: 428,602.
- Percentage of trucks over project duration: 10%.

Based on the assumption of an install period of 44 weeks per year, the cumulative installation season duration was calculated to be 100 weeks over the 116-week project. During installation season: truck deliveries happen 4 days a week, with cars coming 7 days a week. Truck deliveries were assumed to only happen during these install periods. The statistics for the cumulative installation season are shown below:

- Number of trucks (same as total amount): 22,602.
- Number of cars: 350,000.
- Total number of vehicles over cumulative installation season: 372,602.
- Percentage of trucks over cumulative installation season: 6.1%

Below are the statistics of an average delivery day during installation season:

- Number of trucks per delivery day: 56.51
- Number of trucks from North: 37.06
- Number of trucks from South: 19.45
- Trucks per hour (8-hour delivery day): 7.06

- Number of cars: 500
- Number of vehicles: 556.51
- Percentage of trucks during a delivery day: 10.2%

For scenario 2, two, 8-week no delivery periods were required, bringing the cumulative duration to be 16-weeks. The following statistics are from this period.

- Number of trucks: 0.
- Number of cars: 56,000.
- Total number of vehicles over the cumulative no delivery period: 56,000.
- Daily number of cars over the cumulative no delivery period: 500.
- Percentage of trucks over the cumulative no delivery period: 0%.

State of Maine
Department of Transportation
MEMORANDUM

To: Nathaniel Benoit Date: June, 2023

From: Kara Aguilar, Manager - Mobility Engineering & Analysis

Subject: Searsport Offshore Wind Facility WIN 025645.00

The following document provides a review of the mobility analysis conducted for the Offshore Wind facility proposed for construction at either Mack Point or Sears Island for WIN 025645.00. The analysis shows that Station Ave and Sears Island Road could operate at acceptable levels of service with no or minimal intersection changes (such as the addition of short turn lanes) for a fully functioning facility employing up to 400 employees. The Trundy Road intersection would operate at an acceptable level of service under reduced facility capacity or with a traffic signal for a full-capacity facility. An alternative option of utilizing both Trundy Road and Station Ave for a full-capacity facility would alleviate mobility issues without requiring turn lanes or signalization.

The proposed Offshore Wind facility is a new facility that will employ up to 400 people and is planned to be located either at Mack Point or Sears Island in Searsport, Maine. Mobility Engineering and Analysis (ME&A) was asked to assess the mobility impacts for entrances at both locations, including facility entrances at either Trundy Road or Station Ave for the Mack Point facility location, or Sears Island Road for the Sears Island location. ME&A staff assessed the facility operating at full capacity (400 employees) as well as half capacity (200 employees). The operations plan for the facility does not yet exist. Due to this limitation, ME&A assessed a worst-case scenario, assuming that all employee arrivals and departures would correspond to the peak AM and PM travel hours on Route 1. These hours correspond to 11 AM and 4 PM, respectively.

The Average Annual Daily Traffic (AADT) along this stretch of Route 1 ranges from 11,195 south of Trundy Road to 10,023 north of Sears Island Road. Trundy Road has an AADT of 658, Station Ave of 530, and Sears Island Road of 47.

The analysis was conducting using 2022 turning movements developed from StreetLight data. This data was calibrated using MaineDOT 2022 factored AADTs. 2010 turning movement counts were also available at the Trundy Road and Station Ave intersections; however, the 2010 counts are considered obsolete for this analysis.

A delay and Level of Service (LOS) analysis was conducted using Synchro 11 and SimTraffic for each entrance location. Both the existing (no-build) conditions and proposed entrance conditions were modeled and simulated. All scenarios were assessed for both the AM and PM peak hours.

Trundy Road

Table 1 shows the analysis results for the Trundy Road entrance location. The 2022 baseline condition was assessed, as well as four alternatives: (1) existing lane configurations with a full-capacity facility, (2) a full-capacity facility with added turn lanes, (3) a half-capacity facility, and (4) a full-capacity facility with a traffic signal. For this location, Route 1 runs NE/SW, and Trundy Road runs NB/SB.

Baseline
With 2022 volumes and existing lane configurations, the Trundy Road intersection operates at LOS A for all approaches, with delays of under 10 seconds per vehicle.

Full Capacity Facility
A full 400-employee facility was assessed, assuming a 50-50 split in turning traffic entering and leaving the facility, with no changes to the existing lane configurations. In the AM peak hour, delays are increased slightly, resulting in LOS C due to increase left turning traffic of the southwest approach. In the PM peak hour, the Trundy Road approach operates at LOS F of with delays of over 200 seconds per vehicle due to the high turning volumes leaving the facility.

Full Capacity Facility with Turn Lanes
Due to the LOS F leaving the facility in the PM peak hour, turn lanes were considered to help alleviate delays on each of the approaches. Adding the turn lanes on Route 1 improves the LOS C on the southwest approach to LOS A in the AM peak hour by removing turning traffic from the thruway. Although adding separate turn lanes on Trundy Road improves delay from over 200 seconds per vehicle to 67 seconds per vehicle, the approach remains LOS F. Figure 1 shows the proposed turn lane configuration.

Figure 1. Proposed turn lane configuration for Trundy Road

Half Capacity Facility
The intersection was analyzed assuming the facility would operate at half capacity, with only 200 vehicles entering and exiting during peak hours. This results in LOS A on both Route 1 approaches and LOS B in the AM peak hour (11 seconds of delay per vehicle) and LOS C in the PM peak hour (15 seconds of delay per vehicle) on Trundy Road.

Full Capacity Facility – Traffic Signal
To address the LOS F on the Trundy Road approach during the PM peak hour, a traffic signal was considered. Adding a traffic signal resulted in LOS B or better for all approaches in both peak hours. This option should be considered further if the Trundy Road intersection is the preferred entrance and the facility be proposed to operate at full capacity on a regular basis.

Table 1. Trundy Road LOS and delay results

Node	Direction		Alternative									
			Baseline		With Facility		Turning Lanes		Reduced Volumes		Signalized	
			AM Baseline	PM Baseline	AM Trundy	PM Trundy	AM Trundy TLs	PM Trundy TLs	AM Trundy TLs (200)	PM Trundy TLs (200)	AM Trundy Signalized	PM Trundy Signalized
Entire System		Entering Volume	874	1106	1276	1503	1276	1509	1063	1292	1276	1509
		Vehicles Denied Entry	0	0	0	7	0	0	0	0	0	0
		Total Del/Veh (s)	8.7	10.1	15.8	71.3	11.2	28.3	9.6	12.0	16.0	18.6
		Travel Distance (mi)	1291	1624	1703	1999	1702	2031	1486	1808	1702	2035
		Travel Time (hr)	36	45	53	85	51	66	43	51	53	62
		Total Delay (hr)	2.2	3.2	5.8	31.0	4.1	12.3	3.0	4.5	5.9	8.1
5: E Main St & Trundy Ave Performance by approach		Intersection Type	unsig.	unsig.	unsig.	unsig.	unsig.	unsig.	unsig.	unsig.	sig.	sig.
	NB	Total Del/Veh (s)	5.6	7.9	14.7	225.9	12.0	67.1	11.1	15.1	8.2	11.2
	NE	Total Del/Veh (s)	0.4	0.7	2.7	1.4	2.0	1.5	1.2	1.0	5.2	8.6
	SW	Total Del/Veh (s)	4.1	4.1	15.5	4.4	7.7	4.2	5.4	4.0	12.9	10.5
	NB	Approach LOS	A	A	B	F	B	F	B	C	A	B
	NE	Approach LOS	A	A	A	A	A	A	A	A	A	A
	SW	Approach LOS	A	A	C	A	A	A	A	A	B	B
	All	Total Del/Veh (s)	2.4	2.2	9.4	66.5	5.0	21.2	3.5	4.4	9.2	9.9
		Overall Intersection LOS	A	A	A	F	A	C	A	A	A	A

Station Ave

Table 2 shows the analysis results for the Station Ave entrance location. The 2022 baseline condition was assessed, as well as three alternatives: (1) existing lane configurations with a full-capacity facility, (2) a full-capacity facility with added turn lanes, and (3) a half-capacity facility. For this location, Route 1 runs NE/SW and Station Ave runs NW/SE.

Baseline
With 2022 volumes and existing lane configurations, the Station Ave intersection operates at LOS A for all approaches.

Full Capacity Facility
A full 400-employee facility was assessed, assuming a 50-50 split in turning traffic entering and leaving the facility, and no changes to the existing lane configurations. In both peak hours, delays on Route 1 operate at LOS B or better. In the AM peak hour, Station Ave operates at LOS D with delays of approximately 27 seconds per vehicle, and in the PM peak hour, Station Ave operates at LOS F with delays of 70 seconds per vehicle.

Full Capacity Facility with Turn Lanes
Adding turn lanes for the Station Ave location results in LOS A on Route 1 in both peak hours. The Station Ave approach improves from LOS D to LOS B in the AM peak hour, and from LOS F to LOS C in the PM peak hour. Figure 2 shows the proposed turn lane configuration.

Figure 2. Proposed turn lane configuration for Station Ave

Half Capacity Facility

The intersection was analyzed assuming the facility would operate at half-capacity, with only 200 vehicles entering and exiting during peak hours. This results in LOS A for all approaches in both peak hours.

Table 2. Station Ave LOS and delay results

Node	Direction		Alternative							
			Baseline		With Facility		Turning Lanes		Reduced Volumes	
			AM Baseline	PM Baseline	AM Station	PM Station	AM Station TLs	PM Station TLs	AM Station TLs (200)	PM Station TLs (200)
Entire System		Entering Volume	874	1106	1265	1498	1265	1498	1048	1308
		Vehicles Denied Entry	0	0	0	0	0	0	0	0
		Total Del/Veh (s)	8.7	10.1	13.9	28.0	10.0	13.5	8.9	11.0
		Travel Distance (mi)	1291	1624	1700	2024	1699	2027	1478	1832
		Travel Time (hr)	36	45	52	65	50	59	42	52
		Total Delay (hr)	2.2	3.2	5.1	12.0	3.7	5.8	2.7	4.1
2: E Main St & Station Ave Performance by approach		Intersection Type	unsig.	unsig.	unsig.	unsig.	unsig.	unsig.	unsig.	unsig.
	NE	Total Del/Veh (s)	1.8	2.8	4.3	3.4	3.4	3.2	2.5	2.9
	NW	Total Del/Veh (s)	4.9	7.2	26.8	70.1	13.9	15.1	8.7	9.9
	SW	Total Del/Veh (s)	4.5	4.8	14.0	5.2	7.9	5.0	5.8	4.6
	NE	Approach LOS	A	A	A	A	A	A	A	A
	NW	Approach LOS	A	A	D	F	B	C	A	A
	SW	Approach LOS	A	A	B	A	A	A	A	A
	All	Total Del/Veh (s)	3.2	3.7	9.5	22.5	5.8	7.0	4.3	4.6
		Overall Intersection LOS	A	A	A	C	A	A	A	A

Sears Island Road

Table 3 shows the analysis results for the Sears Island Road entrance location. The 2022 baseline condition was assessed, as well as three alternatives: (1) existing lane configurations with a full-capacity facility, (2) a full-capacity facility with added turn lanes, and (3) a half-capacity facility. For this location, Route 1 runs EB/WB and Sears Island Road runs NW/SE.

Baseline
With 2022 volumes and existing lane configurations, the Sears Island Road intersection operates at LOS A for all approaches.

Full Capacity Facility
A full, 400-employee facility was assessed, assuming a 50-50 split in turning traffic entering and leaving the facility, and no changes to the existing lane configurations. In both peak hours, delays on Route 1 operate at LOS B or better. In the AM peak hour, Sears Island Road operates at LOS C with delays of approximately 23 seconds per vehicle, and in the PM peak hour Sears Island Road operates at LOS F with delays of 95 seconds per vehicle.

Full Capacity Facility with Turn Lanes
Adding turn lanes for the Sears Island Road location results in LOS A on Route 1 in both peak hours. The Sears Island Road approach improves from LOS C to LOS A in the AM peak hour and from LOS F to LOS C in the PM peak hour. Figure 3 shows the proposed turn lane configuration.

Figure 3. Proposed turn lane configuration for Sears Island Road

Half Capacity Facility
The intersection was analyzed assuming the facility would operate at half-capacity, with only 200 vehicles entering and exiting during peak hours. This results in LOS A for all approaches in the AM peak hour, and LOS A for all approaches in the PM peak hour, except the Sears Island Road approach which operates at LOS B.

Table 3. Sears Island Road LOS and delay results

Node	Direction		Alternative							
			Baseline		With Facility		Turning Lanes		Reduced Volumes	
			AM Baseline	PM Baseline	AM Sears Island	PM Sears Island	AM Sears Island TLs	PM Sears Island TLs	AM Sears Island TLs (200)	PM Sears Island TLs (200)
Entire System		Entering Volume	874	1106	1283	1484	1283	1484	1079	1292
		Vehicles Denied Entry	0	0	0	0	0	0	0	0
		Total Del/Veh (s)	8.7	10.1	14.9	36.0	10.7	15.8	9.2	11.7
		Travel Distance (mi)	1291	1624	1797	2087	1796	2092	1543	1854
		Travel Time (hr)	36	45	52	70	51	62	43	53
		Total Delay (hr)	2.2	3.2	5.5	15.4	4.0	6.7	2.9	4.3
7: Sears Island Rd & E Main St Performance by approach		Intersection Type	unsig.	unsig.	unsig.	unsig.	unsig.	unsig.	unsig.	unsig.
	EB	Total Del/Veh (s)	3.7	5.1	7.5	6.4	6.4	6.2	5.1	5.5
	WB	Total Del/Veh (s)	1.4	1.4	11.0	2.3	4.6	2.1	2.5	1.8
	NW	Total Del/Veh (s)	5.2	5.7	22.8	95.1	9.8	20.5	6.0	10.5
	EB	Approach LOS	A	A	A	A	A	A	A	A
	WB	Approach LOS	A	A	B	A	A	A	A	A
	NW	Approach LOS	A	A	C	F	A	C	A	B
	All	Total Del/Veh (s)	2.6	3.6	9.4	31.6	5.6	9.2	3.9	5.0
		Overall Intersection LOS	A	A	A	D	A	A	A	A

Two Entrances

ME&A also assessed an alternative condition of two entrances for the facility if it were to reside at Mack Point. This alternative includes utilizing both Trundy Road and Station Ave for a full-capacity facility with no changes in existing lane configurations. The results for this analysis are shown in Table 4. In the AM peak hour, all approaches at both Trundy Road and Station Ave operate at LOS B or better. In the PM peak hour, the approaches leaving the facility (Trundy Road and Station Ave) operate at LOS C, and Route 1 approaches operate at LOS A.

Table 4. Two entrance (Trundy Road and Station Ave) LOS and delay results

Node	Direction		AM Two Entrances	PM Two Entrances
Entire System		Entering Volume	1278	1496
		Vehicles Denied Entry	0	0
		Total Del/Veh (s)	11.9	14.7
		Travel Distance (mi)	1662	2030
		Travel Time (hr)	50	60
		Total Delay (hr)	4.4	6.4
5: E Main St & Trundy Ave Performance by approach		Intersection Type	unsig.	unsig.
	NB	Total Del/Veh (s)	10.3	21.0
	NE	Total Del/Veh (s)	2.2	1.1
	SW	Total Del/Veh (s)	6.1	4.0
	NB	Approach LOS	B	C
	NE	Approach LOS	A	A
	SW	Approach LOS	A	A
	All	Total Del/Veh (s)	4.0	5.4
		Overall Intersection LOS	A	A
2: E Main St & Station Ave Performance by approach		Intersection Type	unsig.	unsig.
	NE	Total Del/Veh (s)	3.1	3.3
	NW	Total Del/Veh (s)	9.1	16.7
	SW	Total Del/Veh (s)	9.2	4.6
	NE	Approach LOS	A	A
	NW	Approach LOS	A	C
	SW	Approach LOS	A	A
	All	Total Del/Veh (s)	6.7	5.8
		Overall Intersection LOS	A	A