Astoria Station

Appendix F: Traffic and Transportation Technical Report



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Traffic and Transportation Technical Report

Astoria Station Project

Otter Tail Power Company June 30, 2017



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1.0 General Information

This technical assessment of the transportation infrastructure is being provided as general guidance as Otter Tail Power Company explores the development of an approximately 250 MW power facility east of Toronto, SD and northwest of Astoria, SD. The project is known as the Astoria Station Project. The site is located 3.5 miles east of Toronto, SD along State Highway 28 and approximately ½ mile north on 482nd Avenue. The Astoria Project site is in the Northeast Quarter of Section 22, T113N, R48W.

2.0 Existing Conditions

2.1 Traffic Volumes

Deuel County is rural in nature and supports the communities of Toronto, Clear Lake, Brandt, and Astoria which are in close proximity to this project site. The most prevalent state, county, or local roads that serve the traffic between these communities are as follows:

Table 2-1. Average Daily Traffic Volumes

Route	Daily Traffic (Yr.)	% Trucks
Interstate 29 South of Toronto Exit 150	7560 (2016)	21%
Interstate 29 North of Toronto Exit 150	7424 (2016)	21%
SD Highway 28 east of SD Highway 15	492 (2016)	35%
SD Highway 28 west of SD 15	1910 (2016)	6%
SD Highway 15	1289 (2016)	20%
479th Avenue / CR 315 north of SD 28	148 (2013)	20% to 30%
483 rd Avenue / CR 311 north of SD 28	227 (2013)	20% to 30%
CR 317 south of SD 28	594 (2013)	20% to 30%
CR 314 east of SD 15	262 (2015)	20% to 30%

Source: Deuel County Highway Department and SDDOT Office of Traffic Inventory



General observation of these corridors indicate that traffic operates in a free flow manner. Based on the recorded volumes, only a small portion of the capacity that is available for I29, SD 28, and SD 15 is being used. In general, the SDDOT uses the term Level of Service (LOS) to define how congested or how much delay is being encountered on a corridor. SDDOT typically designs facilities to LOS "C" or better. In terms of daily traffic, I29 under its current typical section, could handle 40,000 ADT and still operate at LOS C. State highways SD 15 & SD 28 could handle 8,000 ADT with limited congestion. Based on this assessment, capacity levels are not a concern when reviewing how the proposed project would impact the adjacent state facilities. In regards to the county and township facilities, traffic volumes are low in nature. Typically roadways that have volumes of under 200 vehicles per day are gravel and roadways with an ADT between 200 and 1000 have varied surfaces. In this case, County Road 311, 315 and 317 are hard surfaced. The only gravel roadways that may be utilized for either construction traffic or traffic using the site after construction are 482nd Avenue or 193rd Street. Additional discussion regarding those facilities will be addressed later in this technical assessment.

2.2 Pavement Types and Structures

This section of the technical assessment will provide an overview of the major roadways that exist within the study area.

2.2.1 Interstate 29

Interstate 29 within the study area is four-lane divided roadway with 12 foot lanes. Approximately 8 miles of I29 are included in the study area from mile marker (MRM) 147 to MRM 155. The surface of I29 is concrete for the driving lanes and has asphalt shoulders from 4 - 8 feet in width. The oldest section of I29 in this area was constructed in 2005 with some of the surfacing being as new as 2013. Surfacing conditions appear to be in good shape. SDDOT has identified needed maintenance on a periodic basis based on historic trends and yearly visual observations.

The following bridges/structures are located on I29 within the project area and are in good to excellent condition:

Structure Number	MRM	ADT	Sufficiency Rating
06184010	147.80	3780	97.8
06185010	147.80	3780	97.8
20064288	150.06	7560	82.6
20060271	151.85	3745	97.8
20061271	151.85	3745	97.8
20049248	154.50	3745	85.8
20050248	154.50	3745	95.8

Table 2-2. I29 Structures in the Project Area

Source: SDDOT Bridge Office



2.2.2 South Dakota Hwy 28

South Dakota Hwy 28 within the study area is a two lane asphalt typical section. Approximately 15 miles of SD Hwy 28 exists within the project area. The section of SD Hwy 28 between I29 and SD Hwy 15 was improved in 2010 while the section east of SD Hwy 15 was reconstructed in 2002. The shoulders along this corridor range from 1 - 4 feet in width. Improvements are identified in 2021 for the section of SD Hwy 28 east of SD Hwy 15. The recommended improvements at this time are for an asphalt concrete overlay. Additional improvements for maintenance are also in the future plans for this corridor. In general, the roadway surfacing is in good to fair shape and improvements are identified in the future years to mitigate any surfacing concerns.

The following bridges/structures are located on SD Hwy 28 within the project area and are in good condition:

Structure Number	MRM	ADT	Sufficiency Rating
20061280	361.61	1910	83.9
20086280	364.22	1910	82.3
20096280	365.16	1910	82.3
20201280	375.67	478	79.9

Table 2-3. SD Hwy 28 Structures in the Project Area

Source: SDDOT Bridge Office

2.2.3 South Dakota Hwy 15

South Dakota Hwy 15 within the study area is a two lane asphalt typical section. The section of SD Hwy 15 north of SD Hwy 28 was improved in 2010. Approximately 10 miles of SD Hwy 15 are located within the project area. The shoulders along this corridor range from 1 - 2 feet in width. Improvements are identified in 2025 for the section of SD Hwy 15 north of SD Hwy 28. The recommended improvements at this time are for an asphalt reconditioning. Additional improvements for maintenance are also in the future plans for this corridor. In general, the roadway surfacing is in good shape and improvements are identified in the future years to mitigate any surfacing concerns.

This segment of SD Hwy 15 does not have any structures that exceed 20 feet in length.

2.3 County and Township Roads and Bridges

Local roadways identified below are those that would be likely routes for either a construction or permanent workforce to travel to the project site. These roadways are generally in either Scandinavia or Norden Townships within Deuel County. Deuel County maintains CR 311, CR 314, CR 315, and CR 317 north of the Brookings county line. These roadways generally run between smaller rural cities within the county or between state routes. The county roadways have surface widths of 20 to 26 feet and are asphalt roadways. The township roadways range in width from 14 feet to 18 feet. In general, pavement markings on the county facilities delineate the centerline but edge markings and shoulders were not found consistently on all routes.

The following roadways could be used in facilitating either construction traffic or a permanent workforce at the project site:

Roadway	Jurisdiction	Roadway Surface
CR 311 / CR 42 – From south of Astoria north towards SD Hwy 22	Deuel County / Brookings County	Asphalt Surfacing
CR 314 – SD Hwy 15 east to Minnesota Border	Deuel County	Asphalt Surfacing
CR 315 – Brandt, SD south to SD Hwy 28	Deuel County	Asphalt Surfacing
CR 317 / CR 25 – Toronto, SD south towards White, SD	Deuel County / Brookings County	Asphalt Surfacing
193 rd Street – between CR 311 and CR 315	Scandinavia Township	Gravel Surfacing
481 st Avenue – SD Hwy 28 north to 193 rd Street	Scandinavia Township	Gravel Surfacing
482 nd Avenue – SD Hwy 28 north to 193 rd Street	Scandinavia Township	Gravel Surfacing

Table 2-4. County and Township Roadways

Source: Visual Inspection

It should be noted that several county roadway facilities exist within the project area in Brookings County that were not identified above such as CR 29, 37, 42, etc. Those routes generally do not connect smaller cities directly and would not appear to have additional traffic generated on them due to the other more direct route choices that would be available. If it is determined that any of these routes would experience traffic generated due to construction, coordination with the Brookings County Highway Department is recommended.

The bridges/structures identified below exist on the county road facilities, are 20 feet or more in length and inspected on a bi-annual basis:

Table 2-5. County / Township Structures in the Project Area on the routes identified as being impacted by construction or permanent workforce traffic

Structure Number	Location	ADT	Sufficiency Rating
20-111-220	1.2 miles east of SD Hwy 15 on CR 314	381	62.7
20-156-220	2.6 miles east of Brandt on CR 314 (Cobb Creek)	260	Will be replaced in 2017 with Box Culverts
20-170-235	1.5 miles south of CR 314 on CR 311 (Cobb Creek)	145	79.2
20-170-249	2.99 miles south of CR 314 on CR 311	157	79.2

Source: SDDOT Bridge Office

Note: ADT's were provided based on a 20 year projection for these structures. Actual ADT's are less than shown.

All above bridges are not posted and can accommodate legal limits as established by the County.

It should be noted that county and township roadways do have drainage crossings that are small in nature and do not meet the requirements of a structure that needs to be evaluated on a bi-annual basis. The SDDOT had no inventory for structures in the project area on CR 315 or CR 317. It is recommended prior to starting construction that the smaller culverts that exist on the township roads regardless of the size be inspected for condition and any abnormalities, this applies to culverts on 481st and 482nd Avenues and 193rd Street.

3.0 Construction Impacts

In this section general impacts due to construction will be discussed.

3.1 Traffic Generation and Distribution

With the projected construction, a workforce traveling to the site on a periodic basis will cause some short term traffic increases to the routes within the project area. The workforce is projected to come from several communities in and outside of the project area. Based on the preliminary engineering report, at peak 70 workers will be on site. The following table represents an allocation of jobs to the project site based on community size and trades:

City / Town	Workers	Facilities used to Site
Brookings, SD	47	I29 and SD Hwy 28
Watertown, SD	10	I29 and SD Hwy 28
White, SD	2	CR 317 and SD Hwy 28
Clear Lake, SD	4	SD Hwy 15 and SD Hwy 28
Brandt, SD	1	CR 311, CR 315, and SD Hwy 28
Astoria, SD	1	CR 311 and SD Hwy 28
Sioux Falls, SD	5	I29 and SD Hwy 28
Totals:	70	

Table 3-1. Distribution of Workforce and Routes Used

Source: Known workforce trades common to needs at this site and general assumptions on availability based on proximity to site.

Table 3-2. Roadway Assignment for Workforce

Route	% of Workforce Using Route	One-Way Trip Increases due to Construction Workforce
Interstate 29	89%	62
SD Hwy 28	94% to 100%	66 - 70
SD Hwy 15	6%	4
County Road 311 (represents only CR 311 between 193 rd Street and SD Hwy 28)	100%	70
County Roads 311, 314, 315, 317	6%	4

Source: Assumes best route choice from Community to project site based on facility speeds and access. Since two site access options exist, both CR 311 and SD Hwy 28 indicate 100% of the traffic depending on option acceptance. See discussion in Section 3.3 on Site Access.

> Based on the workforce estimates in the preliminary engineering document for the Astoria site, it is clear that a majority of the generated traffic will likely use the facilities of I29 and SD Hwy 28. Both of these facilities have the ability to serve this additional traffic with little to no impact to the current level of service those facilities provide.

3.2 Equipment and Materials Shipment

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Construction materials and equipment will be shipped and delivered by truck to the site. Shipments trucked will travel on I29 and SD Hwy 28. The final route from SD Hwy 28 will either be on 482nd Avenue or 193rd Street, which are both township gravel roadways.

3.3 Traffic Assignment and Routing

As discussed in section 3.1, it is a high probability that I29 and SD Hwy 28 will be the routes of choice to access this project site prior to using 193rd Street and/or 482nd Avenue.

Due to the route choices available to access this site, very little route signage will be needed. Figures 3.1 and 3.2 illustrate the recommended signing plans for the two site access options being considered. The signing plans were developed to properly route construction traffic to the site while making it apparent to local users of the construction traffic.

As shown in Table 3.2, a majority of the traffic will be using I29 to SD Hwy 28, then SD Hwy 28 east to the project site. A minimum number of the construction workers will be using other county road facilities to get to the project site. Both I29 and SD Hwy 28 meet all roadway design standards to support this minor growth in traffic during construction.

The project site is located off of 482nd Avenue which is a township roadway. Due to surface water runoff and wet conditions being typical along this corridor between SD Hwy 28 and the site driveway along 482nd Avenue, two site access options are being considered for further evaluation as shown in Figures 3.1 and 3.2. From a traffic and capacity standpoint it does appear either option would be acceptable. A key factor in selecting the final route for traffic routing will likely be the potentially required road improvements based on future geotechnical and drainage assessments. The text below discusses the site access options.



SITE ACCESS OPTION 1



PATH: \\MSPE-GIS-FILE\GISPROJOTTERTAIL\100514177.2_WORK_IN_PROGRESS\MAP_DOCS\DRAFT\TRANSPORTATION\OTP_11X17_SIGNCONSTRUCTIONIMP_OPT2.MXD - USER: DSCHMIDT - DATE: 6/28/2017

- Site Access Option 1 Recommendations:
 - Widen the north approach to the 482nd Avenue and SD Hwy 28 intersection to receive truck traffic and prepare for additional traffic growth. Widening the roadway surface to 20 feet for a minimum of 300 feet will allow larger trucks to navigate the intersection and prepare that approach leg for the additional traffic that it will experience.
 - Improve drainage structure and complete vertical grade raise for approximately 500 to 700 feet to protect roadway from overtopping and preventing access to the site. The location of this grade raise is roughly 1500 feet north of SD Hwy 28.
 - For the period during construction, it is recommended that truck entering/crossing signs be placed 200 feet either side of the project site driveway to alert other construction workforce traffic and local traffic of the increase in truck traffic.
- Site Access Option 2 Recommendations:
 - Widen the west approach to the 193rd Street and CR 311 intersection to receive truck traffic and prepare for additional traffic growth.
 Widening the roadway surface to 20 feet for a minimum of 300 feet will allow larger trucks to navigate the intersection and prepare that approach leg for the additional traffic that it will experience.
 - At the 193rd Street and 482nd Avenue intersection widen the east approach and south approach to a minimum of 20 feet in width for 300 feet to prepare for the additional traffic and to allow truck turning movements that would be difficult under the current typical section.
 - Since this intersection will experience a significant amount more traffic for an interim period yield signs should be considered on the south and north approach on 482nd Avenue. This will better alert local traffic that there has been a change in conditions.
 - For the period during construction, it is recommended that truck entering/crossing signs be placed 200 feet either side of the project site driveway to alert other construction workforce traffic and local traffic of the increase in truck traffic
- Recommendations/Considerations with either option
 - Develop a dust control maintenance plan likely utilizing a chloride dust control agent on 482nd Avenue and/or 193rd Street.

- Besides those signs shown on Figure 3.1 and 3.2 for construction purposes, additional regulatory signs do not appear to be warranted. See additional discussion under Section 3.5.
- Develop an agreement with the township for maintenance during construction. The agreement should include how the roadway surface will be maintained in wet and dry conditions and how dust is required to be controlled during construction. This agreement should also clarify the townships role in snow maintenance during the winter months.
- It is further recommended that a geotechnical engineer complete an assessment of the gravel depth and structural ability of 482nd Avenue and 193rd Street. This will ultimately help determine which the most feasible route choice is. This assessment could further lead to recommendations of additional gravel surfacing, subgrade adjustments, or in slope flattening to prepare these roadways for the additional traffic of construction.

3.4 Heavy Haul

It is expected that 7-15 heavy haul loads will be delivered to the site. These vehicles will likely need to be permitted for load weights and size. This should be coordinated with the State and County by the haulers. It is expected that the route to serve these heavy loads will be the same as the standard construction workforce route to the project site. Coordination with the haulers will be necessary to ensure that the roadway facilities of 482nd Avenue and 193rd Street are prepared for these loads and widths.

3.5 Capacity Analysis

Observations of traffic volumes provide an understanding of the general nature of traffic, but are insufficient to indicate either the ability of the street network to carry additional traffic or the quality of service provided by the street system. For this reason, the concept of *level of service* (LOS) was developed to correlate numerical traffic operational data to subjective descriptions of traffic performance at intersections. Each lane of traffic has delay associated with it and therefore a correlating LOS. The weighted average delay for each of these lanes of traffic for a signalized intersection is the intersection LOS. LOS categories range from LOS "A" (best) to "F" (worst) as shown in Table 2.

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Level of Service	UNSIGNALIZED Intersection Control Delay (sec)	Intersection LOS Description
А	≤ 10.0	Free flow, insignificant delays.
В	10.1-15.0	Stable operation, minimal delays.
С	15.1-25.0	Stable operation, acceptable delays.
D	25.1-35.0	Restricted flow, regular delays.
E	35.1-50.0	Maximum capacity, extended delays. Volumes at or near capacity. Long queues form upstream from intersection.
F	> 50.0	Forced flow, excessive delays. Represents jammed conditions. Intersection operates below capacity with low volumes. Queues may block upstream intersections.

Table 3-3. Level of Service Description

Source: Highway Capacity Manual

As noted earlier in this report, general observation of the route choices to the project site from I29 would indicate that traffic capacity is in abundance with all corridors experiencing rather low volumes for what the routes can carry at a safe and efficient level of service. The SDDOT Design Manual indicates the capacity for a 2 lane rural roadway such as SD Hwy 28 would be 8000 ADT.

Total Number	Total Design Year ADT ¹		
of Lanes	Rural Level	Urban	
2	< 8,000	< 2,500	
3	2	2,500 to 16,000	
4	8,000 to 20,000 ³	3	
5	2	16,000 to 30,000	
6	> 20,000 ⁴	> 30,000 ⁴	

Source: SDDOT Design Manual



construction will use 129 and SD Hwy 28. Current volumes on SD Hwy 28 west of SD Hwy 15 are less than 2000 ADT and east of SD Hwy 15 are less than 500 ADT. Based on the projected workforce needs, the generated trips from the site will not add enough traffic to alter the level of service on the state highway facility.



Source: SDDOT Design Manual

If Site Access Option 2 is chosen which would be worst case for evaluating the need for left turn warrants, the intersection of SD Hwy 28 and CR 311 will likely be the most affected in regards to travel pattern changes. It is expected that 140 new trips plus delivery vehicles per day will be added to the turning movements. Since approximately 70 workforce employees will enter the site in the AM it can be assumed that roughly that many would be going eastbound on SD Hwy 28 to northbound on CR 311 making a left turn at this intersection and then during the PM peak hour a southbound to the westbound right turn. A review of the SDDOT turn lane warrants for left and right turn lanes was completed. Assuming a "K" factor of 10% to 15%, at most this intersection would have an advancing/opposing volume on SD Hwy 28 of 75 (.15 times 500 vehicles as 492 vehicles was recorded here in 2016) vehicles in the peak hour. Based on the warrant criteria it would appear if that advancing/opposing volume is under 100 vehicles in the peak hour an exclusive turn lane is not warranted. Similarly, the criteria for a right turn lane on CR 311 southbound is not warranted due to volume thresholds not being met. This intersection however will be noticeably busier to local users due to the low volumes that it experiences now. If concerns arise during construction, the placement of portable message boards along SD Hwy 28 east and west of CR 311 would likely help notify local users that volumes are higher than normal due to a nearby construction project. It should be noted that only two months are being forecasted with construction workforce employees of 70 per day and the construction workforce on average for the 13 month duration is likely around 30 per day so it is not likely feasible to construct turn lanes regardless due to the short timeline of need.

In terms of intersection level of service evaluating this location with stop signs on CR 311 and SD Hwy 28 being free flow, and assuming the same "K" factor for the

approach legs of 10% to 15%, this intersection will still provide a very high level of service to the users with only minor delay on the side street.

If Site Access Option 1 is chosen, the above discussion regarding turn lane warrants and intersection Level of Service at the intersection of SD Hwy 28 and 482nd Avenue would have the same results in regards to not warranting a turn lane but would have better overall level of service that Option 2.

4.0 Recommendations

4.1 Signage Program

Implementation of signage for the purposes of routing traffic to the site safely is important and will keep the route defined for those not making daily visits to the site. Figures 3.1 and 3.2 illustrate a basic signing plan for the construction and delivery vehicles. Additional signage below should also be considered:

- On 193rd Street and 482nd Avenue, consider adding two-way traffic signs or Truck crossing signs at intervals of 1000 feet to help convey that traffic patterns are different on this segment of roadway.
- Consider yield signs on the north and south approaches of the 193rd Street and 482nd Avenue intersection to identify to local traffic of the change in traffic patterns. This only applies if the project site route is from CR 311 via 193rd Street.
- All signs placed with state, county, or township right of ways shall meet the requirements of the Manual of Uniform Traffic Control Devices (MUTCD) and shall have the proper breakaway support structures. The signing plan prior to implementation should be approved by the SDDOT. Jeff Senst, Region Engineer for SDDOT, in Aberdeen can direct this review and approval to be conducted.

4.2 Pavement and Surface Treatment Program

For the township facilities, gravel maintenance will be very important during the construction phase of the project. A maintenance plan should be developed and agreed upon by the township for 193rd Street and 482nd Avenue. This should include at a minimum additional gravel surfacing, dust control chlorides, and widening of the typical sections of 482nd Avenue near the site entrance to a minimum of 20 feet, the intersection of 482nd Avenue and 193rd Street on the south and east approaches, and at the intersection of 193rd and CR 311 on the west approach. It is further recommended that a geotechnical engineer provide additional testing of the surface thickness and subgrade to determine if any modifications are necessary to prepare these township roadways for the construction traffic and equipment shipments.

Over width and overweight permitting for heavy haulers will be necessary on the state and county facilities and haulers should coordinate as necessary to obtain written permits.

Based on the information provided in this report, it is understood all bridges on the county or state routes will allow legal loads as they are not posted. Coordination in regards to bridges shall be done as necessary with state and county officials if permitting is necessary for overweight or over length vehicles.

4.3 Other Recommendations

It is recommended prior to starting construction that the smaller culverts that exist on the township roads regardless of the size be inspected for condition and any abnormalities, this applies to culverts on 481st and 482nd Avenues and 193rd Street.

If site access Option 1 is chosen, a drainage assessment will be necessary in order to establish the height of the grade raise needed along 482nd Avenue to reduce the concern of roadway inundation for longer periods of time. It should be noted that there are not requirements for a township road to pass design year events typically greater than a 2 year or 5 year event. Therefore, if a grade raise is necessary the amount of work completed will likely be dictated by the proposed project site access needs.