

# **APPENDIX F**

## **TRAFFIC ANALYSIS**

**FOR THE CONSTRUCTION OF  
LAND-WATER INTERFACE AND SERVICE PIER EXTENSION  
AT NAVAL BASE KITSAP BANGOR**



# Memo

**To:** Ted R. Turk, PhD  
**From:** Aruna Mathuranayagam, P.E., P.T.O.E.  
**CC:** Jennifer Wallin  
**Date:** 01/27/2016  
**Re:** Naval Base Kitsap Bangor – Revised Traffic Analysis for Land Water Interface & Service Pier Extension EIS

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## PROJECT DESCRIPTION

Traffic data review and operational analysis was conducted to study the impacts of the additional trips generated by the construction traffic to the proposed north and south Land Water Interface (LWI) sites and the proposed Service Pier Extension (SPE) site within Naval Base Kitsap (NAVBASE Kitsap) at Bangor. The LWI Proposed Action includes constructing two LWI structures and modifying the existing floating Port Security Barrier (PSB) system. The SPE Proposed Action will require extension of the existing Service Pier and improvements to land-based associated support facilities, including construction of a maintenance support facility, utility upgrades that include an emergency power generator, and a parking lot.

In addition to studying the temporary impacts of the construction traffic along the existing roadway network, traffic operational impacts following the Proposed SPE Action caused by the addition of 322 new employees to the site were also studied.

Proposed construction activity for the LWI project is expected to occur between May 2016 and May 2018 with most of the soil hauling work completed by 2017. The SPE project is currently unprogrammed and a construction schedule has not been established. For the purposes of traffic impact analysis, a construction period of April 2018 through March 2020 has been assumed as a reasonably representative case. Construction of all proposed facilities is anticipated to take approximately 24 months. The area evaluated includes the primary access roads leading to the Naval Base and the internal roadway network within NAVBASE Kitsap Bangor. The primary entrance routes to the base include Trigger Avenue and Trident Boulevard (NW Luoto Road) as they provide direct access from State Route 3 (SR 3), which is the major controlled access roadway serving the base from Bremerton, Poulsbo, Silverdale, and Hood Canal Bridge.

## ROADWAY NETWORK

Staging (i.e., parking lot, material/equipment storage, and soil stockpiling) for both LWI project sites would take place at a single site located near the intersection of Archerfish and Seawolf Roads. This site is approximately 5.4 acres (2.2 hectares) in size and has been used recently for staging for other projects. Flier Road and Sealion Road would be the primary haul routes for construction of the LWI north and south project sites.

Staging (i.e., parking lot, material/equipment storage, and soil stockpiling) for the SPE project site would be located at the SPE construction site. The following roadway sections were identified as the primary access and internal roadways under the area of the influence of the proposed LWI and SPE projects within the study area:

- Trigger Avenue south of Trident Boulevard (LWI / SPE),
- Trident Boulevard east of Trigger Avenue (LWI / SPE),
- Trigger Avenue East of Escolar Road (LWI / SPE),
- Escolar Road North of Trigger Avenue (LWI),
- Escolar Road North of Sturgeon Street (LWI),
- Greenling Road West of Archerfish Road (LWI),
- Archerfish Road North of Seawolf Road (LWI),
- Seawolf Road East of Flier Road (LWI North),
- Flier Road North of Seawolf Road (LWI North),
- Trigger Avenue South of Sturgeon Street/Attu Road (LWI South / SPE),
- Sturgeon Street/Attu Road West of Trigger Avenue (LWI South / SPE), and
- Sealion Road North of Sturgeon Street/Attu Road/ (LWI South / SPE).

Of the above shown roadway sections, Trigger Avenue and Trident Boulevard (NW Luoto Road) are multi-lane divided highways serving as primary entrance routes to the base providing access from SR 3.

Similarly, the following intersections were identified as those under the area of the influence of the proposed changes within the study area:

- Trigger Avenue and Ohio Street (LWI / SPE),
- Trigger Avenue and Trident Boulevard (LWI / SPE),
- Trigger Avenue and Escolar Road (LWI / SPE),
- Escolar Road and Sturgeon Street (LWI),
- Escolar Road and Greenling Road (LWI),
- Archerfish Road and Seawolf Road (LWI),
- Seawolf Road and Flier Road (LWI North), and
- Trigger Avenue and Sturgeon Street (LWI South / SPE).

The existing roadway and intersection geometry and intersection control conditions were used in performing the traffic analyses for the baseline traffic conditions, future traffic demand conditions during construction generated by the construction-related activities, and future traffic demand conditions following construction generated by the proposed action improvements. Roadway sections and intersections operating at unacceptable levels of service (LOS) under the various analysis scenarios were identified.

**TRAFFIC DATA**

Existing Baseline (2011 and 2012) average daily traffic data, and morning and evening peak period intersection turning movement data, along the study area roadway sections and intersections affected by the LWI and SPE projects were obtained from the Parametrix Report completed in February 2011 and traffic counts conducted by All Traffic Data in November 2012. Review of the data indicated that the morning peak hour occurred between 07:00 and 09:00 a.m. and the evening peak hour occurred between 02:00 and 04:00 p.m. The highest hourly traffic demand observed during the morning and evening peak periods was used in developing future projections and conducting traffic operational analysis to determine the LOS.

Table 1 shows the Baseline 2011 and 2012 average daily traffic (ADT) for the key study area roadway sections affected by the proposed construction traffic. Table 2 shows the Baseline 2011 and 2012 overall intersection entering traffic for the study area intersections affected by the proposed construction traffic.

**Table 1: Baseline Average Daily Traffic Volumes — NAVBASE Kitsap at Bangor Roadways**

Location	Cars / Bikes / SUVs	Trucks /Buses	Total
<b>All Site Traffic:</b>			
Trigger Avenue north of Thresher Avenue	6,854	266	7,120
Trigger Avenue east of Escolar Road	8,676	702	9,378
Trident Boulevard east of Scorpion Avenue	10,830	751	11,581
<b>LWI Site Traffic:</b>			
Escolar Road south of Goldfinch Lane	4,026	226	4,252
Escolar Road north of Sturgeon	3,446	96	3,542
Greenling Road west of Archerfish Road	829	25	854
Archerfish Road north of Tinian Road	446	2	448
<b>LWI North Site Traffic:</b>			
Seawolf Road east of Flier Road	n/a	n/a	510
Flier Road north of Seawolf Road	n/a	n/a	520
<b>LWI South OR SPE Site Traffic:</b>			
Trigger Avenue south of Sturgeon Street	n/a	n/a	2,710
Sturgeon Street west of Trigger Avenue	n/a	n/a	3,220
Sealion Road north of Sturgeon Street	n/a	n/a	2,100

Source: Parametrix 2011, All Traffic Data Services, Inc. 2012

Table 2: Baseline Overall Intersection Entering Traffic Volumes — NAVBASE Kitsap at Bangor

Location	Overall Intersection Entering Traffic		Overall Intersection Peak Hour Factor <sup>1</sup>		Overall Intersection Heavy Vehicle Factor	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
<b>All Site Traffic:</b>						
Trigger Avenue/Ohio Street	1,267	1,424	0.94	0.90	1.6%	1.2%
Trigger Avenue/Trident Boulevard	1,693	1,512	0.83	0.79	0.1%	0.1%
Escolar Road/Trigger Avenue	1,445	1,480	0.89	0.77	0.7%	0.9%
<b>LWI Site Traffic:</b>						
Escolar Road/Sturgeon Road	625	460	0.81	0.79	2.7%	3.0%
Escolar Road/Greenling Road	398	347	0.77	0.68	2.0%	0.6%
Archerfish Road/Seawolf Road	91	72	0.84	0.78	1.1%	4.2%
<b>LWI North Site Traffic:</b>						
Seawolf/Flier	45	36	0.70	0.69	13.3%	8.3%
<b>LWI South OR SPE Site Traffic:</b>						
Trigger/Sturgeon	313	415	0.84	0.80	3.8%	3.9%

Source: Parametrix 2011, All Traffic Data Services, Inc. 2012

**NOTE:**

1. Peak hour Factor indicates the hourly volume during the maximum-volume hour of the day divided by the peak 15-min flow rate within the peak hour; a measure of traffic demand fluctuation within the peak hour.

The baseline traffic data were used in developing future projections for the years 2016, 2017, 2018, 2019, and 2020 for the primary entrance routes to the Naval Base and other internal roadways. Project-generated ADT and intersection turning movement projections for the analysis roadways and intersections within the study area were developed for the years 2016, 2017, and 2018 (for the LWI projects), and the years 2018, 2019, and 2020 (for the SPE project), when the generated automobile and truck trips are expected to be at their maximum. The baseline traffic data and intersection turning movement counts were projected using a 1.2% average annual growth factor to determine the future baseline 2016, 2017, 2018, 2019, and 2020 traffic trips.

Construction-related truck traffic would be generated by the need to deliver construction materials and remove construction debris from the construction sites. Construction debris would be hauled off site to an approved disposal location. Over the duration of construction (48 months), construction workers and large truck traffic including construction vehicles and soil hauling trucks will drive to and from the LWI and SPE construction sites.

**LWI Sites:**

Over the duration of construction (24 months), a maximum of 100 workers are conservatively assumed to drive to and from the LWI construction sites. General large truck traffic is estimated to be five (5) to ten (10) trips per day on average, while other construction traffic such as inspectors, visitors, and miscellaneous smaller vehicles is estimated to be 30 trips per day on average. Soil hauling is expected to require an additional 1,300 truck trips over a period of 6 months (a minimum of 95 work days) during 2016 and 2016, for a daily average of 15–20 truck trips per day during that period. Based on relative cut and fill volumes, 80 percent of these soil hauling trucks are estimated to go to the north site, while 20 percent are estimated to go to the south site. During peak construction activities, there would be a substantial increase in the peak number of daily truck trips.

**SPE Site:**

Over the duration of construction (24 months), a maximum of 70 workers are conservatively assumed to drive to and from the SPE construction site. General large truck traffic is estimated to be 18 trips per day on average, while other construction traffic such as inspectors, visitors, and miscellaneous smaller vehicles is estimated to be 70 trips per day on average. Materials and equipment for the in-water work would be brought in by barge, while materials and equipment for upland construction would be brought in by truck.

The estimated trips generated from the construction-related activities were combined with the future projected traffic volumes to obtain the analysis volumes for the years 2016, 2017, and 2018 (for the LWI sites), and 2018, 2019, and 2020 (for the SPE site). These were used in performing traffic operational analysis at all the affected roadways and intersections to determine LOS and traffic delays.

The following conditions were used to distribute the generated trips from the construction-related activities along the study area roadways and intersections:

- Automobile traffic will enter from either the gate on Trident Boulevard or Trigger Avenue and head northwesterly towards Escolar Road. A 50/50 percent assumption was used to estimate automobile traffic entering the base via Trident Boulevard and Trigger Avenue.
- Truck traffic will enter the base only at Trident Boulevard. Trucks will then follow the same route as the automobiles.

**LWI Sites:**

- Traffic accessing the north LWI project site will head north on Escolar Road, traveling east on Greenling Road, and then north on Archerfish Road to reach the construction site via Seawolf and Flier Roads.
- Traffic accessing the south LWI project site will continue along Trigger Avenue west of Escolar Road to access the construction site via Sturgeon and Sealion Roads.

- 90 percent of the soil hauling truck trips will be generated by the LWI north site; these trips will follow the same route as the automobiles: Escolar → Greenling → Archerfish → Seawolf → Flier.
- 10 percent of the soil hauling truck trips will be generated by the south LWI project site; these trips will follow Trigger → Sturgeon → Sealion.
- Construction workers will park at the staging area located near the intersection of Archerfish and Seawolf Roads.

**SPE Site:**

- Traffic accessing the SPE site will continue along Trigger Avenue west of Escolar Road to access the construction site via Sturgeon → Sealion → Wahoo.
- All traffic will travel to the site and park at the one available parking area.
- Construction workers will also park at the staging/parking area at the site.

The generated trip numbers and traffic distribution patterns were used to determine the future construction trips along all the study area key roadway sections and intersections. The future projected trips along the primary entrance routes of Trigger Avenue and Trident Boulevard are shown in Table 3 and Table 4.

**Table 3: Projected Daily Traffic Volumes along Trident Boulevard / NW Luoto Road for the LWI & SPE Projects — NAVBASE Kitsap Bangor**

<b>LWI Projects</b>			
<b>Trip Description</b>	<b>Year 2016</b>	<b>Year 2017</b>	<b>Year 2018</b>
Non-Project Traffic	13,526	13,689	13,853
Construction Worker Automobile Trips - LWI	100	100	100
Soil Hauling Truck Trips - LWI	20	20	0
Other Construction Truck Traffic Trips - LWI	8	8	8
Other Construction Traffic - LWI	30	30	30
<b>Total</b>	<b>13,684</b>	<b>13,847</b>	<b>13,991</b>
<b>SPE Project</b>			
<b>Trip Description</b>	<b>Year 2018</b>	<b>Year 2019</b>	<b>Year 2020</b>
Non-Project Traffic	13,853	14,187	14,358
Construction Worker Automobile Trips - SPE <sup>1</sup>	70	70	70
Soil Hauling Truck Trips - SPE <sup>1</sup>	0	0	0
Other Construction Truck Traffic Trips - SPE <sup>1</sup>	18	18	18
Other Construction Traffic - SPE <sup>1</sup>	70	70	70
<b>Total</b>	<b>14,011</b>	<b>14,345</b>	<b>14,516</b>

Source: (1) U.S. Navy, email dated Wednesday - 03/20/2013.



**Table 4: Projected Daily Traffic Volumes along Trigger Avenue  
for the LWI & SPE Projects — NAVBASE Kitsap Bangor Roadways**

<b>LWI Projects</b>			
<b>Trip Description</b>	<b>Year 2016</b>	<b>Year 2017</b>	<b>Year 2018</b>
Non-Project Traffic	12,570	12,721	12,873
Construction Worker Automobile Trips - LWI	100	100	100
Soil Hauling Truck Trips - LWI	20	20	0
Other Construction Truck Traffic Trips - LWI	8	8	8
Other Construction Traffic - LWI	30	30	0
<b>Total</b>	<b>12,728</b>	<b>12,879</b>	<b>12,981</b>
<b>SPE Project</b>			
<b>Trip Description</b>	<b>Year 2018</b>	<b>Year 2019</b>	<b>Year 2020</b>
Non-Project Traffic	12,873	13,184	13,342
Construction Worker Automobile Trips - SPE <sup>1</sup>	70	70	70
Soil Hauling Truck Trips - SPE <sup>1</sup>	0	0	0
Other Construction Truck Traffic Trips - SPE <sup>1</sup>	18	18	18
Other Construction Traffic - SPE <sup>1</sup>	70	70	70
<b>Total</b>	<b>13,031</b>	<b>13,342</b>	<b>13,500</b>

Source: (1) U.S. Navy, email dated Wednesday - 03/20/2013.

## TRAFFIC OPERATIONAL ANALYSIS & METHODOLOGY

Traffic analysis to study the impacts of additional traffic generated during construction-related activities and following construction, from proposed action improvements, was performed at signalized intersections and roadway sections. The analysis for signalized intersections was conducted using Synchro/SimTraffic. The analysis for the two-lane and four-lane divided/undivided roadway sections was conducted using the Highway Capacity Software (HCS 2010), which is based on the guidelines listed in the Highway Capacity Manual (HCM) 2010 to determine the LOS. LOS is a measure of traffic operations, which uses a qualitative grading scale from A to F. LOS A represents the best traffic operations and LOS F represents the worst traffic operations. The LOS for multi-lane divided/undivided roadways is defined by vehicular density (vehicles per mile per lane). The LOS for two-lane roadways is defined by average travel speed and percent time spent following. The LOS for signalized and unsignalized intersections is defined by control delay (seconds per vehicle). Table 5 shows the measures of effectiveness used in determining the LOS of the various roadway facilities and intersection control types encompassed within the study area.

### Analysis Software - Synchro/SimTraffic

Synchro is a macroscopic signal design software application supported by SimTraffic, the microscopic simulation model. This application was used to determine the LOS for optimized signal timing and phasing conditions at all the signalized and unsignalized intersections within the study area. Synchro is

based on the HCM-recommended guidelines for signalized and unsignalized intersections. Synchro models traffic arriving or present at the intersection approaches and does not account for traffic flow or spillback conditions at adjacent intersections.

**Table 5: Measures of Effectiveness used in Determining Levels of Service**

LOS	At-Grade Un-Signalized Intersection Average Control Delay Per Vehicle (s/veh)	At-Grade Signalized Intersection Control Delay Per Vehicle (s/veh)	Percent Time Spent Following for Two-Lane Highways in Class II
A	0 - 10	≤ 10	≤ 40
B	> 10 - 15	> 10 - 20	> 40-55
C	> 15 - 25	> 20 - 35	> 55-70
D	> 25 - 35	> 35 - 55	> 70-85
E	> 35 - 50	> 55 - 80	> 85
F	> 50	> 80	Note 1

**NOTE:**

1. LOS F applies whenever the flow rate exceeds the segment capacity

### **Analysis Software - HCS 2010**

The Highway Capacity Software is based on concepts and guidelines outlined in the HCM developed by the Transportation Research Board (TRB) to determine the capacity and quality of service of various roadway facilities that carry both vehicular and non-vehicular traffic. The HCM is a result of a multi-agency effort including TRB, American Association of State Highway and Transportation Officials, and Federal Highway Administration and is a widely used reference for traffic and transportation engineering practice.

## **ANALYSIS OF ALTERNATIVES**

The various scenarios analyzed under the baseline and future morning (a.m.) and evening (p.m.) peak hour traffic demand conditions for the key roadway sections and intersections include the following:

- Baseline Condition 2011 or 2012 (a.m. / p.m. Peak Analysis)
- Future 2016 Condition with Construction Traffic for LWI projects only (a.m. / p.m. Peak Analysis)
- Future 2017 Condition with Construction Traffic for LWI projects only (a.m. / p.m. Peak Analysis)
- Future 2018 Condition with Construction Traffic for LWI projects only (a.m. / p.m. Peak Analysis)
- Future 2018 Condition with Construction Traffic for SPE project only (a.m. / p.m. Peak Analysis)
- Future 2019 Condition with Construction Traffic for SPE project only (a.m. / p.m. Peak Analysis)
- Future 2020 Condition with Construction Traffic for SPE project only (a.m. / p.m. Peak Analysis)

Table 6 shows the morning and evening peak hour LOS and measures of effectiveness values for the intersections within the NAVBASE Kitsap Bangor study area. The LOS shown indicates the impact of the added traffic from the LWI project(s) and the SPE project. Results of the intersection operational

analysis indicate all of the key intersections operating at acceptable levels of service, LOS A, B, C, or D under the future 2016, 2017, 2018, 2019, and 2020 traffic demand conditions.

Tables 7 and 8 show the morning and evening peak hour LOS and measures of effectiveness values for the roadway sections within the NAVBASE Kitsap Bangor study area. The LOS shown indicates the impact of the added traffic from the LWI project(s) and the SPE project, respectively. Results of the operational analysis indicate all of the multi-lane and two-lane roadway sections operating at acceptable levels of service, LOS A, B, C, or D, under the future 2016, 2017, 2018, 2019, and 2020 traffic demand conditions.

**LWI Proposed Action Operations:**

The proposed LWI action and future operations will not generate additional traffic. Hence, the impacts of this proposed action on the major access roadways, internal base roadway network, and intersections are negligible.

**SPE Proposed Action Operations:**

The proposed SPE action will require improvements to land-based associated support facilities, including construction of a maintenance support facility, utility upgrades that include an emergency power generator, and a parking lot. The proposed Maintenance Support Facility would be located on an existing parking lot on the east side of Wahoo Road. With the completion of the proposed action, 322 new employees will be added to support the shore-based maintenance activities. This, in turn, will generate additional trips, with the new employee traffic accessing the proposed parking lot. Access to and from the proposed main parking lot will be via Sturgeon Street (Attu Road) controlled by a stop sign. The proposed parking lot will be 6 acres (2.4 hectares) in size and contain 535 parking spaces. Access to the smaller lot for Government vehicles will be via Sealion Road.

A review of the post-construction traffic impacts to the SPE site under the highest peak hour traffic demand conditions also indicated the following:

- Trigger & Sturgeon (a.m. Peak) - LOS C / 20.5 seconds (decline from a LOS B)
- Trigger & Escolar (p.m. Peak) - LOS D / 51.6 seconds (approaching LOS E)

## **CONCLUSIONS & RECOMMENDATIONS**

The construction activity for the proposed Waterfront Restricted Area LWI and SPE actions will add construction traffic to the existing roadway network within NAVBASE Kitsap Bangor and to the primary roadways providing access to the base. Added construction-related traffic will include both automobile and truck traffic. The impact from this additional traffic is estimated to affect traffic operations at the Escolar/Trigger and Escolar/Sturgeon and Trigger/Sturgeon intersections. Similarly, the additional traffic will also impact the operations of the roadway sections along Escolar Road between Trigger and Greenling, Greenling Road, Archerfish Road and Flier Road; Trigger Avenue between Escolar and Sturgeon, Sturgeon Street and Sealion Road. In spite of the additional construction-related traffic, the

existing roads planned for construction traffic could accommodate the additional vehicles and trucks, and would not need to be upgraded to accommodate construction traffic. However, the additional traffic volumes may create longer wait times to enter the base, particularly during the a.m. peak hour, as vehicles queue up to pass through the security checkpoint.

To maintain a LOS D along the roadways providing access to the SPE site post, the proposed action, the following improvements are recommended:

- Trigger & Escolar Intersection - Widen southbound approach to add an additional left turn lane
- Sturgeon Street - Improve existing street at the parking lot access drive

Road improvements to accommodate changes in traffic patterns along Wahoo and Sealion roads as well as repairs to existing roads damaged from construction activity are included as part of the SPE alternative.

## **REFERENCES**

All Traffic Data Services. 2012. Traffic counts at various NAVBASE Kitsap Bangor intersections, November 2012. All Traffic Data Services, Inc., Renton, WA.

Parametrix. 2011. Technical Memorandum: Bangor traffic analysis - construction of EHW-2. Prepared by Cindy Clark, Parametrix, Poulsbo, WA. Prepared for SAIC, Bothell, WA. February 11, 2011.

U.S. Navy. 2013. Curtis Hickle, SPE Project Manager, NAVFAC Northwest, Silverdale, WA. Email, March 20, 2013. Personal communication with Ted Turk, Senior Project Manager, Science Applications International Corporation, Bothell, WA, re: SPE construction and operations information.

**Table 6: Peak Hour Intersection Level of Service Analysis for the LWI & SPE Proposed Actions – NAVBASE Kitsap Bangor Roadways**

LWI PROPOSED ACTIONS																
Intersection	AM Peak								PM Peak							
	BASELINE		FUTURE WITH CONSTRUCTION TRAFFIC						BASELINE		FUTURE WITH CONSTRUCTION TRAFFIC					
	2011 / 2012		2016		2017		2018		2011 / 2012		2016		2017		2018	
	LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)
Trigger & Ohio	B	11.2	B	11.5	B	11.6	B	11.7	B	12.6	B	12.8	B	12.9	B	13.1
Trigger & Trident	B	19.8	C	23.2	C	23.8	C	29.2	B	10.2	B	12.1	B	12.2	B	12.3
Trigger & Escolar	A	5.5	A	7.8	A	7.9	A	8.1	D	37.9	D	42.5	D	43.9	D	45.3
Escolar & Sturgeon	B	14.3	C	16.9	C	17.1	C	17.2	C	22.9	D	26.1	D	26.7	D	28.1
Escolar & Greenling	B	11.5	C	16.2	C	16.6	C	16.8	A	9.9	B	13.7	B	13.9	B	14.1
Archerfish & Seawolf	A	9.4	B	11.4	B	11.4	B	11.6	A	9.3	B	11.2	B	11.2	B	11.4
Seawolf & Flier	A	8.9	A	9.3	A	9.3	A	9.4	A	9.3	A	9.5	A	9.5	A	9.6
Trigger & Sturgeon	B	11.1	B	11.7	B	11.7	B	11.8	B	10.0	B	10.3	B	10.3	B	10.5

  

SPE PROPOSED ACTION																
Intersection	AM Peak								PM Peak							
	BASELINE		FUTURE WITH CONSTRUCTION TRAFFIC						BASELINE		FUTURE WITH CONSTRUCTION TRAFFIC					
	2011 / 2012		2018		2019		2020		2011 / 2012		2018		2019		2020	
	LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)	LOS	Delay (seconds)
Trigger & Ohio	B	11.2	B	11.8	B	11.9	B	12.0	B	12.6	B	13.0	B	13.1	B	13.2
Trigger & Trident	B	19.8	C	24.0	C	24.2	C	24.4	B	10.2	B	12.0	B	12.0	B	12.1
Trigger & Escolar	A	5.5	A	7.0	A	7.1	A	7.1	D	37.9	D	44.1	D	43.9	D	45.7
Trigger & Sturgeon	B	11.1	B	14.3	B	14.4	B	14.5	B	10.0	B	11.3	B	11.7	B	12.2

NOTE:

1. Default values used in determining the LOS were obtained from Parametrix 2011 Bangor Traffic Analysis-Construction of EHW Impacts (Technical Memorandum)
2. LOS values shown for the unsignalized intersections are for the stop-controlled movements experiencing the highest delay.
3. LOS values shown indicate the cumulative impacts of the LWI and SPE projects.
4. LOS = Level of Service

**Table 7: Peak Hour Roadway Sections Level of Service Analysis for the LWI Proposed Actions – NAVBASE Kitsap Bangor Roadways**

LWI PROPOSED ACTIONS																
Multi-Lane Roadway Sections																
Roadway Section	AM Peak								PM Peak							
	BASELINE		FUTURE WITH CONSTRUCTION TRAFFIC						BASELINE		FUTURE WITH CONSTRUCTION TRAFFIC					
	2011/2012		2016		2017		2018		2011/2012		2016		2017		2018	
	LOS	Density (veh/mile/lane)	LOS	Density (veh/mile/lane)	LOS	Density (veh/mile/lane)	LOS	Density (veh/mile/lane)	LOS	Density (veh/mile/lane)	LOS	Density (veh/mile/lane)	LOS	Density (veh/mile/lane)	LOS	Density (veh/mile/lane)
Trigger north of Thresher	A	7.8	A	8.9	A	9.1	A	9.2	A	6.7	A	7.7	A	7.9	A	8.1
Trident east of Trigger	A	7.2	A	8.4	A	8.4	A	8.5	A	6.9	A	8.0	A	8.1	A	8.1
Trigger north of Trident	B	14.8	B	17.3	B	17.5	B	17.6	B	13.0	B	15.4	B	15.6	B	15.7
Trigger east of Escolar	B	14.3	C	18.3	C	18.4	C	18.5	B	14.7	B	17.3	B	17.4	B	17.5
Trigger south of Sturgeon	A	2.3	A	2.7	A	2.7	A	2.8	A	3.5	A	3.9	A	3.9	A	4.0
Two-Lane Roadway Sections																
Roadway Section	AM Peak								PM Peak							
	BASELINE		FUTURE WITH CONSTRUCTION TRAFFIC						BASELINE		FUTURE WITH CONSTRUCTION TRAFFIC					
	2011/2012		2016		2017		2018		2011/2012		2016		2017		2018	
	LOS	Percent Time Spent Following (PTSF%)	LOS	Percent Time Spent Following (PTSF%)	LOS	Density (veh/mile/lane)	LOS	Percent Time Spent Following (PTSF%)	LOS	Percent Time Spent Following (PTSF%)	LOS	Percent Time Spent Following (PTSF%)	LOS	Density (veh/mile/lane)	LOS	Percent Time Spent Following (PTSF%)
Escolar north of Trigger	D	79.5%	D	83.2%	D	83.4%	D	83.7%	D	76.7%	D	80.9%	D	81.1%	D	81.2%
Escolar north of Sturgeon	D	72.3%	D	73.7%	D	73.9%	D	74.0%	C	68.8%	D	73.4%	D	73.5%	D	73.5%
Greenling west of Archerfish	C	58.9%	C	66.5%	C	66.8%	C	66.9%	B	51.3%	C	63.7%	C	63.9%	C	64.0%
Seawolf east of Archerfish	B	46.2%	C	60.2%	C	60.4%	C	60.5%	A	31.8%	C	57.6%	C	57.8%	C	58.0%
Flier north of Seawolf	A	37.1%	B	40.7%	B	40.8%	B	40.9%	A	38.7%	B	44.2%	B	44.4%	B	44.5%
Sturgeon west of Trigger	C	67.3%	C	68.5%	C	68.7%	C	68.9%	D	71.9%	D	73.5%	D	73.7%	D	73.8%
Sealion north of Sturgeon	C	62.1%	C	63.2%	C	63.4%	C	63.5%	C	66.1%	C	67.8%	C	68.0%	C	68.2%

1. Default values used in determining the LOS were obtained from Parametrix 2011 Bangor Traffic Analysis-Construction of EHW Impacts (Technical Memorandum)
2. LOS values shown indicate the cumulative impacts of the LWI and SPE projects.
3. LOS = Level of Service

**Table 8: Peak Hour Roadway Sections Level of Service Analysis for the SPE Proposed Action – NAVBASE Kitsap Bangor Roadways**

SPE PROPOSED ACTION																
Multi-Lane Roadway Sections																
Roadway Section	AM Peak								PM Peak							
	BASELINE		FUTURE WITH CONSTRUCTION TRAFFIC						BASELINE		FUTURE WITH CONSTRUCTION TRAFFIC					
	2011/2012		2018		2019		2020		2011/2012		2018		2019		2020	
	LOS	Density (veh/mile/lane)	LOS	Density (veh/mile/lane)	LOS	Density (veh/mile/lane)	LOS	Density (veh/mile/lane)	LOS	Density (veh/mile/lane)	LOS	Density (veh/mile/lane)	LOS	Density (veh/mile/lane)	LOS	Density (veh/mile/lane)
Trigger north of Thresher	A	7.8	A	9.0	A	9.1	A	9.2	A	6.7	A	7.9	A	7.9	A	8.1
Trident east of Trigger	A	7.2	A	8.5	A	8.6	A	8.7	A	6.9	A	8.1	A	8.2	A	8.3
Trigger north of Trident	B	14.8	B	17.7	B	17.9	C	18.1	B	13.0	B	15.7	B	15.9	B	16.1
Trigger east of Escolar	B	14.3	C	18.7	C	18.9	C	19.1	B	14.7	B	17.7	B	17.9	C	18.1
Trigger south of Sturgeon	A	2.3	A	3.9	A	4.0	A	4.1	A	3.5	A	5.0	A	5.1	A	5.2

  

Two-Lane Roadway Sections																
Roadway Section	AM Peak								PM Peak							
	BASELINE		FUTURE WITH CONSTRUCTION TRAFFIC						BASELINE		FUTURE WITH CONSTRUCTION TRAFFIC					
	2011/2012		2018		2019		2020		2011/2012		2018		2019		2020	
	LOS	Percent Time Spent Following (PTSF%)	LOS	Percent Time Spent Following (PTSF%)	LOS	Density (veh/mile/lane)	LOS	Percent Time Spent Following (PTSF%)	LOS	Percent Time Spent Following (PTSF%)	LOS	Percent Time Spent Following (PTSF%)	LOS	Density (veh/mile/lane)	LOS	Percent Time Spent Following (PTSF%)
Sturgeon west of Trigger	C	67.3%	D	72.9%	D	73.0%	D	73.1%	D	71.9%	D	74.0%	D	74.1%	D	74.2%
Sealion north of Sturgeon	C	62.1%	D	69.2%	D	69.3%	D	69.4%	C	66.1%	D	72.2%	D	72.3%	D	72.3%

1. Default values used in determining the LOS were obtained from Parametrix 2011 Bangor Traffic Analysis-Construction of EHW Impacts (Technical Memorandum)
2. LOS values shown indicate the cumulative impacts of the LWI and SPE projects.
3. LOS = Level of Service

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