Appendix E
Detailed Ridership Analysis Memorandum

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steer davies gleave

Kitsap Transit Passenger-Only Ferry Business Plan and Long Range Strategy: Detailed Ridership Analysis

Report
December 2015

KPFF Consulting Engineers

Our ref: 22691102
Client ref: 115050

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1 Introduction and Project Purpose

Steer Davies Gleave (SDG) is part of a team led by KPFF Consulting Engineers tasked to develop the Passenger-Only Ferry (POF) Business Plan and Long-Range Strategy (the Project). The Project is seen as providing a plan to develop POF service between Seattle and three locations in Kitsap County: Bremerton, Kingston and Southworth.

SDG has been tasked with developing projections of ridership and revenue for the proposed services. In this phase of work SDG provided detailed hourly ridership forecasts under multiple operating scenarios. This allows for the identification of service levels that best serve the needs of users while remaining within the limits of resource constraints. The Puget Sound is home to the nation's largest passenger ferry network, and the existence of passenger services that have been operating for years, sometimes decades, provides a rich basis for developing the ridership projections for the Project. In preparing its ridership projections, SDG explicitly made full use of this history both in developing its modeling tools as well as in ensuring that projections fit past trends and observed behavior.

2 Ridership Modeling and Results

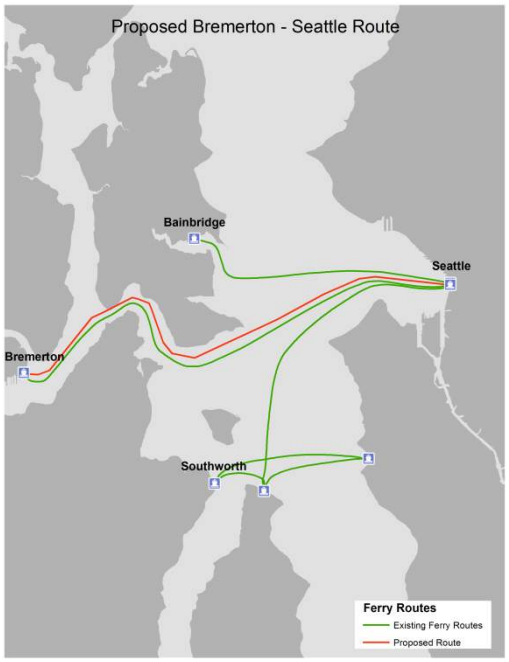
Outputs of the ridership model were produced for the entire system under various operating scenarios. All results were produced for the base year 2015. All revenue estimates are capacity constrained, in current 2015 dollars and are based on the full $12 fare. Detailed ridership methodology can be found in Appendix F of the previously-submitted *Passenger-Only Ferry Business Plan and Long Range Strategy Final Report*.

Alternative Routes and Levels of Service

Bremerton to Seattle

The proposed Bremerton to Seattle is similar to the previous POF services that operated on the same route between Bremerton and Seattle. Bremerton currently has ferry service to downtown Seattle operated by WSF. However there is no POF option and the existing Vehicle Ferry makes the crossing in 60 minutes. The proposed service will utilize a high speed vessel that produces little wake, enabling it to operate at high speeds through Rich Passage without harming the coastline and complete the crossing in around 28 minutes.

Figure 2.1: Proposed Bremerton to Seattle POF Route



Ridership forecasts are produced using the existing ridership model developed by SDG. The model predicts the ridership for the POF Service by comparing its characteristics (in particular travel time, frequency and fare) to the existing alternative mode or modes. The level of service characteristics of the following routes were used to produce ridership forecasts for the Bremerton to Seattle POF service:

- Proposed POF Service
- Existing WSF Vehicle Ferry

Table 2.1: Bremerton – Seattle Alternative Routes Level of Services

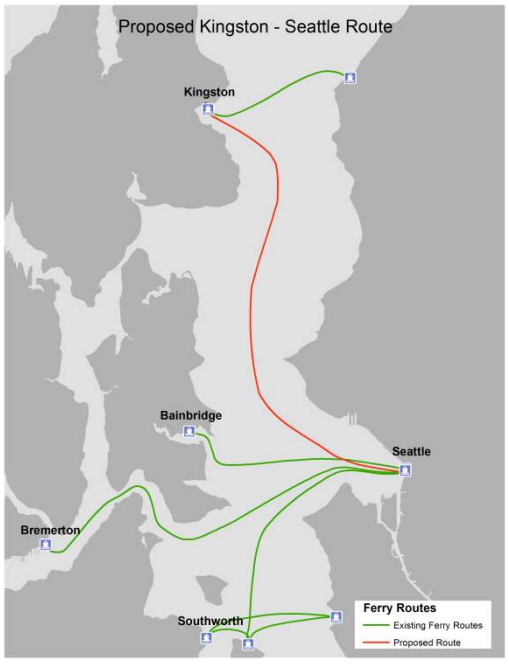
Alternative Routes LOS	Proposed POF Service	Existing WSF Bremerton Ferry
Travel time	28 minute crossing	60 minute crossing
Round trip cost	$12	$8
Frequency	6-9 round trips/weekday 6-8 round trips/weekend	15 round trips/day

Ridership forecasts for the Bremerton to Seattle POF route were developed using the existing WSF Vehicle Ferry foot passenger ridership and applying the existing ridership model developed by SDG to estimate the capture of this existing, observed market. There is therefore no need to model ridership from the base of households and associated commutation as is done with the ridership forecasting for the other proposed routes.

Kingston to Seattle

The proposed Kingston to Seattle POF route would be similar to past POF services that operated on the same route. The area currently has ferry service to Edmonds operated by WSF. The proposed route to downtown Seattle will have a crossing time of 33 minutes and will be operated by a vessel with a 150 passenger capacity.

Figure 2.2: Proposed Kingston to Seattle POF Route



The level of service characteristics of the following routes were used to produce ridership forecasts for the Kingston to Seattle POF service:

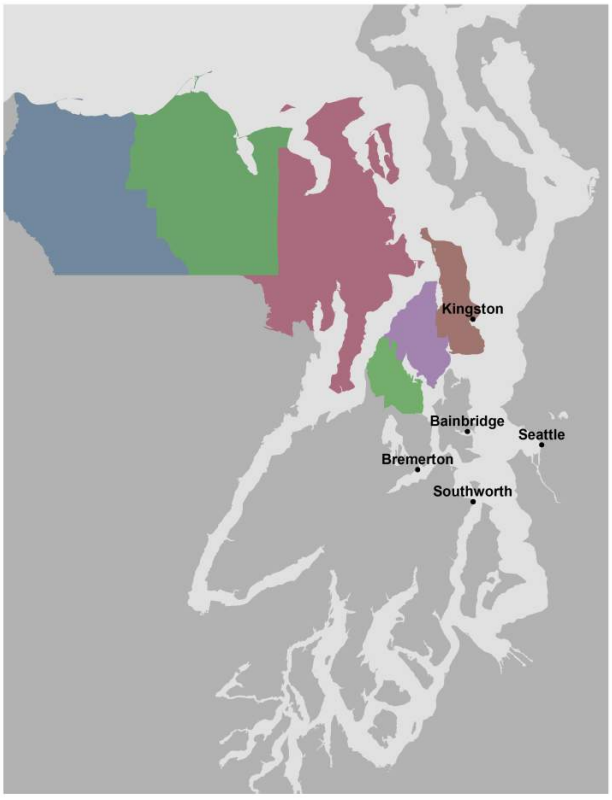
- Proposed POF Service
- Existing Kingston Ferry and auto
- Existing Kingston Ferry and transit
- Drive and Existing Bainbridge Ferry

Table 2.2: Kingston - Seattle Alternative Routes Levels of Service

Alternative Routes LOS	Proposed POF Service	Existing WSF Vehicle Ferry King - Edmonds + Drive to Sea	Existing WSF Vehicle Ferry King - Edmonds + Transit to Sea	Drive + Existing WSF Vehicle Ferry Bainbridge - Sea
Travel time	33 minute crossing	60 minutes	80 minutes	35 minutes
Round trip cost	$12	$47.80	$15	$17.95
Frequency	6-8 round trips/weekday 5-6 round trips/weekend	15 round trips/day	4 round trips/day	21 round trips/day

Ridership forecasts for the Kingston to Seattle POF service were estimated using journey-to-work (JTW) data for defined catchment areas. The number of commuters within the catchment area was then used to estimate the potential demand. Figure 2.3 shows the catchment area used for the Kingston to Seattle POF route.

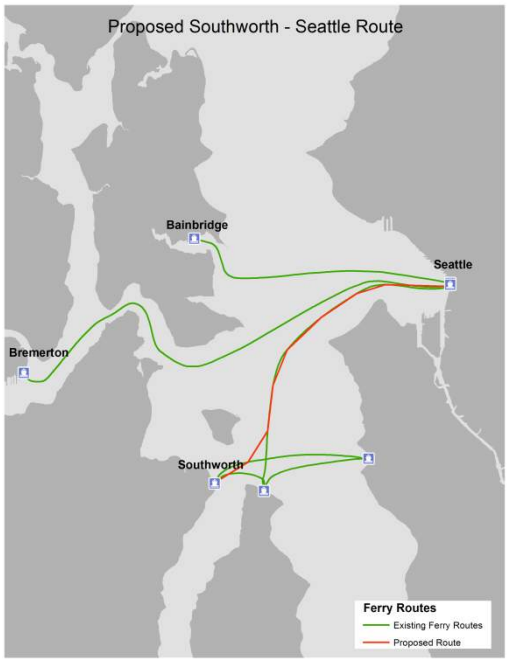
Figure 2.3: Kingston - Seattle Catchment Area



Southworth to Seattle

The proposed Southworth to Seattle POF route would be a completely new service for the area. While the area does have ferry service to Vashon Island and West Seattle, it does not have any service that goes directly to downtown Seattle. The proposed route to downtown Seattle will have a crossing time of 23 minutes and will be operated by a vessel with a 150 passenger capacity.

Figure 2.4: Proposed Southworth to Seattle POF Route



Ridership forecasts for the Southworth to Seattle POF service were estimated using JTW data and defined catchment areas. The number of commuters within the catchment area was then used to estimate the potential demand. The level of service characteristics of the following routes were used to produce the ridership forecasts:

- Proposed POF Service
- Existing Southworth Ferry and auto
- Existing Southworth Ferry and transit
- Drive and Existing Bremerton Ferry
- Drive all the way to Seattle

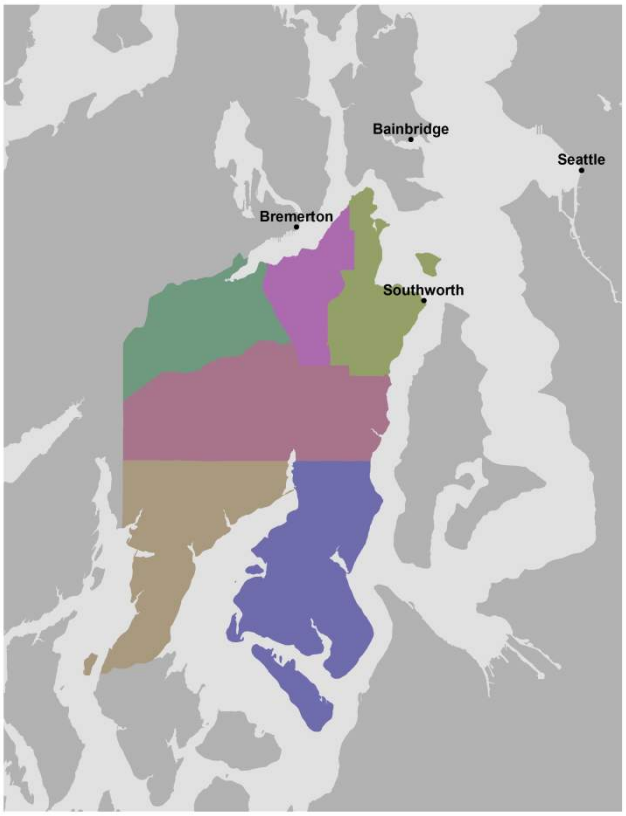
Table 2.3: Southworth - Seattle Alternative Routes Levels of Service

Alternative Routes LOS	Proposed POF Service	Existing WSF Vehicle Ferry Southworth - Fauntleroy + Drive to Sea	Existing WSF Vehicle Ferry Southworth - Fauntleroy + Transit to Sea	Existing WSF vehicle Ferry Southworth- Fauntleroy + Water Taxi to Sea	Drive + Existing WSF Vehicle Ferry Bremerton - Sea	Drive all the way to Seattle
Travel time	23 minutes	60 minutes	80 minutes	50 minutes	60 minutes	70-90 minutes
Round trip cost	$12	$55.40	$11.25	$11.00	$17.95	$30-35
Frequency	6-9 round trips/weekday 6-8 round trips/weekend	24 round trips/day	24 round trips/day	6 round trips/day	15 round trips/day	N/A

In this market area, the optimal route to Seattle involves a combination of the above alternatives. The optimal route involves taking the existing WSF Vehicle Ferry from Southworth to Fauntleroy and utilizing transit from Fauntleroy to Seattle, then returning using the King County Water Taxi from Seattle to Vashon Island and taking the exist WSF Vehicle Ferry from Vashon Island to Southworth. The optimal route would take 50 minutes and have a round trip cost of $7.25 with only 6 round trips per day. This optimal route was incorporated into the model as the existing alternative to the proposed POF Service for Southworth.

As previously mentioned, catchment areas were used to generate ridership. The number of commuters within the catchment area was then used to estimate the total potential demand. Figure 2.5 shows the catchment area used for Southworth to Seattle POF route.

Figure 2.5: Southworth - Seattle Catchment Area



Results: Basic Weekday Schedule

Table 2.4 lists the service characteristics and ridership forecasts for all three routes using the basic weekday schedule. This scenario provides peak 6 round trips for each of the three services, split between morning and evening. As mentioned, all forecasts are capacity constrained. In the event of forecasted capacity issues, overflow trips are noted.

Table 2.4: Basic Weekday Ridership Estimates

		Bremerton	Kingston	Southworth
Service Characteristics	Travel Time	28	33	23
	Round Trips/Day	6	6	6
	Round Trip Cost	$12.00	$12.00	$12.00
Ridership and Revenue Summary	Total Market Demand	1.6M	1.1M	0.7M
	Annual POF Ridership	232,221	205,381	139,248
	Annual Revenue	$1,181,540	$1,044,977	$708,493
	Avg Riders/Day	929	822	557
	Avg Riders/Sail	77	68	46
	Annual Overflow Trips	0	6,581	0

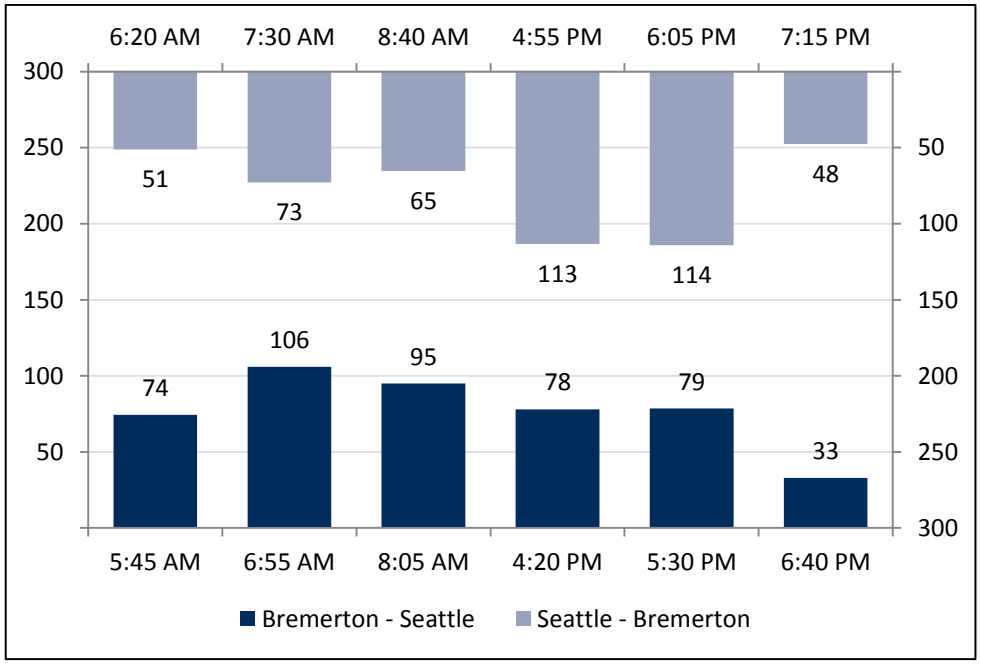
The daily ridership for 6 round trips between Bremerton and Seattle is estimated to be 929 trips. Kingston to Seattle daily ridership is estimated to be slightly less, at 822 trips. Southworth to Seattle daily ridership is estimated to be 557 trips.

Daily Ridership by Sailing

Ridership by sailing was estimated by applying the observed hourly distribution of foot passengers on existing WSF services. For the proposed Bremerton to Seattle POF service, the directionality of the passenger flow was estimated by applying the observed directionality split on the previous POF service operated by Kitsap Ferry Co. Since there is no previous service to help estimate the directionality for the other two routes, we assume that riders travel to Seattle in the morning and return in the evening. This assumption is made to illustrate the most extreme case of crowding.

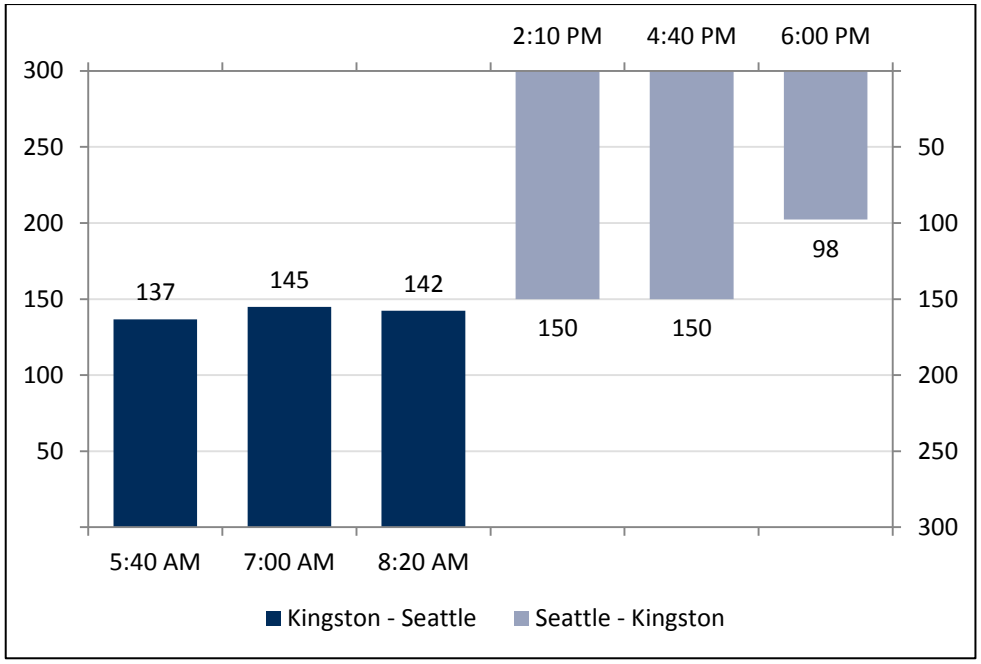
Figures 2.6, 2.7, and 2.8 show the forecasted passenger flow in each direction for all routes under the basic weekday schedule.

Figure 2.6: Bremerton - Seattle Ridership by Sailing, 6 Round Trips/Day



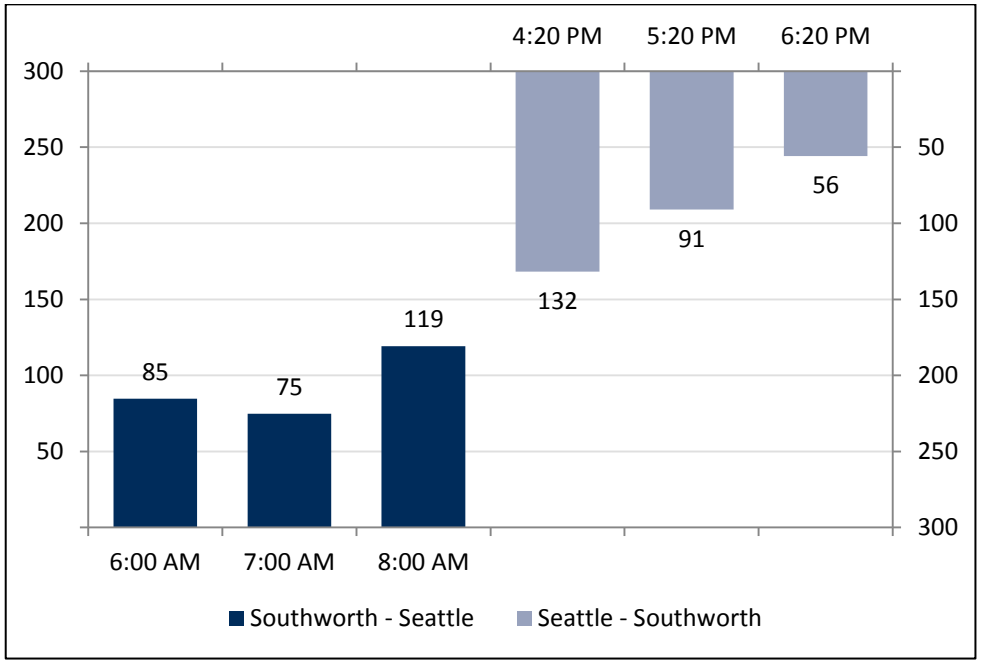
With a $12 fare and vessel capacity of 118, the Bremerton route is not expected to face capacity issues. The Kingston – Seattle service is forecasted to experience some capacity issues for PM trips with a proposed vessel capacity of 150.

Figure 2.7: Kingston - Seattle Ridership by Sailing, 6 Round Trips/Day



The proposed Southworth to Seattle POF service faces no capacity constraints with a vessel capacity of 150.

Figure 2.8: Southworth - Seattle Ridership by Sailing, 6 Round Trips/Day



Results: Basic Weekday and Evening Schedule

Table 2.5 lists the service characteristics and ridership forecasts for all three routes using the basic weekday plus evening schedule. This scenario provides peak 8-9 round trips for each of the three services, with three round trips in each of the peak periods and an additional 2-3 trips in the evening. Service is covered between 5:40am and 10:00pm. Bremerton has a late-night trip leaving Seattle at 10:50pm. As mentioned, all forecasts are capacity constrained. In the event of forecasted capacity issues, overflow trips are noted.

Table 2.5: Basic Weekday + Evening Ridership Estimates

		Bremerton	Kingston	Southworth
Service Characteristics	Travel Time	28	33	23
	Round Trips/Day	6 peak + 3 off peak	6 peak + 2 off peak	6 peak + 3 off peak
	Round Trip Cost	$12.00	$12.00	$12.00
Ridership and Revenue Summary	Total Market Demand	1.6M	1.1M	0.7M
	Annual POF Ridership	376,550	241,728	217,350
	Annual Revenue	$1,915,885	$1,229,913	$1,105,876
	Avg Riders/Day	1,506	967	869
	Avg Riders/Sail	84	60	48
	Annual Overflow Trips	51,605	68,477	19,627

The daily ridership for 9 round trips between Bremerton and Seattle is estimated to be 1,506 trips. Kingston to Seattle daily ridership is estimated to be less, at 967 trips. Southworth to Seattle daily ridership is estimated to be 869 trips.

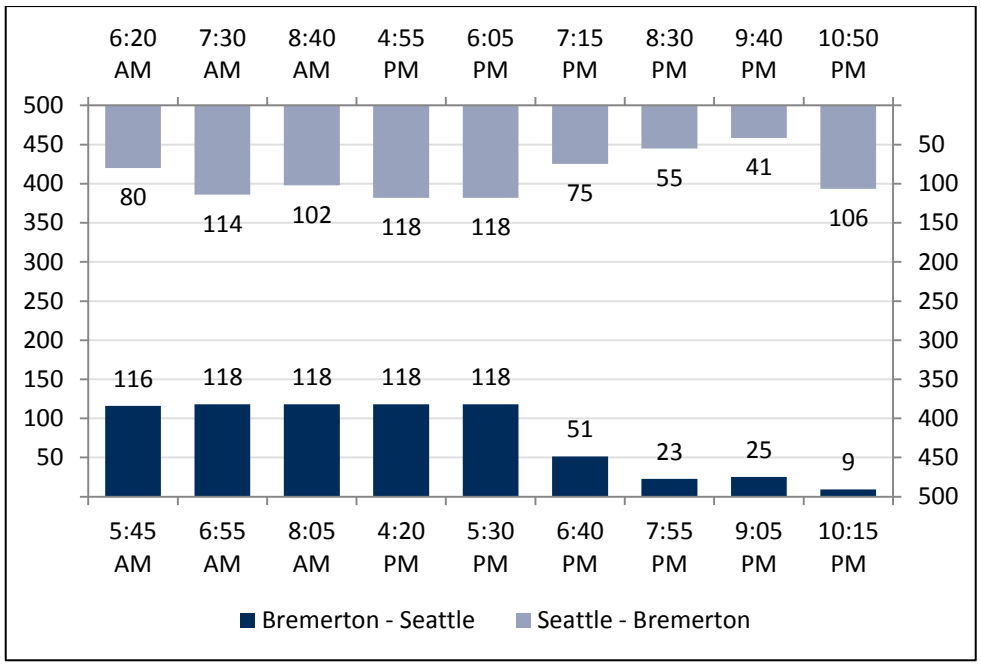
Note that the additional evening service has a significant effect on ridership. This result echoes trends seen in transit service with frequency levels such as the Basic Weekday schedule: Additional sailings provide convenience and options for sailing times that encourages additional ridership even during the periods already served by the POF.

Daily Ridership by Sailing

Daily ridership for the peak weekday trips were estimated using the same method as described above. Off-peak trips for the proposed Bremerton to Seattle POF service are distributed using the existing WSF service by direction. Since there is no previous service to help estimate the directionality for the other two routes, we again assume that riders travel to Seattle in the morning and return in the evening for peak trips. We further assume an even split in directionality for the evening off-peak trips.

Figures 2.9, 2.10, and 2.11 show the forecasted passenger flow in each direction for all routes under the basic weekday plus evenings schedule. Bremerton experiences capacity constraints during AM and PM peak hours.

Figure 2.9: Bremerton – Seattle Ridership by Sailing; 6 Peak Round Trips/Day + 3 Off-Peak Round Trips/Day



Kingston morning and peak trips are capacity constrained, while Southworth only faces capacity constraints for one hour during each peak period.

Figure 2.10: Kingston - Seattle Ridership by Sailing; 6 Peak Round Trips/Day + 2 Off-Peak Round Trips/Day

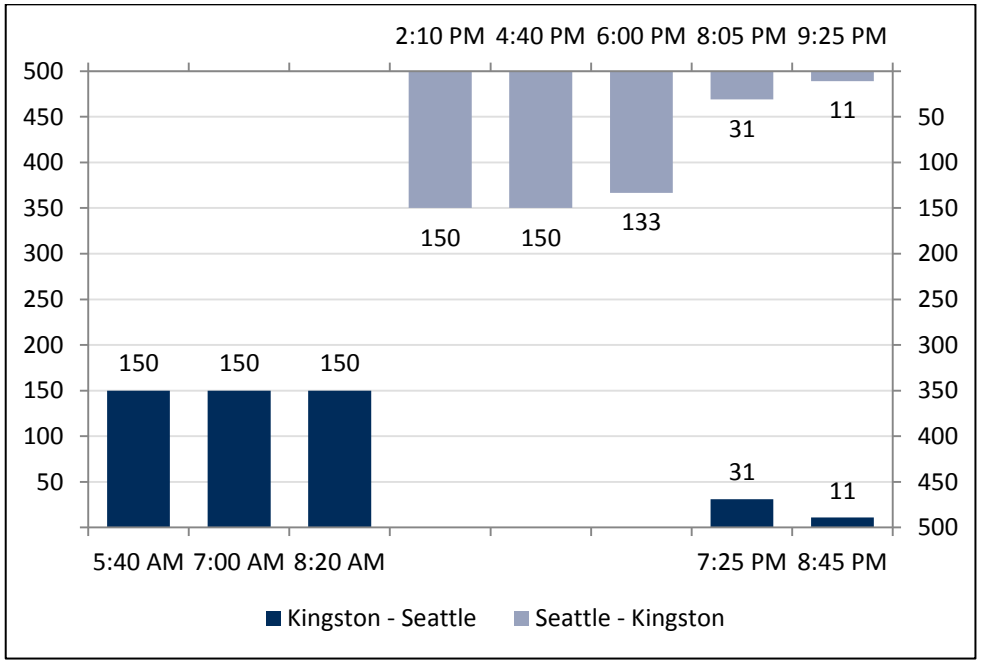
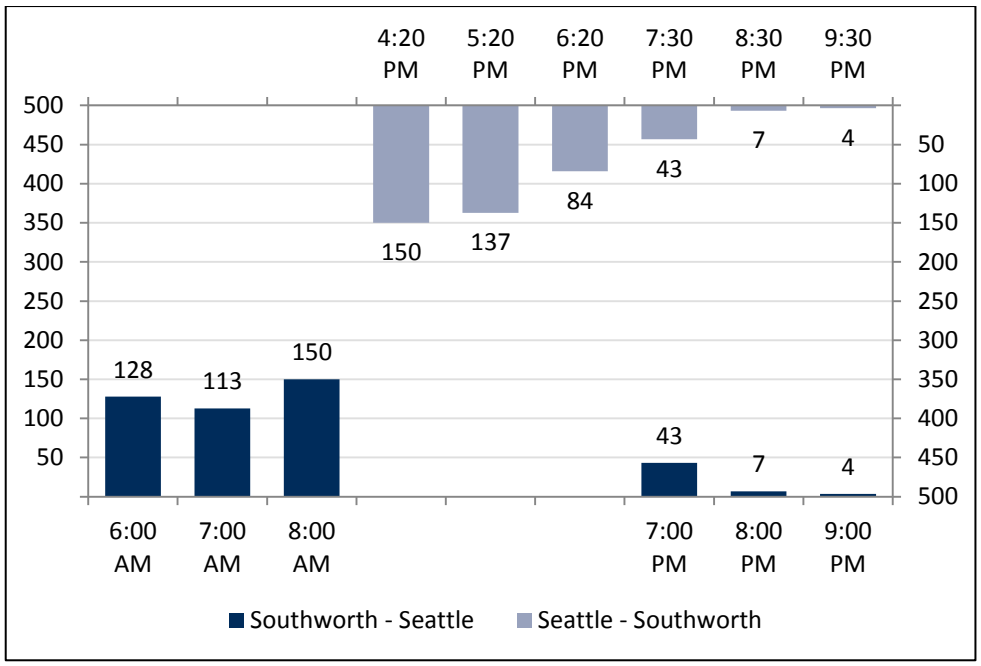


Figure 2.11: Southworth - Seattle Ridership by Sailings; 6 Peak Round Trips/Day + 3 Off-Peak Round Trips/Day



Results: Saturday Schedule - Option 1

Two sets of schedules are proposed for Saturday service; this section documents forecasts for the lower frequency option. Six round trips are offered between 9:30am and 4:00pm. Table 2.6 lists the service characteristics and ridership forecasts for all three routes using the basic weekday plus evening schedule. As mentioned, all forecasts are capacity constrained.

Table 2.6: Saturday Option 1 Ridership Estimates

		Bremerton	Kingston	Southworth
Service Characteristics	Travel Time	28	33	23
	Round Trips/Day	6	6	6
	Round Trip Cost	$12.00	$12.00	$12.00
Ridership and Revenue Summary	Total Market Demand	1.6M	1.1M	0.7M
	Annual POF Ridership	28,008	17,871	9,294
	Annual Revenue	$142,503	$90,927	$47,286
	Avg Riders/Day	560	357	186
	Avg Riders/Sail	47	30	15
	Annual Overflow Trips	0	0	0

The daily ridership for 6 Saturday round trips between Bremerton and Seattle is estimated to be 560 trips. Kingston to Seattle Saturday ridership is estimated to be less, at 357 trips. Southworth to Seattle daily ridership is estimated to be 186 trips.

Ridership by Sailing

Saturday sailings for the proposed services are estimated using the same method as the Bremerton off-peak sailings. We use the off-peak Saturday distribution of existing WSF services to get the hourly distribution.

Figures 2.12, 2.13, and 2.14 show the forecasted passenger flow in each direction for all routes under the Saturday Option 1 schedule. None of the routes experience capacity constraints.

Figure 2.12: Bremerton - Seattle Ridership by Sailings; 6 Round Trips/Saturday

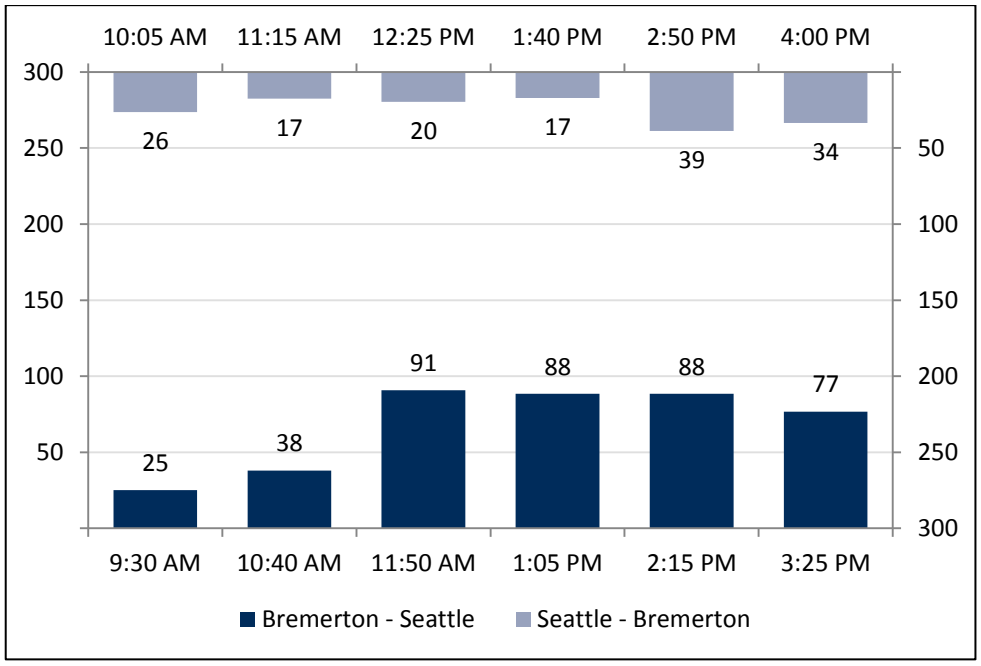


Figure 2.13: Kingston - Seattle Ridership by Sailings; 5 Round Trips/Saturday

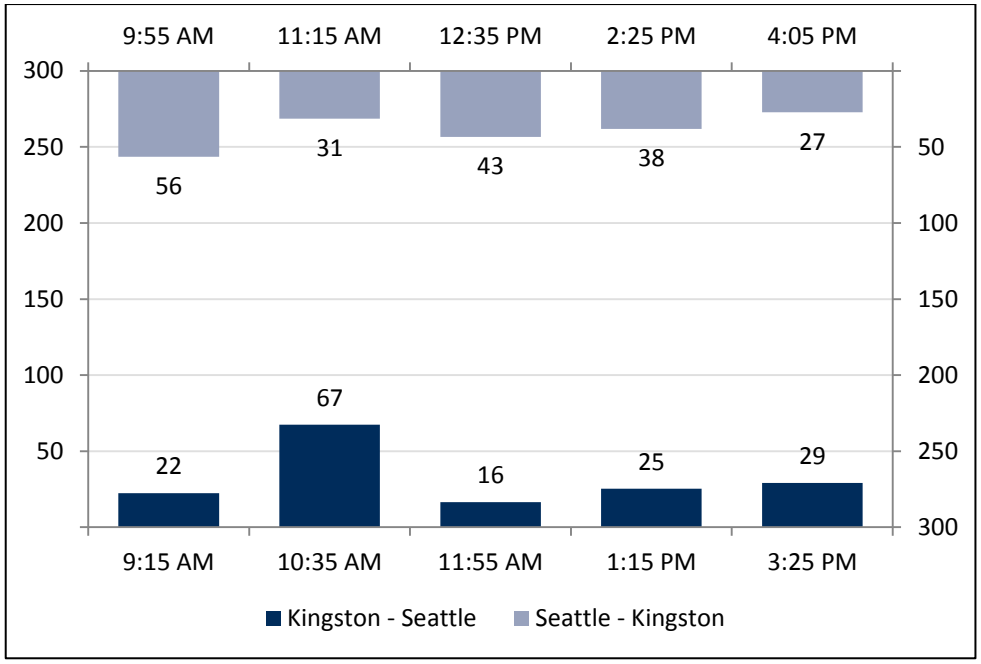
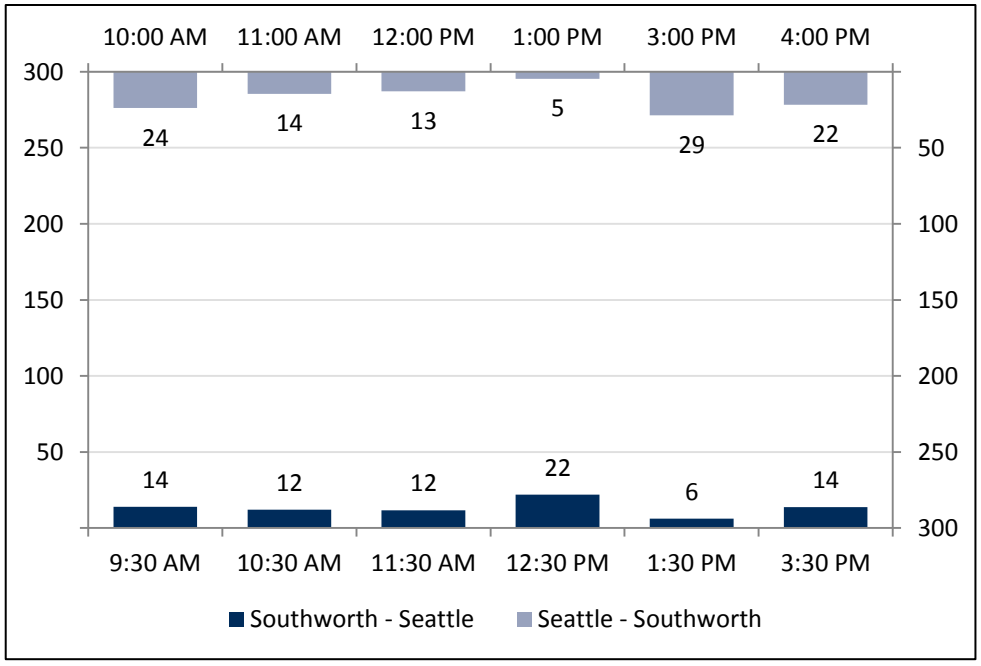


Figure 2.14: Southworth - Seattle Ridership by Sailings; 6 Round Trips/Saturday



Results: Saturday Schedule - Option 2

Two sets of schedules are proposed for Saturday service; this section documents forecasts for the higher frequency option. Six to eight round trips are offered between the hours of 9:00am and 6:00pm. Table 2.7 lists the service characteristics and ridership forecasts for all three routes using the basic weekday plus evening schedule.

Table 2.7: Saturday Option 2 Ridership Estimates

		Bremerton	Kingston	Southworth
Service Characteristics	Travel Time	28	33	23
	Round Trips/Day	8	6	8
	Round Trip Cost	$12.00	$12.00	$12.00
Ridership and Revenue Summary	Total Market Demand	1.6M	1.1M	0.7M
	Annual POF Ridership	33,959	23,320	12,042
	Annual Revenue	$172,782	$118,654	$61,269
	Avg Riders/Day	679	466	241
	Avg Riders/Sail	42	39	15
	Annual Overflow Trips	0	0	0

The daily ridership for 8 Saturday round trips between Bremerton and Seattle is estimated to be 679 trips. Kingston to Seattle Saturday ridership is estimated to be less, at 466 trips. Southworth to Seattle daily ridership is estimated to be 241 trips.

Ridership by Sailing

Saturday sailings for the proposed services are estimated using the same method as the Bremerton off-peak sailings. We use the off-peak Saturday distribution of existing WSF services to get the hourly distribution.

Figures 2.15, 2.16, and 2.17 show the forecasted passenger flow in each direction for all routes under the Saturday Option 2 schedule. None of the routes experience capacity constraints.

Figure 2.15: Bremerton - Seattle Ridership by Sailing; 8 Round Trips/Saturday

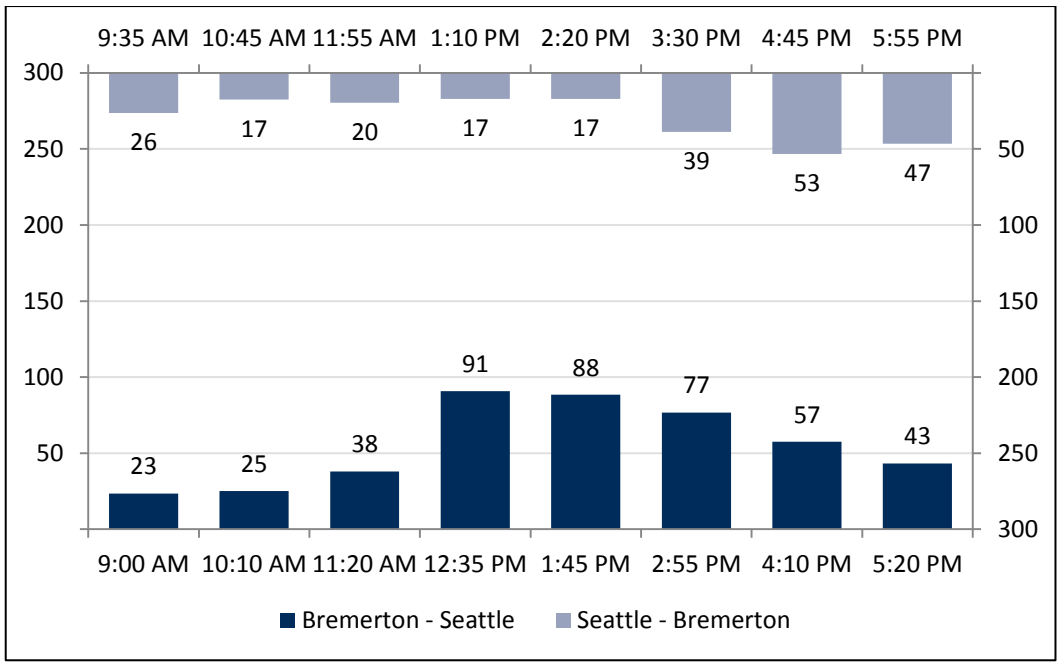


Figure 2.16: Kingston - Seattle Ridership by Sailing; 6 Round Trips/Saturday

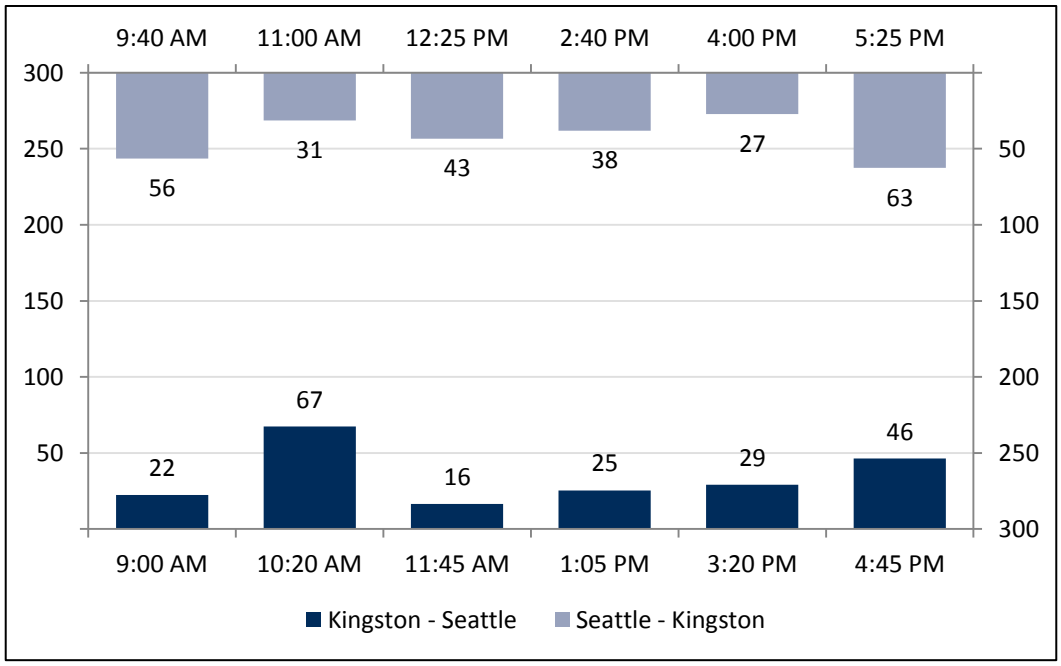
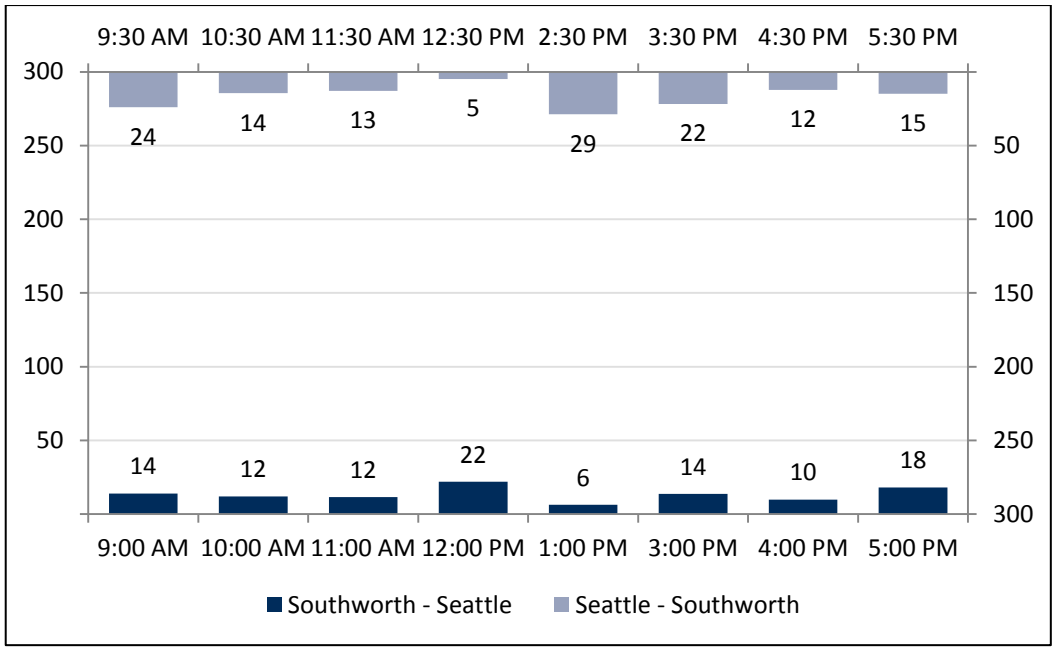


Figure 2.17: Southworth - Seattle Ridership by Sailing; 8 Round Trips/Sailing



3 Hourly Forecast Tool

Methodology

Steer Davies Gleave developed an hourly forecast tool to help Kitsap Transit with their scheduling efforts for three new proposed services – Bremerton, Kingston, and Southworth. These forecasts were prepared using the same fare and vessel capacity assumptions as in the aforementioned results.

The tool utilizes full day hourly distributions from existing WSF services to provide an hourly breakdown of the forecasted ridership for each route. The user can select the hours served in each direction under each of the service configurations to develop daily forecasts. The total number of hours selected should match the frequency suggested by the service levels. Daily forecasts are factored to get the annual ridership and revenue projections.

Results

Table 3.1 outlines the frequencies run for each service level. These are fed into the model, the results of which are used in the hourly tool.

Table 3.1: Hourly Forecast Tool Service Levels - Frequency

	Bremerton				Kingston				Southworth			
	Oct-Apr	Full	Level 1	Level 2	Oct-Apr	Full	Level 1	Level 2	Oct-Apr	Full	Level 1	Level 2
	October - April											
Monday - Friday	6				6				6			
	May - September											
Monday - Thursday		12	9	7		10	9	7		13	9	7
Friday		15	12	10		12	11	9		17	13	11
Saturday		12	10	10		10	8	10		13	11	10
Avg Weekday		12.6	9.6	7.6		10.4	9.4	7.4		13.8	9.8	7.8

The provided tool is only applicable for the above-listed frequencies at the $12 fare.

4 POF Ridership within Proposed District

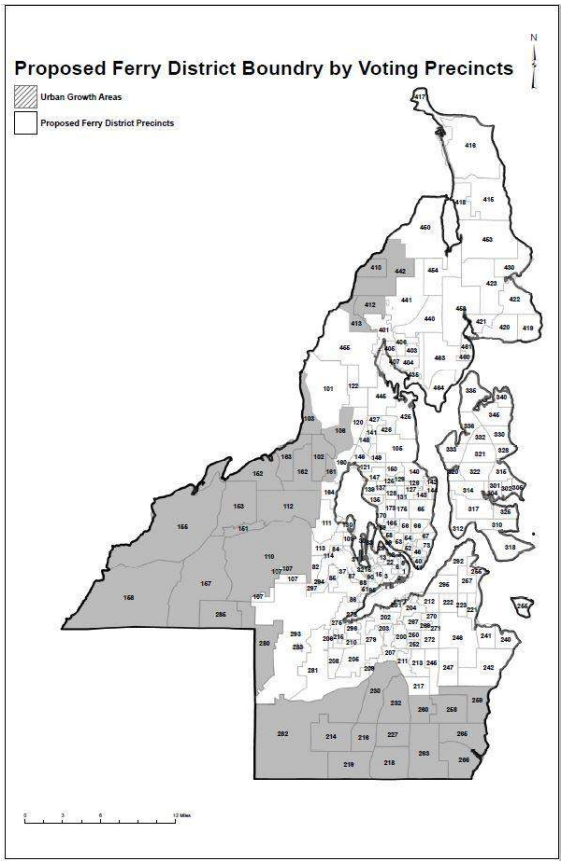
Methodology

Steer Davies Gleave has evaluated the percent of ferry ridership that would originate from within the proposed ferry district. In order to complete this analysis, we looked at each catchment area individually and identified what proportion of the population in each catchment area was also within the proposed district. These proportions were applied to the final forecasts to determine the proportion of ridership that is expected to be generated from within the ferry district.

Results

The proposed ferry district, is shown in Figure 4.1.

Figure 4.1: Proposed Ferry District Boundary



Source: Carla Sawyer, Progressions

Results for our analysis are shown in Table 4.1. Seventy-seven percent of system wide ridership is expected to originate from within in the ferry district. Bremerton has the highest proportion of riders from within the proposed district with riders from within the district making up 86% of the forecasted ridership.

Table 4.1: Percent of Ridership within Proposed Ferry District

Route	% of Ridership within Proposed Ferry District
Bremerton	86%
Kingston	78%
Southworth	61%
Overall	77%

5 Conclusions

This report contains a comprehensive analysis of three proposed POF services between Bremerton, Kingston, Southworth and Seattle under multiple service configurations. SDG has developed detailed hourly ridership and revenue forecasts.

As detailed in the previous sections, the POF services provide considerable travel cost benefits to a significant number of potential users. The ridership forecasts show that a relatively buoyant demand can be expected for the services.

The ridership forecasting exercise was greatly helped by the fact that several past POF services have been operated from Bremerton. These services generated ridership outcomes that were used by SDG in the development of the forecasting models used for the current analysis.

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